1

Evaluation of Ultrasound Scanning for Prediction of Meat Lamb Growth Performance and Carcass Quality Traits. K. Adams* and T. Wuliji, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101;C. Ke; University of Missouri, Columbia, MO 65201.

This study is to evaluate Ultrasound Scanning (USC) for small ruminant production, selection, and carcass evaluation. Sixty suckling lambs were assigned to two groups, a non-creep feeding (control) and creep feeding (treatment) group. USC was conducted on the longissimus dorsi muscle area over 12th and 13th ribs, and measured back fat depth (BFD), loineye muscle depth (LED), loineye muscle width (LEW), and loineye muscle area (LEA) for prediction of growth and carcass quality trait in lambs. Each group (30 d) was balanced with sexes and compared for weight gain and carcass quality trait at weaning (90 d) and postweaning (120 d) intervals. Weaning body weight, average daily gain, and post-weaning growth weight were 24.0 kg, 226 g/d, and 28.0 kg for treatment group ($P < 0.05$) compared to control at 21.3 kg, 196 g/d, and 25.3 kg, respectively. The ultrasound scanned carcass traits increased in creep feeding over control lambs at weaning and post-weaning measurements. The ultrasound scanned BFD, LED, LEW, and LEA were 2.2 mm, 17.9 mm, 45.6 mm and 5.8 cm2 at weaning; and 2.6 mm, 20.9 mm, 48.0 mm, and 7.0 cm2 at 120 d of age respectively. The correlative associations between carcass traits and weight gain were significantly improved ($P < 0.05$) with increased live weight. There was no difference in these traits due to treatment except BFD, which was significantly higher for treatment and females. The results indicate that USC is an effective method to predict weigh gain and carcass quality in live meat animals.

2

Effects of lycopene supplementation to semen extender on the motility and kinematic parameters of ram spermatozoa stored at 4 °C for 72 hours. J. Woodard*, T. Brisby, A.M. Shahat, J. Jordan, J. Fareed, D. Beal, R.S. Kolikapongu, L. Wartley, H. Balagoni, V.P. Tanguturi, B. Kouakou, A.R. Moawad, Animal Science Program, Fort Valley State University, Fort Valley, GA, 31030

Research has shown that ram sperm quality significantly decreases after 3-5 d of cold liquid storage due to excessive generation of reactive oxygen species (ROS). Lycopene, a carotenoid red pigment, mostly found in tomatoes and watermelon has100 times higher free radicals scavenging ability than other antioxidants. Our aim was to evaluate the effect of supplementing semen extender with lycopene on the motility and kinematic parameters of ram spermatozoa after cooling. Semen samples collected from 5 mature Katahdin rams once/week for 3 weeks using electroejaculation were pooled and diluted to a final concentration of 800×10^6 sperm/ml in Andromed® extender supplemented with 0 (control), 10, 20, and 30 µM lycopene. Diluted semen was then cooled at 4 °C for 72 h. Sperm motility and kinematics were evaluated using CASA at 4, 24, 48, and 72 h post-cooling. Data were analyzed by general linear model using SPSS. Results showed that sperm motility and kinematics decreased ($P < 0.05$) in a time dependent manner, and the lowest value were recorded at 72 h. Supplementing semen extender with 20 and 30 µM lycopene improved total (48.0 ±5.6% and 52.7±7.5%, respectively) and progressive sperm motility (46.3±6.0% and 51.6±6.5%, respectively) than the control (44.9±8.5% and 42.3±7.8%, respectively) and other lycopene concentrations. Sperm VCL, VSL, VAP, DCL, ALH, and STR tended to be higher in 20 and 30 µM lycopene than other concentrations. In conclusion, supplementation of semen extender with 20 or 30 µM lycopene improved sperm motility and kinematic parameters in cooled ram spermatozoa.

3

Testicular heat stress through scrotal insulation impairs sperm quality in rams. H. Kancheti*, A.M. Shahat, R.S. Kolikapongu, H. Balagoni, V.P. Tanguturi, M. Singh, B. Kouakou, A.R. Moawad, Animal Science Program, Fort Valley State University, Fort Valley, GA, 31030

Heat stress (HS) is known to disrupt testicular homeostasis, primarily through oxidative stress. Our aim was to evaluate the effects of mild testicular HS through scrotal neck insulation on sperm quality in rams. Ten mature Katahdin rams were assigned into two groups: a HS group (n=5), where scrotal neck insulation was applied for four days, and a control group (n=5) without scrotal neck insulation. Semen samples were collected with electroejaculation from all rams once/week for seven weeks following insulation removal. Semen was diluted in Andromed® extender to a final concentration of 800 x 10^6 sperm/ml. Sperm motility (using CASA), membrane integrity (using hypo-osmotic swelling

test; HOS), acrosome status (using FITC-PNA staining), mitochondrial activity (by Hoechst/Rhodamine 123), and lipid peroxidation (by BODIPY C11 probe) were analyzed. Data were collected and analyzed by univariate analysis using SPSS. Results showed that sperm progressive motility decreased from 65.9% in control group to 43.9% in HS one at week 2 of semen collection with time and treatment*time interaction effects (P=0.001). The percentages of spermatozoa with intact acrosome were lower ($P < 0.05$) in HS than control groups (69% vs. 84%, respectively). Mitochondrial integrity was affected by both treatment (P=0.002) and time (P=0.004). Lipid peroxidation was higher in the HS group than control one (14.2% vs. 6.7%, respectively). In conclusion, scrotal neck insulation as a model for mild testicular heat stress significantly reduced ram sperm quality, with the most pronounced effects observed during the second to fourth weeks post-treatment.

4

Effects of Aronia berry extract on the motility of cooled ram semen. T. Brisby*, J. Woodard, A. M. Shahat, S. G. Saroja, L. Wartley, J. Jordan, J. Fareed, D. Beal, R. S. Kolikapongu, H. Balagoni, V. P. Tanguturi, B. Kouakou, N. Joshee, A. R. Moawad, Fort Valley State University, Fort Valley, GA, 31030.

Ram spermatozoa experience oxidative stress injuries during cold storage mainly because of the high amount of polyunsaturated fatty acids in the plasma membrane. Black chokeberry (*Aronia melanocarpa*) is rich in antioxidants. Our aim was to evaluate the impact of supplementing semen extender with Aronia berries extract on the motility of cooled ram spermatozoa. Following preparation of Aronia berry extracts, the total flavonoid, polyphenol contents, and antioxidant capacities were determined. Semen was collected from 5 mature Katahdin rams once/week for 3 weeks using electroejaculation. Semen samples were then pooled and diluted in Andromed® extender supplemented with 0 (control), 100, 200, 300 and 400 µg/ml Aronia extract. Sperm cell concentration was adjusted at 800×10^6 sperm/ml. Diluted semen was then stored at 4 °C for 72 h. Sperm motility and kinematic parameters were evaluated using CASA at 4, 24, 48, and 72 h post-cooling. Data were analyzed using general linear model using SPSS and significance was set at $P < 0.05$. One gram of dried Aronia berries contain 45.30 mg quercetin, 5 mg gallic acid, and 1309 µM trolox. Sperm motility and kinematics decreased ($P < 0.05$) in a time dependent manner, and the lowest value were seen at 72 h. Supplementing semen extender with 100 µg/ml Aronia extract improved total and progressive sperm motility (46.5±4.4% and 42.4±2.9%, respectively) compared to the control (39.0±4.4% and 35.8±3.0%, respectively) and other Aronia extract concentrations. In conclusion, supplementation of semen extender with 100 µg/ml Aronia berry extract improved ram sperm motility after cooling.

5

Comparison of Triladyl® and Andromed® extenders on the quality of cryopreserved ram semen. M. Williams*, A. M. Shahat, R. S. Kolikapongu, M. Singh, B. Kouakou, A. R. Moawad, Fort Valley State University, Fort Valley, GA, 31030

Ram spermatozoa are highly vulnerable to cold chock during cryopreservation which negatively impacts post-thaw sperm quality. Semen extenders are solutions that provide nourishment and protect sperm cells against injury during the cooling and freezing process. Our aim was to assess the effects of two commercially available extenders (Triladyl® and Andromed®) and two cooling methods before freezing (cooling in 15 ml conical tube versus cooling in straws) on the quality of cryopreserved ram semen. Semen samples collected from five mature Katahdin rams once/week for 3 weeks were pooled and diluted in either Andromed® or Triladyl® to a final concentration of 800×10^6 sperm/ml. Diluted semen was either cooled in a 15 ml conical tube before packaging in 0.25 ml French straws (cool-then-package) or package in the straws then cooled (package-then-cool). Both groups were stored at 4 °C for 3 hours before freezing. Samples were subsequently frozen in a programmable freezer (MiniDigitcool, IMV®), stored in liquid nitrogen, and thawed later for analysis. Post-thaw sperm motility was assessed by CASA. Sperm progressive motility was higher ($P < 0.05$, one way ANOVA) in Triladyl® groups than Andromed® ones. Cool-then-package method resulted in higher ($P < 0.05$) sperm motility than package-then-cool method in both extenders. In conclusion, Triladyl® can be used effectively for cryopreservation of ram semen cryopreservation as it resulted in higher post-thaw sperm motility than Andromed®. Cooling the semen in a tube before packaging in the straws is more efficient than cooling in the straws for the quality of frozen/thawed ram semen.

6

Machine Learning Approaches for Classifying Small Ruminant Health Status from RFID Motion Signals. A. R. Villa*, A. Siddique, A. K. Mahapatra, T. H. Terrill,, Department of Agricultural Sciences, Fort Valley State University, Fort Valley, GA 31030; S. S. Panda, Institute for Environmental Spatial Analysis, University of North Georgia, Oakwood, GA 30566; E. R. Morgan, Institute for Global Food Security, Queen's University Belfast, UK; J. A. van Wyk, Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

Animal health management is critical for improving productivity and food security in resource-poor livestock systems. Parasitic diseases, poor nutrition, and limited access to veterinary knowledge often lead to undetected illness and productivity loss in small ruminants. This study investigated the use of RFID-transponder motion-based data, coupled with machine learning (ML), to classify animal behavior and detect potential health abnormalities. Motion activity data were collected from goats over a two-year period, generating ~800 × 7 cell matrices per day with activity values between 0–255. After cleaning and preprocessing, features were extracted to classify behaviors into normal and abnormal categories. Normal patterns were characterized by 2–4 daily activity peaks with rest during night hours (7 pm–6 am), while abnormal patterns showed elevated nocturnal activity and reduced daytime grazing. Two ML algorithms, Random Forest and K-Nearest Neighbors (KNN) were evaluated for classification performance. Random Forest achieved 76% accuracy, while KNN achieved 82%, demonstrating greater robustness in distinguishing abnormal signals. The developed models were integrated into a prototype mobile application to deliver real-time decision support for farmers, enabling early detection of health issues and timely intervention. The results confirm that RFID-based motion signal mining, combined with ML, offers a scalable and cost-effective strategy for precision animal health management. This framework supports sustainable livestock production by enhancing disease detection, reducing economic losses, and providing resource-poor farmers with accessible digital tools.

7

Development of a Convolutional Neural Network for the Classification of Gastrointestinal Parasite Eggs in Small Ruminants. S. Rao*, A. Siddique, Fort Valley State University, Fort Valley, GA 31030; A.A. Pech-Cervantes, Prairie View A&M University, Prairie View, TX 77446; S. S. Panda, University of North Georgia, Oakwood, GA 30566; E. R. Morgan, Queen's University Belfast, UK; J. A. van Wyk, University of Pretoria, Onderstepoort, South Africa; A. K. Mahapatra, E. Appleberry, I. Carter, S. Lewis, T. H. Terrill, Fort Valley State University, Fort Valley, GA, 31030.

Gastrointestinal parasitism is a prevalent issue in small ruminant livestock, leading to significant health challenges and economic losses. Accurate identification of parasite eggs in fecal samples is crucial for effective management and treatment. This study presents the development of a Convolutional Neural Network (CNN) model tailored for the classification of microscopic images of gastrointestinal parasite eggs commonly found in small ruminants. The dataset comprises 330 high-resolution microscopic images of three parasite species: *Trichostrongylus*, *Haemonchus*, and *Oesophagostomum*, collected from 75 male Spanish goats at the Fort Valley State University (FVSU) Agriculture Research Center. The images were split in training and testing ratios of 80:20, preprocessed, and augmented to enhance the model's learning capability, followed by a split into training, validation, and test sets. The CNN model was then trained using a systematic approach to optimize the architecture and hyperparameters. The performance of the model was evaluated based on its overall accuracy, precision, recall, and F1 score. Preliminary results demonstrate promising potential of the developed CNN model in accurately classifying the microscopic images of gastrointestinal parasite eggs up to a testing accuracy of 70.25% with a 100% recall, 55% precision and a F1-score of 71% for *Oesophagostomum*, and 55% *Trichostrongylus* type eggs, and an accuracy of 68% for *Haemonchus* species. The developed model needs to be trained on a larger image dataset for improvement in classification purposes. This classification model in conjunction with more images with different classes of parasites will help to improve the model and will be helpful in developing the database.

8

The Effect of *Sericea Lespedeza* on *Haemonchus Contortus* in Goats. V. Lugo*, Department of Agriculture, Alcorn State University, Lorman, MS, 39096; and M. Mason-Montgomery, Department of Agriculture, Alcorn State University, Lorman, MS, 39096.

Parasitism is one of the most significant constraints in small ruminant production worldwide. Among gastrointestinal nematodes, *Haemonchus contortus*, is the most pathogenic and economically devastating parasite affecting goats. Traditional control of this parasite has relied heavily on chemical anthelmintics; however, increasing anthelmintic resistance has severely compromised the efficacy of many dewormers. As a result, there is growing interest in exploring non-chemical and sustainable methods for parasite control. The purpose of this study is to evaluate the effect of *Sericea lespedeza* (SL), a leguminous forage rich in condensed tannins, on existing infections of *Haemonchus contortus* in goats. Fifteen does between the ages of 1 and 4 years were selected for this study. All animals were clinically healthy at the time of enrollment and had no prior treatment with *SL*. Prior to the study anthelmintics were administered once daily for three consecutive days with a 14-day withdrawal period. Animals were randomly assigned to a Control Group (n = 5): Standard diet with no *SL*; Treatment Group 1 (n = 5): Standard diet plus *SL* at 0.25% of body weight; or a Treatment Group 2 (n = 5): Diet including *SL* at 0.5% of body weight. The experimental period lasted eight weeks. Animal body weights, fecals and Famacha scores were collected bi-weekly. Descriptive statistics was used to calculate all FEC and body weight data. Changes in FEC over time was analyzed using repeated measures ANOVA to assess treatment effects across sampling points. Results pending.

9

Radiofrequency wave in conjunction with AI/ML technique for Animal health monitoring systems. D. Brown*, A. Siddique, N. Whitley, T. H. Terrill Department of Agricultural Sciences, Fort Valley State University, Fort Valley, GA 31030, J. A. van Wyk, Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

Anemia caused by gastrointestinal parasitism remains a major constraint to small ruminant productivity, particularly in resource-limited systems where diagnostic tools are scarce. Sustainable livestock production requires accessible, non-invasive, and scalable technologies that minimize animal stress, reduce dependency on chemical dewormers, and support long-term herd resilience. This study evaluated the potential of radiofrequency-based non-destructive testing (RF-NDT) features as biomarkers for anemia detection in goats, benchmarked against FAMACHA© scoring as the biological standard. Spectral clustering of the ten most discriminatory frequencies revealed distinct dielectric signatures across anemia states. Healthy animals were defined by a dominant cluster at 8.43 GHz, explaining 93.7% of variance. Moderately affected animals shifted toward 9.33 GHz with reduced uniformity (88.7%), while borderline animals exhibited two clusters (9.89 and 8.23 GHz), explaining 91.0% of variance. These patterns suggest progressive tissue heterogeneity accompanying anemia severity. Predictive modeling confirmed the feasibility of RF-derived diagnostics. Linear Regression achieved $R^2 = 1.00$ with RMSE = 0.07, and Random Forest $R^2 = 0.79$, while Support Vector Regression underperformed ($R^2 = 0.31$). Classification models reinforced categorical detection capacity, with a Multilayer Perceptron yielding the best results, outperforming Support Vector Machine and K-Nearest Neighbors. These findings establish proof-of-concept that RF waves capture physiologically meaningful dielectric signatures linked to hemoglobin concentration, hydration, and microcirculatory dynamics. Integrating RF sensing with machine learning offers a rapid, non-invasive, and sustainable diagnostic framework for herd health management, reducing chemical inputs and supporting resilient livestock systems. Future directions include crossbreed validation, sensor refinement, and embedded neural classifiers for field deployment.

10

Nutritional Supplementation Modulation on Milk Composition and Cheese Yield in Alpine Goats. C. Alexander*, C. Alvarado, A. K. Patra, A. Bakhsh, F. Belkasmi. Sherman Lewis School of Agriculture and Applied Sciences, Langston University, OK, 73050.

In dairy goat enterprises, cheese yield is a critical determinant of profitability and is directly influenced by milk composition, which is a function of the animal's breed and feeding regimen. Optimizing nutrient supply through targeted feed supplementation has emerged as a promising strategy to enhance milk and cheese quality. This study aims to evaluate the effect of rumen undegradable protein (RUP), bypass fat (BPF), and essential oils (EO), individually and in combination, on milk yield, composition, and cheese yield in Alpine dairy goats (*Capra aegagrus hircus*). Forty multiparous does were assigned to five dietary treatments (n = 8 per group): control (Cont), RUP, BPF, EO, and RUP + BPF + EO (Mix). Over a 12-week feeding period, milk yield and composition were recorded daily, while milk, blood, and rumen fluid samples were analyzed to assess nutrient utilization and metabolic responses. It is anticipated that supplementation with RUP, BPF, and EO will enhance rumen fermentation efficiency, improve milk

fat and protein content, and subsequently increase cheese yield and quality. The Mix treatment is expected to produce synergistic improvements in milk nutrient density and cheese recovery compared with individual supplements. If confirmed, these outcomes will demonstrate the potential of integrative nutritional strategies to promote rumen health, improve milk composition, and enhance profitability in dairy goat production systems.

11

Bioelectrical Impedance in conjunction with Machine Learning for Non-Invasive Diagnosis of Caseous Lymphadenitis in Goats. A. Klingler*, R. Kota, A. R. Villa, S. Rao, A. Siddique, N. Whitley, T. H. Terrill, Fort Valley State University, Fort Valley, GA 31030; J. A. van Wyk, University of Pretoria, Onderstepoort, South Africa.

This study employed bioelectrical impedance analysis (BIA) and machine learning to differentiate caseous lymphadenitis (CL) affected goats from healthy (H) animals using resistance (Rs), reactance (Xc), phase angle, hematocrit (blood packed cell volume, PCV), and frequency-dependent electrical signatures. Measurements collected across multiple frequencies were modeled through the Cole–Cole equation to derive dielectric parameters (R_0, R_∞, τ, and α), revealing distinct dispersive behavior between CL and H groups. The CL animals exhibited higher Rs and reduced Xc and phase angle, reflecting altered membrane integrity and ionic conduction. Machine learning classifiers, such as Support Vector Machines (SVM), K Nearest Neighbor (KNN), and back-propagation neural network, achieved robust discrimination, with the SVM showing the highest ROC-AUC (≈0.92). SHAP analysis identified phase angle and Rs as dominant predictors, confirming their mechanistic linkage to cellular and extracellular resistance shifts during infection. Decision curve analysis demonstrated a net clinical benefit across threshold probabilities of 0.3–0.7, indicating the model's practical diagnostic potential. A composite diagnostic index (DI) integrating Rs, Xc, PCV, and phase angle improved separation between groups, yielding an AUC of 0.94. Together, these findings confirm that impedance spectroscopy combined with AI-based feature interpretation provides a rapid, non-invasive diagnostic framework for early CL detection. The proposed DI and SHAP-based variable importance enhance biological interpretability and translational potential for field-deployable herd-health monitoring.

12

Goat Meat (Chevon) Trade and Market Dynamics in the United States: Trends, Import Dependence, and Opportunities for Domestic Production. D. R. Katuwal*, L.B. Karki, and E. N. Escobar [1]Department of Agriculture, Food, and Resource Sciences, [2]UMES Extension, University of Maryland Eastern Shore, Princess Anne, MD, 21853.

Goat (*Capra hirscus*) meat production in the U.S. remains regionally concentrated and heavily import-dependent, despite growing domestic demand from various ethnic and health-conscious consumers. This study analyzes two decades of trends in goat population, production, and trade to understand the dynamics of the goat meat market. The main objective was to investigate the long-term relationship between domestic production and international trade, with a focus on self-sufficiency and import dependence. Data from USDA-NASS and FAOSTAT (2002–2022) show an overall decline of about 20% in the total U.S. goat inventory, from 3.14 million head in 2007 to 2.52 million in 2022, with meat goats consistently comprising around three-quarters of the total herd. Texas accounted for about 30% of the national inventory, while the top five states collectively contributed over 40%, highlighting regional concentration in the southern and western regions. Goat meat imports averaged 13,322 tonnes annually, and increased at a rate of 2.65%, while exports averaged 293 tonnes, resulting in a persistent trade deficit of 13,000 tonnes per year. The Net Import Dependence Ratio averaged 95.5%, confirming long-term reliance on foreign supply, primarily from Australia, which supplied more than 96% of total imports. These results underscore the vulnerability of the U.S. goat meat sector to external supply shocks and price fluctuations. These findings highlight the urgent need to strengthen domestic herd improvement, processing capacity, and market integration and reduce dependence on imports in the U.S. goat meat industry.

13

Effects of Biochar Supplementation On Body Weight, Feed Intake, Methane Production, And Carcass Characteristics In Boer×Spanish Male Goats. B. Budha*, S. Chaudhary, V. Kanyi, M. Hilaire, H. Ismael, H. Abdo; B. Min, and N. Gurung, Department of Agricultural and Environmental Sciences, Tuskegee University, Tuskegee, AL, 36088.

The growing interest in sustainable livestock systems has prompted the exploration of biochar as a feed additive capable of enhancing nutrient utilization and growth efficiency in ruminants. This study assessed the effects of increasing levels of biochar on feed intake, daily weight gain, methane, and carcass characteristics of Boer × Spanish castrated male goats. Thirty-six goats were randomly allotted to four treatment groups (n = 9), receiving 0, 0.026, 0.052, or 0.078 g of biochar per kg of feed on a dry-matter basis for 60 days, and provided pelleted diets incorporating biochar through a mechanical mixer. Feed intake was recorded daily, body weight was measured biweekly, and carcass data were collected following slaughter. Methane output was determined using the Greenfeed system to evaluate rumen fermentation efficiency. Statistical analyses were performed using SAS 9.2 with repeated-measures ANOVA and orthogonal contrasts to examine linear and quadratic effects ($P < 0.05$). Results showed that feed intake and body weight were significantly influenced by biochar inclusion level ($P < 0.05$). Goats supplemented with 0.052 g/kg DM exhibited the greatest feed intake and live weight, increasing by approximately 23.80 percent relative to the control group. Carcass evaluation indicated minor quadratic responses in goats receiving high biochar. Methane emissions declined linearly ($p < 0.05$) in the biochar group. Overall, the inclusion of biochar up to 40 g/kg DM enhanced intake and body weight while reducing methane emissions, suggesting potential for sustainable goat production. Further studies are recommended to assess its long-term and economic feasibility.

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Kentucky Small Ruminant Production: Assessing Producer Needs for Extension Programming. E. A. Oduntan*, A. R. Hines, V. Niyigena, and S. N. Carr, Department of Agriculture, Health, and Natural Resources, Kentucky State University, Frankfort, KY, 40601.

The Small Ruminant Research and Extension Program at Kentucky State University sought to conduct an assessment aimed at providing a practical, and information-based perspective of small ruminant production needs in Kentucky to inform future extension programming across the state. Responses were collected from 75 farmers, who identified themselves as beginner (35%), intermediate (47%), or expert (17%) producing sheep (45%), goat (25%), or both (19%). Data collected represents 36 of Kentucky's 120 counties, spanning all regions in the state. Unsurprisingly, the greatest challenge reported by all active producers was managing parasites (n = 31), followed by challenges with marketing/ processing (n = 13), generalized farm management concerns (n = 8), and breeding/ genetics (n = 8), and these were consistent across experience levels and Kentucky regions. When looking into future programming, the most requested topics were lambing/ kidding (n = 39), reproduction (n = 38), meat production (n = 33), nutrition (n = 31), and genetics (n = 31), while the least requested topics were fiber production (n = 8), value added products (n = 15), and emerging technologies (n = 16). Collectively, this analysis has offered a basis to create programming that would better fit producer needs and reinforce small-scale sheep and goat enterprises in the state by determining the various challenges based on experience levels, species, and region.

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Seasonal hatch effects on egg production in Barred Rock Pullets through 52 weeks of age. D. Knipker*, R. Baker, T. Mitchell, T. Fisher, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO, 65101.

Chickens (*Gallus gallus domesticus*) are long-day breeders whose egg production is stimulated by increasing day length. Large commercial operations use artificial lighting to maintain consistent year-round production. However, many small-scale egg producers avoid artificial lighting due to cost, infrastructure limitations, or desire for low-input, natural management systems. Therefore, these producers must understand how management decisions (e.g., hatch timing) may affect egg production in natural-light systems. This study compared first-year egg production of Barred Rock pullets hatched in fall (September 2023) and spring (March 2024). Each cohort of 56 one-day-old pullets was divided into four replicate pens and raised outdoors with ad libitum feed and water. Pullets were housed in hoop coops at 0.4 m^2/bird and managed identically. Body weight, feed consumption, and egg production were measured through 52 weeks of age. Feed intake and body weights were similar between groups. Spring-hatched pullets began laying earlier, but their production rapidly declined as day length shortened. This decline contradicts the common belief that spring pullets maintain egg production through their first winter. In contrast, fall-hatched pullets initiated lay as day length increased and sustained higher egg production throughout their first year. Overall, fall-hatched pullets laid significantly more eggs than spring-hatched pullets during their first year of life. These findings suggest fall chick placement may improve egg production and flock productivity for small-scale producers managing flocks under natural light conditions. Further research should evaluate whether fall-hatched pullets maintain higher production beyond their first year or whether these trends vary across breeds and environments.

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Exploring the Effects of Brown Mushroom Stem on Gut Health in Layer Chicks. P. K. Goswami[1]*, M. Salahuddin, A.A.A. Abdel-Wareth, T. Carr**,** K. Stamps, A. Cervantes, M. Hitit, C. Gray, A. Aviña, and Jayant Lohakare. CAFNR Research, Prairie View A&M University, Prairie View, TX, 77446, United States.

Brown mushroom stem (BMS) powder, a by-product of mushroom processing, offers potential as a sustainable poultry feed ingredient, though its impact on intestinal barrier integrity remains uncertain. This study assessed the ileal morphology and barrier-related gene expression in layer chicks fed diets partially replacing soybean meal with BMS. A total of 160 Lohmann LSL Lite chicks were divided into four dietary groups: Control (0% BMS), and BMS at 2%, 4%, and 6% across five replicates of eight chicks, each over 36 days. Ileal samples were collected and fixed in 10% neutral buffer formalin. Tissue samples were embedded, sectioned, and stained to measure villus height (VH) and crypt depth (CD). RT-qPCR was used to quantify expression of gut integrity related genes. Data was analyzed in one way ANOVA using SAS with polynomial contrast. BMS supplementation showed a non-linear morphological response. VH was consistently reduced across all BMS groups ($p<0.001$), while CD reached its lowest point at 4% inclusion, showing a quadratic trend ($p<0.001$). Gene expression varied by BMS level. CLDN1 peaked at 2% and declined at higher levels ($p=0.001$), and ZO-2 decreased with increasing BMS ($p=0.009$). No consistent changes were observed for OCLN, ZO-1, or MUC2. Composite indices were highest at 2% BMS, with reduced and more variable values at 4–6%. Conclusively, low level BMS (2%) appeared to enhance barrier-related gene expression despite minor structural changes, while higher levels showed mixed effects. These findings underscore the importance of optimizing BMS addition to balance between gut integrity and performance goals.

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Sustainability and Environmental Impact in Poultry Production: Emerging Nutritional and Management Strategies. A.O. Akoto*, A.A.A. Abdel-Wareth, M. Salahuddin, and J. Lohakare. CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX, 77446.

Global poultry production continues to expand rapidly to meet the growing demand for affordable and high-quality animal protein among consumers. However, this growth raises pressing concerns regarding environmental sustainability, resource use efficiency, and public health. Although current initiatives, such as improved housing systems, optimized feeding practices, and partial substitution of soybean meal, have contributed to mitigating some impacts, comprehensive and integrated solutions remain underexplored. This review synthesizes emerging nutritional

and management innovations that enhance the sustainability of poultry production while maintaining productivity and profitability. It addresses three central research questions: (1) Which alternative feed ingredients most effectively preserve animal performance while minimizing environmental burdens? (2) How can environmental management practices enhance resource efficiency and waste valorization? (3) What roles do life cycle assessment methodologies and policy frameworks play in advancing sustainable poultry systems? Evidence from 100 peer-reviewed studies, industrial data, and field analyses reveals that incorporating insect meals, algae, and agro-industrial by-products reduces dependence on soybean meal by 20–40% while improving feed efficiency by 5–12% across poultry systems. Furthermore, integrating management strategies, such as manure valorization, precision water and energy use, and the adoption of renewable energy, significantly reduces gaseous emissions and promotes circular economy principles. Life cycle assessment studies confirm that combined dietary and management interventions yield greater reductions in carbon footprint than isolated measures. Future research should focus on optimizing feed policy interactions through digital technologies, nanomaterial-based feed additives, and region-specific sustainability frameworks to accelerate the transition toward resilient and resource-efficient poultry production systems.

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Antimicrobial and Immunomodulatory Potency of Apple Peel Powder in Broiler Chicks Challenged with *Salmonella* Enteritidis. O. O. Apalowo*, O. C. Iwuozo, O. E. Orimaye, S. A. Suberu, S. T. Quarmyne, L. Elegbede, D. A. Ekunsietan, and Y. O. Fasina, Department of Animal Sciences, North Carolina Agricultural and Technical State University, Greensboro, NC, 27411.

Salmonella Enteritidis (SE) infection in poultry remains an important cause of foodborne illness in humans. Increasing restriction of antibiotic usage in poultry production warrants continuous evaluation of promising alternatives. A 2-week study was conducted to evaluate the potency of polyphenol-rich Apple Peel Powder (APP) in mitigating SE infection and modulating immune responses in broiler chicks. Day-old chicks (Ross708, male, n=400) were randomly assigned to 4 treatments with 5 replicates of 20 birds each. All treatment groups were fed a corn-soybean meal basal diet: Control (CON) basal diet, APP (basal diet + 3% APP). On day 2, birds in CONSE and APPSE treatments were orally gavaged with 1ml SE (4.8 × 108 CFU). APP reduced cecal *Salmonella* at D5PC (3.37 $\log_{10}$ CFU/g), and D12PC (0.66 $\log_{10}$ CFU/g). Flow cytometry of the spleen was done on D5PC to characterize immune cell populations, $CD4^+$, $CD8^+$ T lymphocytes, $CD44^+$ T-cell activation marker, and B-cell subsets (Bu-$1a^+$ IgM^+ and Bu-$1a^-$ IgM^-) to evaluate immune modulation. In SE group, APP supplementation enhanced $CD4^+$ T-cell expression and maintained low $CD44^+$ T-cell activation levels which suppresses excessive inflammation, supporting adaptive immune responses while preventing excessive inflammation. Similarly, birds fed diet containing APP exhibited higher Bu-$1a^+$ IgM^+ B-cell proportions (73.63%) and lower Bu-$1a^-$ IgM^- proportions (16.30%), indicating enhanced antibody-producing potential. In conclusion, dietary APP at 3% level reduced cecal SE and modulated splenic lymphocyte population by enhancing T-cell responses and promoting B-cell differentiation. These mechanisms suggest that dietary GRE improved adaptive immunity while preventing excessive inflammation in chicks.

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Dietary Ginger Root Extract Mitigates Cecal *Salmonella* Colonization and Modulates Intestinal Immune Response in Broiler Chicks. O. E. Orimaye*, O. C. Iwuozo, T. E. Ogundare, S. A. Suberu, O. O. Apalowo, S. T. Quarmyne, D. A. Ekunseitan, and Y. O. Fasina, Department of Animal Sciences, North Carolina Agricultural and Technical State University, Greensboro, NC, 27411.

Salmonella Typhimurium (ST) is a major challenge in poultry. A 42-day study was conducted to evaluate the effect of ginger root extract (GRE) on ST colonization and immune responses in broiler chickens. Day-old (600 male, Ross708) chicks were randomly allotted to 6 treatments, each with 5 replicates of 20 birds in a completely randomized design. All treatment groups received a corn-soybean basal diet: CON, CON-ST, BMD-ST (0.055 bacitracin antibiotic g/kg), GREA-ST (0.75% GRE), GREB-ST (1.5% GRE), and GREC-ST (3% GRE). With the exception of CON, all treatments were given 1ml ST (7.46 × 108 CFU/mL) on day 2. Ileal tissue samples collected on day 5 and day 12 PC, were subjected to qRT-PCR to determine the expression of interleukin (IL)-2, IL-10, IL-1β, interferon gamma (IFN-γ), and tumor necrosis factor alpha (TNF-α) genes. Data were subjected to one-way ANOVA ($P<0.05$). Cecal ST was lowest in GREC-ST at day 5 PC (3.62 CFU/g) and d 12 PC (1.50 CFU/g). At day 5 PC, GREA-ST upregulated IFN-γ, while GREB-ST and GREC-ST upregulated IL-10. These results indicate that dietary GRE reduced intestinal ST without excessive inflammation. IL-1β was downregulated in GREB-ST compared to other GRE-ST groups. By day

12 PC, GRE-ST groups increased IL-2 expression compared to CON-ST, while GREA-ST upregulated IL-1β relative to CON. GRE-ST groups did not differ significantly from CON or CON-ST for IFN-γ expression. In conclusion, dietary GRE up to 3% level reduced ST colonization and modulated effective immune response with minimal inflammation.

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Expansion of Processing Capacity of Poultry and Small Livestock for Kentucky's Small-Scale Producers. O. Oyewo*, S. N. Carr, A. R. Hines, M. M. Goins, S. T. Skelton, Department of Agriculture, Health, and Natural Resources, Kentucky State University, Frankfort, KY, 40601.

Limited access to USDA-inspected meat processing facilities limits capacity of small-scale producers across the Southeastern United States. Particularly challenging in Kentucky, only 26 processing facilities provide USDA-inspected services to more than 100 counties. In response, a multistate Meat and Poultry Processing Workforce Development Program was enacted to expand processing capacity and human capital. At Kentucky State University (KSU), the Mobile Processing Unit (MPU) is central to this effort by delivering inspection-approved, on-farm processing while also serving as a hands-on training platform. The MPU initiative, 1) allows producers to raise, process and market species of small livestock, including poultry, rabbits, freshwater prawns, and finfish, and 2) provide educational training for facility managers. From 2021 to 2024, the MPU supported 50 small livestock processors and engaged audiences including 4-H and FFA youth, schools, and small-farm producers. It facilitated processing of 5,642 chickens, 551 turkeys, 200 quail, and 1,108 rabbits, along with 25 kg of tilapia and 396 kg of freshwater prawns. Project activities reached 303 participants statewide and resulted in certification of 22 new facility managers and four renewal certifications. Training emphasized MPU operation, food safety and humane handling, equipment uses, and regulatory compliance. Since 2005, MPU-related efforts have collectively certified 347 facility managers across Kentucky. The MPU has become a valuable tool for strengthening small-scale, local producers to process small livestock while ensuring food safety, traceability, and welfare. These outcomes highlight the MPU's potential as a replicable and scalable framework for regional food systems and rural development initiatives.

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Effects of Probiotic and Xylanase Supplementation in DDGS Feeds on Splenic Gene Expression of Berkshire Pigs Finished in Hoop Structures. A. Harrison*, A. C. Robinson, B. Carter, D. Peele-Kendrick, K. J. Branch, H. Pettress, and D. J. Coble, Department of Animal Sciences, North Carolina Agricultural and Technical State University, Greensboro, NC, 27411.

In this study, we evaluated the effects of probiotic and xylanase supplements in distiller's dried grains with solubles (DDGS) feeds on the splenic transcriptome of Berkshire finisher pigs. Over a 35-day period that spanned August and September of 2024, twenty-four, 4-month old Berkshire pigs weighing 64.8±4.8 kg were randomly assigned to four diets: "15% DDGS" (Control), "15% DDGS + Probiotic" (Treatment 1), "15% DDGS + Xylanase (Treatment 2), 15% DDGS + Probiotic/Xylanase (Treatment 3). The probiotic supplement was added to the DDGS feed at a concentration of 1kg/ton, while the xylanase supplement was added at a concentration of 4,000 U/Kg. Spleens from these animals were harvested for RNA isolation, cDNA library construction, and RNA-sequencing using the NovaSeq X Plus platform from Illumina. The reads will be mapped back to reference genome, Sscrofa11.1 and counted to assess differential expression (DE) ($P \leq 0.05$, Log2 Fold Change ≥ 1.0). When comparing Treatment 1 to the Control, there were 579 DE genes, 297 up-regulated and 282 down-regulated. When comparing Treatment 2 to the Control, there were 406 DE genes, 142 up-regulated and 264 down-regulated. When comparing Treatment 3 to the Control, there were 547 DE genes, 177 up-regulated and 370 down-regulated. In conclusion, we observed a much stronger trend of down-regulation amongst the DE genes compared to up-regulated DE genes (916 vs. 616). We also observed gene expression patterns that reflect a reduction in the ion gradient needed for ATPase to transport bile and water, as well as anti-inflammatory responses.

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Gene Expression Analysis and Whole Genome Sequencing Reveal Potential Origins Of Ciprofloxacin-Resistance In A Salmonella Dublin Isolate, Revealing Novel Mutations In The Gyrb Gene. K. Bentum[1]*, A. Leesemaker-Palmer[2], S. Nuss[2], W. Abebe[1], T. Samuel[1], L. Bemudez[2]* [1] Center for Food Animal Health, Food Safety

and Defense, Department of Pathobiology, College of Veterinary Medicine, Tuskegee University, Tuskegee, AL 36088, USA. [2] College of Veterinary Medicine, Oregon State University, Department of Microbiology, Corvallis, OR 97331, USA.

Ciprofloxacin (CIP) resistance in Salmonella remains a public health threat. However, research investigating the prevalence and mechanism of resistance in less frequent Salmonella isolates remains scarce. This study investigated ciprofloxacin resistance among Salmonella isolates collected from 1985 to 2023. Briefly, susceptibility of the isolates to CIP was determined by the Oregon Veterinary Diagnostic Laboratory on July 7th, 2024, using the broth dilution method. The minimum inhibition concentration (MIC) of each isolate was used to infer its susceptibility to CIP. Resistant isolates and their sensitive counterparts were subjected to gene expression analysis for the acrAB efflux transporter genes and the regulator genes marA, ramA, and soxS. Whole genome sequencing of the isolates was also and their quinolone resistance-determining regions were examined for mutations. For our results, Salmonella Dublin isolated in 1985 was the only CIP-resistant isolate identified (MIC = 1µg/mL). The expression of the acrA, acrB, ramA, and soxS genes was significantly higher in the resistant isolate compared to its susceptible (MIC < 0.125µg/mL) counterpart. The resistant isolate had a single mutation in the gyrA gene, resulting in a Serine (Ser) to Phenylalanine (Phe) (S-83-F) codon switch. Three novel mutations: Asparagine (Asn) to Histidine (His) (N-452-H), Arginine (Arg) to Glycine (G) (R-457-G), and Lysine (Lys) to Glutamine (G) (K-460-Q) were, however, identified in the gyrB gene. No mutations were, however, identified in the parC and parE genes. The findings of this study add to our knowledge of the possible mutations that can be associated with ciprofloxacin resistance in Salmonella Dublin.

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Impact of Different Forms of Artemia on Growth, Stress Physiology, and Gut Microbiome of *Litopenaeus vannamei* Post-Larvae. R. Kurapati*, Y. Ramena, G. Ramena, T. White, Department of Aquaculture and Fisheries, University of Arkansas at Pine Bluff, 1200N University Dr, Pine Bluff, AR 71601; A. Fuller, Harry K. Dupree Stuttgart National Aquaculture Research Center, 2955 Highway 130 East, Stuttgart, Arkansas, 72160.

Global shrimp aquaculture is projected to exceed six million tons by 2025; however, inconsistent larval feeding strategies, particularly the use of different *Artemia* life stages, continue to limit survival and performance across production regions. Although *Artemia* remains the primary live feed for *Litopenaeus vannamei* larvae and post-larvae, the optimal life stage and delivery form remain insufficiently defined. This study evaluated four dietary treatments using GSLA™ *Artemia*: T1 (100% live instar I nauplii), T2 (100% decapsulated cysts), T3 (60% live:40% decapsulated), and T4 (40% live:60% decapsulated). Growth was monitored using AI-based image processing technology using CNN and YOLO algorithms, and post-larvae were analyzed for proximate composition, amino acids, fatty acids, immune responses (HSP60, HSP70, HSP90), and gut microbiome was analyzed using 16S rRNA sequencing, rarefaction, and LEfSe. Treatment effects were assessed using a MIXED model ($P \leq 0.05$). Results showed distinct diet-dependent responses. T1 produced the highest growth and survival, demonstrating the superior nutritional suitability of live nauplii. In contrast, T2 resulted in poor growth and reduced survival, indicating that decapsulated cysts alone do not provide adequate nutritional or functional support. Microbiome analysis revealed that diets containing live *Artemia* (T1, T3, T4) promoted diverse, probiotic-associated bacterial communities, whereas T2 was dominated by opportunistic taxa with the predominance of Enterobacteriaceae. Gene expression revealed that diets with greater proportions of decapsulated *Artemia* (T2, T3, T4) displayed enhanced stress resilience compared with T1, despite T1 yielding the strongest growth performance.

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Comparative Assessment of Conventional and Fermented (Fermex200) Soybean Meals as Fishmeal Replacements in Rainbow Trout (Oncorhynchus Mykiss) Diets. S. Onileowo*, P. Randolph, A. Ishola, A. Nassiwa, M. Haruna, C. King, A. Coursey, J. Loesch, and M. Matuha, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO, 65101.

Aquaculture is one of the fastest-growing food-producing sectors, with rainbow trout (Oncorhynchus mykiss) ranking as the third most produced finfish species in the United States. Formulated diets for trout have traditionally relied on fishmeal (FM) as the primary protein source; however, rising FM costs and limited supply have driven interest in (plant-based) alternative protein sources. This study evaluated the impacts of fermented soybean meal (Fermex200) and conventional soybean meal (SBM) as partial and full replacements for FM in rainbow trout diets. A 12-week

feeding trial is underway using 414 rainbow trout at the grow-out stage (79.80 ± 4.21g; 19.46 ± 0.22cm). Fish were randomly assigned to six diets in triplicate tanks (23 fish per tank) within a closed recirculating aquaculture system. Diets were isonitrogenous (43% crude protein) and isolipidic (20% crude lipid), with FM replaced at graded levels: 0% (control-FM), 25% SBM (SBM25), 50% SBM (SBM50), 25% Fermex200 (Ferm25), 50% Fermex200 (Ferm50), and 50:50 SBM: Fermex200 (SBM+Ferm). Fish are being fed to apparent satiation, and growth is monitored every four weeks. In the first 28 days, rainbow trout grew equally well on all diets. Fish fed 50% soybean meal gained the most weight, while those fed 25% fermented soybean meal used feed most efficiently. Growth rate, feed intake, and survival were similar among all groups. These early results suggest fishmeal can be replaced by up to 100% soybean or fermented soybean meal without negatively affecting growth. The study and further analyses are ongoing.

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Evaluating Antibacterial and Antipollutant Effects of Anthocyanins on Channel Catfish *Ictalurus punctatus* Immune Function Using *In Vitro* Models. M. Thakur*, S. Salukuti, Department of Environmental Toxicology, College of Agricultural, Human and Environmental Sciences, Southern University and A&M College, Baton Rouge, LA, 70813; M. Contin Ortega, Southern University Agricultural Research and Extension Center, Baton Rouge, LA, 70813; S. Batra, Department of Environmental Toxicology, College of Agricultural, Human and Environmental Sciences, Southern University and A&M College, Baton Rouge, LA, 70813; L. Anderson-Hodges, Southern University Agricultural Research and Extension Center, Baton Rouge, LA, 70813; C. G. Lutz, Renewable Natural Resources, Louisiana State University Agricultural Center, Baton Rouge, LA, 70803.

Aquaculture provides more than half of the seafood consumed globally. The increasing demand for aquatic food leads to the expansion and intensification of aquaculture practices, which usually involve high stocking densities. This may have a negative effect on fish growth and allows the occurrence of infectious diseases, leading to high mortality rates. In the United States, channel catfish (*Ictalurus punctatus)* represents the highest market share of the freshwater aquaculture industry. However, health management issues constantly challenge this sector due to its intensive nature. Antibiotics have traditionally been used in aquaculture as prophylactic methods, but the emergence of antibiotic-resistant strains poses a threat to animal and public health and has a negative effect on the environment. Beyond the issue of antibiotic resistance, the overall deterioration of water quality due to various pervasive substances presents a further challenge. For instance, pollutants like pentachlorophenol (PCP) and perfluorooctanoic acid (PFOA) persist in aquatic ecosystems and are known to compromise fish immune function and development. Phytochemicals such as anthocyanins are promising alternatives, functioning to counter bacterial infections and reduce the immunotoxic effects of pollutants by enhancing fish immune response. The current project, using an *in vitro* approach, will evaluate the effects of anthocyanin on channel catfish macrophages exposed to *E. coli* lipopolysaccharide and model pollutants (PCP and PFOA). This study aims to identify how dietary phytochemicals support sustainable immune health in aquaculture-relevant species under environmental stress, and its findings will help elucidate the mechanisms by which they achieve this support.

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Elevated Water pH Improves Ammonia Tolerance in Channel Catfish Through Enhanced Ion Regulation, Energy Homeostasis, and Rh Glycoprotein Gene Activity. F. I. Fahim*, T. Bhattacharjee, K. Adhikari, S. Bhattarai, A. K. Sinha. Dept. of Aquaculture and Fisheries, University of Arkansas at Pine Bluff, Pine Bluff, AR, 71601.

Catfish farming is vital to U.S. aquaculture, but ammonia accumulation in culture systems severely impairs fish performance and survival. This study examined whether pH manipulation can reduce ammonia toxicity in channel catfish (*Ictalurus punctatus*). Fish were exposed to three pH levels (7.1, 7.8, 8.5) with or without high environmental ammonia (HEA, 5.42 mg/L) for two months across six treatment groups with three replicate tanks each. Ammonia exposure at pH 7.1 and 7.8 caused significant plasma ion depletion (Na^+, K^+, Ca^{2+}, Mg^{2+}), indicating disrupted osmoregulation. However, fish at pH 8.5 under HEA maintained near-normal ionic balance, supported by enhanced gill ion transporter activity. Elevated Na^+/K^+-ATPase improved sodium-potassium regulation, while increased H^+-ATPase enhanced proton excretion and acid-base homeostasis. Energy metabolism was severely compromised at pH 7.1, with substantial depletion of glycogen, lipids, and proteins reflecting high metabolic costs. Conversely, fish at pH 8.5 preserved greater energy reserves, demonstrating reduced physiological stress under chronic ammonia exposure. Gene expression analysis revealed that ammonia transport genes (*Rhbg* and *Rhcg*) remained unchanged at pH 7.1 and 7.8 under HEA, indicating impaired ammonia excretion. In contrast, fish at pH 8.5 + HEA showed significant

upregulation of both genes, suggesting enhanced branchial ammonia elimination under alkaline conditions. These findings demonstrate that maintaining alkaline water (pH 8.5) effectively mitigates chronic ammonia toxicity by stabilizing plasma ions, enhancing gill transport capacity, preserving energy stores, and upregulating the pathways for ammonia excretion. pH adjustment represents a practical and cost-effective management strategy to enhance ammonia tolerance and productivity in catfish aquaculture.

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Ammonia Pre-Conditioning Enhances Resistance and Gene Expression in Channel Catfish Exposed to Elevated Ammonia Levels. K. Adhikari*, T. Bhattacharjee, F.I. Fahim, N. Kafle, S. Bhattarai, R. Lochmann, and A. Sinha, Dept. of Aquaculture and Fisheries, University of Arkansas at Pine Bluff, Pine Bluff, AR, 71601.

Ammonia accumulation is a persistent challenge in intensive aquaculture, where high stocking densities and limited water exchange increase the risk of toxicity, impairing fish growth and survival. Because no rapid treatment exists, preventive strategies are critical. This study tested whether pre-acclimation to low ammonia levels could induce an adaptive "stress-avoidance memory" in channel catfish (*Ictalurus punctatus*), improving tolerance to subsequent exposure. Fish were pre-exposed to 2.17 mg/L total ammonia (10% of 10-day LC_{50}) for 14 or 21 days, followed by a 7-day recovery in clean water. Groups were then challenged with lethal (100% 96 h LC_{50}) or sub-lethal 12.2 mg/L ammonia (~25% 96 h LC_{50}) for 14 days. Fish pre-exposed for 14 days showed markedly improved survival under lethal challenge. Under sub-lethal exposure, ionic balance (Na^+, K^+, Ca^{2+}, Mg^{2+}, Mn^+) and gill ion transporter (Na^+/K^+-ATPase) activities were better maintained, supporting enhanced ion-regulation. Energy reserves (glycogen, protein, lipid) were also conserved under sub-lethal exposure, whereas naïve and 21-day pre-exposed fish showed accelerated depletion. Gene expression analyses revealed significant upregulation of ammonia transporters (Rhbg, Rhcg) in pre-exposed groups, particularly after 14 days, indicating transcriptional adjustments that favor ammonia excretion. In contrast, prolonged pre-exposure (21 days) offered no additional protection and in some cases reduced resilience, suggesting stress fatigue. Overall, short-term pre-acclimation (14 days) effectively enhances physiological and molecular defenses against ammonia toxicity in channel catfish, providing a practical conditioning strategy to mitigate risk in aquaculture systems.

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Assessment of Undergraduate Students' Attitudes and Knowledge of Issues on Animal Welfare and Ethics. E. Soles* and V. A. Uyanga, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101.

There has been increased public interest in farm animal production systems, ethics, and welfare among consumers. This study was designed to assess the attitudes and knowledge of undergraduate students regarding animal welfare and ethical issues. Qualtrics software was used to collect anonymous responses from 130 undergraduate participants. The survey employed a 5-point Likert scale: (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, and (5) strongly agree, and data were analyzed using descriptive statistics. To assess students' perceptions, 46% of participants strongly agreed that animal welfare is important in farm animal production, while 37% agreed that animals have inherent value. Regarding ethical views and attitudes, 59% of participants supported the use of animal welfare certifications such as "humane certified," and 51% agreed that they considered animal welfare implications when choosing the food they consumed. To assess students' knowledge, 40% responded neutrally to knowing the current laws and regulations governing animal welfare in farming practices, while 26% agreed that they were familiar with such regulations. More than half of the participants (52%) agreed that consumers have the right to know how farm animals are treated through labeling on animal products, and 51% agreed that educational programs are essential for improving public knowledge and action on animal welfare. Overall, the findings from this survey provide valuable insights into the perceptions, attitudes, and knowledge of undergraduate students, who play vital roles as consumers, producers, advocates, and future professionals in the animal industry.

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Evaluating the Academics and Personal Growth of Students in the Study Abroad Program: A Mixed-Methods Approach. C. Maragh*, L. Douglas, P. Jackson, M. Daley , CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View TX 77446.

The 2025 Jamaica Study Abroad Program, hosted by the College of Agriculture, Food and Natural Resources, provided ten undergraduate students with an immersive, faculty-led experience focused on animal production, veterinary medicine, and agricultural research, within an international context. Over the period, participants engaged with key Jamaican institutions, including the Jamaica Society for the Prevention of Cruelty to Animals (JSPCA), Hope Zoo, Bodles Agricultural Station, Ebony Park, and Caymanas Park, through site visits and cultural exchanges. This study aimed to assess students' acquisition of veterinary and animal science knowledge, cultural adaptability, and personal development. Data were collected via pre- and post-program surveys administered through Qualtrics, incorporating Likert-scale items, open-ended questions, and reflective prompts, alongside student essays. Overall, the program was considered successful, and students were able to gain hands on knowledge in animal and veterinary science.

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Effects of Brown Mushroom Stem Powder as a Partial Soybean Meal Replacement on Laying Performance and Egg Quality of Lohmann LSL Lite Hens. A.D. Smith[1,*], A.A.A. Abdel-Wareth[1], K.G. Stamps[1], M. Salahuddin[1], V. Balan[2], W.K. Kim[3], P.K. Goswami[1], C.D. Gray[1], A.M.W. Aviña[1], T. Carr[1], A. Argueta[1] and J. Lohakare[1]. [1]Prairie View A&M University, CAFNR Research, Texas, United States. [2]University of Houston, Department of Engineering Technology, Cullen College of Engineering, Texas, United States. [3]University of Georgia, Department of Poultry Science, Athens, United States.

Brown mushroom stem powder (BMSP), a nutrient-rich byproduct, may serve as a sustainable and low-cost alternative to soybean meal (SBM) to enhance laying performance and egg quality. A total of 120 Lohmann LSL Lite layers (34 weeks old) were used to evaluate the effects of BMSP as a partial substitute for SBM on laying performance and egg quality. The birds were randomly assigned to three dietary treatments: a control and two experimental groups in which 10% or 20% of SBM was replaced with BMSP. Each treatment consisted of eight replicates with five hens per pen. Dietary inclusion of BMSP positively influenced laying performance, particularly during the later stages of production. Hens receiving 20% BMSP exhibited significantly higher egg production ($p = 0.019$), egg mass ($p = 0.006$), and egg weight at 40 weeks of age. Feed intake increased slightly ($p < 0.05$), while feed conversion ratio improved numerically, indicating better nutrient utilization. Egg quality parameters also improved with BMSP inclusion: albumen percentage increased linearly ($p = 0.002$), yolk percentage decreased ($p = 0.004$), and egg color and Haugh unit scores were significantly enhanced ($p < 0.05$), reflecting improved freshness and appearance. Shell thickness and strength were unaffected. The findings demonstrate that replacing up to 20% of SBM with BMSP enhances laying performance and egg quality without compromising shell integrity. Future research should explore the underlying mechanisms of nutrient bioavailability, antioxidant contribution, and long-term production impacts. Incorporating BMSP provides a sustainable and cost-effective strategy for enhancing layer productivity and feed efficiency.

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Sustainable Poultry Nutrition Through the Use of Brown and White Mushroom Stem Powders. T. Carr[1]*, A.A.A. Abdel-Wareth[1], K.G. Stamps[1], M. Salahuddin[1], A.A. Ahmed[2], V. Balan[3], M. Mohammadi[3], W.K. Kim[4], C.D. Gray[1], A.M.W. Aviña[1], and J. Lohakare[1]. [1]CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446, [2]Computer Science Department, Prairie View A&M University, TX 77446, [3]University of Houston, Department of Engineering Technology, Cullen College of Engineering, Texas, United States. [4]University of Georgia, Department of Poultry Science, Athens, GA, United States.

This study investigated the potential of *Agaricus bisporus* brown mushroom stem (BMS) and white mushroom stem (WMS) powders as sustainable substitutes for soybean meal in poultry nutrition. The work evaluated their influence on growth performance, feed efficiency, organ development, gas emissions, blood biochemistry, and mineral utilization in Lohmann LSL Lite chicks. A 2x4 factorial design was used, with two mushroom types (BMS and WMS) and four supplementation levels (0, 2, 4, and 6%). The experiment included 320 three-week-old chicks, randomly assigned to eight treatment groups, each consisting of five replicates, and conducted over a five-week period. Birds were monitored for feed intake, body weight, and feed conversion efficiency was calculated. Physiological responses were assessed through organ weight evaluation, blood metabolite profiling, and nutrient retention, while gas emission analysis provided insights into environmental impacts. The results indicated that BMS and WMS powders had no significant effects on body weight or feed efficiency but influenced feed intake, gas emissions and physiological responses. BMS increased feed intake and reduced gas emissions compared to control, while WMS elevated serum

glucose, protein, and enzyme levels. Both mushrooms affected mineral retention differently, with complex interactions between mushroom type and supplementation level, depending on inclusion percentages. These findings highlight the complexity of nutritional and metabolic interactions that occur when replacing conventional protein sources with novel by-products. In conclusion, BMS and WMS powders show promise as sustainable partial replacements for soybean meal, contributing to feed diversification, nutrient recycling, and environmental stewardship in poultry production.

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The Effects of Oyster, Fine Limestone, and Coarse Limestone as A Free Choice Supplementation of Calcium on The Eggshell Quality and Bones of Mature Laying Hens. J. Brown*, H. Mellieon, Jr., D. Pollard. Department of Agricultural Sciences and Technology, College of Agricultural, Human and Environmental Sciences, Southern University and A&M College, Baton Rouge, LA, 70813;, F. DeRouen, II, J. Obuya, Southern University Agricultural Research and Extension Center, Baton Rouge, LA, 70813.

Higher egg production puts demand on the hen's calcium metabolism and therefore requires a quality calcium source. Despite this, some egg producers endure substantial economic losses from cracked shells and from hen loss due to poor bone quality, especially in aged hens. Calcium is acquired by the hen through feed, and if improperly supplied, the hen can obtain calcium from medullary bone reserves. The objective of this study was to compare the effects of the supplementation of either fine limestone (FL), coarse limestone (CL), or oystershell (OS) (treatments) to no supplement (control) in the free-choice feeding of 40, two-year old Leghorn, laying hens for 8 weeks. Some parameters included the total number of eggs (TNE), percentage of cracked eggs, egg weight (EW), eggshell thickness (ET), hen-housed average (HHA), and bone analysis. Although not throughout the study, the control had significantly lower EW in the study at week 2. When compared to the control, FL and OS had a significantly higher TNE. The OS had the highest percent weight and ES. The HHA was significantly different amongst the groups as FL and OS were similarly effective and were significantly higher than the control. The results showed some positive effects of FL and OS supplementation, and the combinations of aforementioned supplements will be investigated on various ages of layers in order to optimize egg laying production.

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From Blood Drop to Decision: AI-Based Biosensor for Rapid On-Farm Anemia Detection in Goats. C. Griffin*, A. Siddique, A. K. Mahapatra, T. H. Terrill, Fort Valley State University, Fort Valley, GA 31030.Fort Valley State University, Fort Valley, GA 31030; S. S. Panda, University of North Georgia, Oakwood, GA 30566; E. R. Morgan, Queen's University Belfast, UK; J. A. van Wyk, University of Pretoria, Onderstepoort, South Africa.

Small ruminants, such as goats, are vital contributors to global food security, fiber production, and rural livelihoods. However, their productivity is often compromised by anemia caused by blood-feeding internal parasites like *Haemonchus contortus*. Early, accurate diagnosis of parasitic infection is key to reducing animal suffering, minimizing drug overuse, and improving sustainable herd management. This study presents an artificial intelligence (AI)-enabled biosensor designed to detect anemia rapidly and cost-effectively under farm conditions. Seventy-five Spanish goats were sampled to establish blood packed cell volume (PCV) ranges and link blood profiles to anemia severity. A semi-invasive method using only 30 μL of blood deposited on glycerol-infused filter paper generated dispersion patterns captured via smartphone imaging. These images were analyzed against standard PCV readings and used to train multiple machine learning models, including support vector machines (SVM), K-nearest neighbors (KNN), backpropagation neural networks (BPNN), and a Keras-based image classifier, on a dataset of 3,000 images with 10-fold cross-validation. Results showed strong model performance, with detection accuracy rising from 70% at early epochs to 97.8% after optimization. BPNN and SVM achieved high precision, with F1 scores of up to 100% in classifying healthy to severely anemic animals. Beyond accuracy, this approach highlights the potential of AI-driven diagnostic tools to reduce reliance on laboratory infrastructure, support targeted deworming strategies, and improve animal welfare while lowering costs for resource-limited farmers. By integrating AI with sustainable livestock practices, this biosensor represents a scalable pathway toward resilient agricultural systems, promoting both productivity and environmental stewardship.

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Effects of copper oxide wire particles and selected botanicals for gastrointestinal parasite and heat stress management in Spanish goats in Oklahoma, USA. K. Brown*, A. Sonibare, R. Puchala, D. Tadesse, H. Yirga, A. Patra, R. Merkel, and I. Tovar-Luna. American Institute for Goat Research, Sherman Lewis School of Agriculture and Applied Sciences, Langston University, OK,73050.

This study evaluated the effects of copper oxide wire particles (COWP), *Cymbopogon citratus* essential oil (CCSO), *Ulmus fulva* (UMF), and *Artemisia absinthium* (ART) supplementation on naturally acquired gastrointestinal parasite infections and heat stress (HS) in Spanish goats. Forty doelings (2–3 years old; 39.3±5.8 kg) were randomly assigned to five treatment groups (n = 8 per group): COWP (0.3 g in gel capsule per os once/week/goat), control (no supplement), CCSO (1 ml/goat/day), ART (6 g in 200 ml water/goat/day), and UMF (10 g in 200 ml water/goat/day). Treatments were administered orally each morning for six weeks. Parasite burden was assessed via fecal egg counts (FEC), larval development, and packed cell volume (PCV). Heat stress indicators included rectal temperature, respiration rate, ambient temperature (AT, °F), relative humidity (RH, %), and temperature-humidity index (THI, °F). Coefficient of heat tolerance (CHT) and index of adaptability (IA) were also calculated. Average AT, RH, and THI during the study were 80.9±6.4°F, 68.8±9.6%, and 84.4±9.1°F, respectively. Supplementation with COWP and botanicals reduced FEC compared to controls, with COWP and CCSO showing the strongest anthelmintic effects. ART and UMF yielded moderate reductions, though UMF demonstrated limited antiparasitic activity. Goats receiving COWP, CCSO, and ART exhibited improved physiological responses to HS, including lower respiration rates and reduced rectal temperatures during peak heat periods. Findings suggest that copper oxide and selected botanicals offer promising natural alternatives for integrated parasite management and heat stress mitigation in goats. Such interventions may enhance productivity of small ruminants under increasingly challenging climatic conditions.

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Effects of Natural Sources of Brackish/Saline Water on Water Intake, Feed Intake and Body Weight of Alpine Dairy Goats. D. Chery *, H. Yirga, D. Woldemariam, R. Puchala, D. Tadesse, A. K. Patra, C. Alvarado, and S. Adekayode. School of Agriculture and Applied Sciences, Langston University, Langston, OK, 73050, USA.

This study evaluated the effects of different United States Geological Survey (USGS) water classifications on feed intake, water consumption, and performance of lactating Alpine dairy goats. Thirty-two goats were assigned to one of five drinking water treatments for six weeks: fresh water (FRW), West Pasture brackish water (BRW), USGS group 2 (GR-2), USGS group 3 (GR-3), and an unclassified source (G-UC). Total dissolved solids (TDS) were 383 ± 119, 6385 ± 356, 3099 ± 227, 5410 ± 125, and 2567 ± 165 mg/L for FRW, BRW, GR-2, GR-3, and G-UC, respectively. Goats were fed a total mixed ration (50% forage, 50% concentrate) at 4% of their body weight (air-dry basis). Dry matter (DM) offered, refused, and consumed differed significantly among weeks ($P < 0.05$) but was not affected by water treatment ($P > 0.05$). Average daily DM intake ranged from 2.05 to 2.49 kg/day across weeks and from 2.05 to 2.36 kg/day among treatments. Nutrient intake followed similar trend. Water consumption averaged 6.44–8.17 kg/day, and although neither treatment nor time alone influenced intake, occasional treatment × time interactions were observed. Average daily gain (ADG) did not differ among treatments; however, goats receiving GR-3 lost 50.5 g body weight/day, while others gained 29.9–83 g/day, likely due to lower nutrient intake. In conclusion, water quality had no significant effect on feed or water intake, indicating that Alpine dairy goats tolerate a range of water salinities and USGS-classified sources. Nevertheless, observed intake temporal changes warrant further investigation in the long term.

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Impact of Nutritional Interventions on Hair Quality and Correlations with Serum Biochemical Markers in Dairy Goats. F. Hernandez*, F. Belkasmi. Sherman Lewis School of Agriculture and Applied Sciences, Langston University, OK, 73050.

This study aimed to characterize the physical properties of dairy Alpine goats under different nutritional treatments. Hair samples were collected from the left flank region of each goat. A square area of approximately 1 cm^2 was carefully shaved using a clipper, then placed in labeled plastic bags. Fiber length, fineness, brightness, and fiber diameter were evaluated using scientific test-standard methods to explore their relationship with key blood biochemical parameters.

Blood samples were collected simultaneously to determine concentrations of total protein, albumin, urea, and creatinine. Data were analyzed using linear mixed models, with treatment groups as a fixed effect and animal as a random effect. Multiple comparisons were adjusted using the Tukey method, and statistical significance was declared at $p < 0.05$. The study results showed that hair quality was affected by nutritional treatment, indicating that goats receiving diets enriched with essential oils or the combined supplement showed improved hair brightness and increased fiber diameter compared to the other groups. A positive correlation was observed between hair brightness and serum total protein. These findings highlight that the physical traits of hair may reflect underlying metabolic and nutritional status in dairy goats. Monitoring hair characteristics alongside blood biomarkers could offer a non-invasive tool for assessing animal health and dietary efficiency in small ruminants. Furthermore, dietary supplementation with essential oils may represent a promising strategy to enhance hair quality in dairy goats, particularly in show or breeding animals where coat appearance is a key trait.

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Evaluation of Nutritional Strategies on Productive Performance of Alpine Goats Under Thermal Stress. K. Jackson*; C. Alvarado; F. Belkasmi. Sherman Lewis School of Agriculture and Applied Sciences, Langston University, OK, 73050.

This study evaluated the effects of targeted nutritional strategies on the productive performance of Alpine goats exposed to thermal stress. Forty lactating does were randomly assigned to one of five dietary treatments. Milk yield was recorded daily during mid-lactation, and milk composition (fat, protein) was analyzed to assess its relationship with environmental parameters. Ambient temperature (°C), relative humidity (%), light intensity (lux), and dew point (°C) were continuously monitored using HOBO (MX1104) data loggers to quantify heat load, and the temperature–humidity index (THI) was subsequently calculated. Descriptive statistics were computed for each sensor. Thermal heterogeneity between barn zones was evaluated at two levels: (1) daily averaged THI differences, analyzed by one-way ANOVA with sensor as a fixed factor and Tukey post-hoc tests; and (2) time-distribution of severe exposures, analyzed using Pearson's chi-square test followed by two-proportion z-tests to report percent-time differences and exact p-values. All analyses were performed in Python (using pandas, statsmodels, and pingouin) within an Anaconda Jupyter environment. When THI exceeded 80, milk yield and fat-corrected milk decreased across all groups; however, goats receiving essential oils (EO) and the combined supplement (MIX: undegradable protein + bypass fat + essential oils) maintained significantly higher milk output compared with control and single-additive groups ($P < 0.05$). Enhanced milk fat and protein percentages further suggested improved metabolic resilience and nutrient partitioning under heat stress. These findings suggest that integrative nutritional supplementation can mitigate the impacts of thermal stress, enhance thermotolerance, and sustain productivity in dairy goats under challenging climatic conditions.

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Effect of Supplementation Level of an Agro-byproduct Mix on Indicators of Gastrointestinal Parasitism in Post-weaning Landrace Hair Sheep Lambs. D. Epps*, Department of Agriculture, Virginia State University, Petersburg, VA 23806; D. O'Brien, Cooperative Extension and Agricultural Research Station, Virginia State University, Petersburg, VA, 23803; K. Matthews, Department of Agriculture and Natural Resources, Delaware State University, Dover, DE 19901; and S. Wildeus, Agricultural Research Station, Virginia State University, Petersburg, VA, 23803.

The post-weaning transition is critical for the subsequent growth and well-being of lambs. This experiment evaluated the use of a soy hull (SH) and corn gluten feed (CG) for diets of weaned lambs transitioning to pasture for grow-out. Mixed-sex Barbados Blackbelly and St. Croix lambs (ewe and wethers; n=32) weaned the end of January at 9 weeks of age were and placed in 8 pens semi-covered pens with outdoor access balanced by breed, sex and weaning weight. Following a 2-week adaptation period, lambs received SH/CG mix (50/50) at either 2.5% or 3.5% of body weight and *al lib* moderate quality hay (4 pens per ration) during a 56-day feeding trial. Body condition, packed blood cell volume, and fecal egg counts were determined at the beginning, middle and end of the trial. Data was analyzed as repeated measurements in a model with supplement level, breed, sex, and time of sampling as the main effects. Fecal eggs counts were analyzed following log transformation. The higher level of supplementation significantly reduced fecal egg counts at the end of the trial, but did not affect body condition or packed cell volume. In contrast, breed and sex affected body condition score and packed cell volume of lambs, but not fecal egg count. Time of sampling also significantly affected body condition score and packed cell volume with a significant decrease at the end of the trial.

Results indicate that higher levels of agro-byproduct supplementation can be useful in suppressing gastrointestinal parasitism in lambs.

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Impact of Season, Breed, Litter Size and Ewe Age on Gestation Length of Landrace Hair Sheep Ewes. C. Sellers*, Department of Agriculture, Virginia State University, Petersburg, VA 23806; D. O'Brien, Cooperative Extension and Agricultural Research Station, Virginia State University, Petersburg, VA, 23803; and S. Wildeus, Agricultural Research Station, Virginia State University, Petersburg, VA, 23803

Various factors affect gestation length in sheep including breed and ewe age, but limited information is available on the influence of mating season. This study evaluated gestation length in landrace hair sheep mated at different times of the year. A data set (n=335) covering 11 breeding seasons over 5 years was used to quantify variables affecting gestation length. Ewes were managed under accelerated mating and bred in March, July and November in single sire groups. Rams were equipped with marking harnesses and breeding marks were recorded daily throughout breeding. Ewes lambed on pasture and birth dates, litter weight and litter size were recorded within 24 hours, as was ewe age at breeding. Gestation length was calculated by subtracting marking date and lambing date. Data were analyzed in a model with mating season, breed, ewe age, and litter size as main effects. Gestation length was significantly longer (1 to 1.5 days) following July and November compared to March mating. Gestation length also differed for breeds with Barbados Blackbelly being 1 day longer than St. Croix ewes. There was no effect of litter size on gestation length, but gestation length increased by >2 days in yearling to <6 years of age. Average gestation length in landrace hair sheep used in this study (148 days) was slightly longer than the 147 days commonly used in gestation tables, and values should also be adjusted for ewe age, breed and mating season when calculating expected lambing dates for landrace hair sheep.

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Meta-Analysis of the Dietary Inclusion of Grape Pomace on Intake, Carcass Yield, and Meat Quality of Sheep. K. King*, A. Pech-Cervantes, M. Hitit, E. Memili, and Z.M. Estrada-Reyes, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, TX, 77446.

Grape production (*Vitis vinifera*) generates byproducts such as grape pomace (GP), which can be used as a feed ingredient for ruminants. This study aimed to evaluate the effects of dietary GP inclusion on intake, carcass yield, and meat quality of sheep (*Ovis aries*) using a meta-analytic approach. Data was collected following the PRISMA methodology. Eight studies published between 2018 and 2023, involving a total of 316 sheep (26.6 ± 4.1 kg), met the inclusion criteria. The raw mean difference (RMD) between GP and control diets was estimated, followed by robust variance estimation and meta-regression based on dietary crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), tannin, and GP content (0–50%). Dietary GP did not affect ($p > 0.05$) dry matter intake, average daily gain, or hot carcass weight. However, GP tended to increase ($p = 0.09$) final body weight and significantly increased ($p < 0.05$) cold carcass weight. Dressing percentage, carcass pH, and meat color (L*, a*, b*) were unaffected ($p > 0.05$). GP inclusion reduced (P = 0.02) cooking loss and tended to reduce (P = 0.08) shear force. Variance component analyses revealed low heterogeneity across most variables, except for meat color and cooking loss. Meta-regression indicated that dietary tannins and CP strongly influenced cooking loss ($R^2 = 0.80$) and shear force ($R^2 = 0.89$). Dose-response analysis confirmed that increasing dietary tannins from GP reduced both variables ($p < 0.01$). Overall, dietary GP improved meat tenderness and reduced cooking loss in sheep.

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Survey and Molecular Identification of Lice Infesting Goats and Sheep in the Delmarva Region. M. Rabb*, S. Zebelo, T. Tolosa , A. Ahmed, N. Escobar, University of Maryland Eastern Shore, Princess Anne, Maryland, 21853.

This study aims to evaluate the abundance and diversity of lice infesting goats and sheep in the Delmarva region, providing baseline data for integrated pest management. We aim to Sample r monthly over at least 3-4 months across at least five farms, with each farm sampling ten animals, five goats, and five sheep, totaling 50 animals. We have already sampled two farms. Each animal was systematically examined for lice, and samples collected using standardized methods to ensure consistency. Molecular techniques, such as DNA barcoding, will be used to accurately

identify lice species, including closely related or potential new species. We are in a process of analyzing the data to assess the spatial and temporal prevalence and infestation intensity across farms and host species, while accounting for factors such as management practices, seasonal changes, and host susceptibility. The results will help develop targeted control strategies and deepen understanding of lice epidemiology in small ruminants in the area. Ultimately, the findings aim to guide local farmers in reducing parasite burdens, improving animal health, and increasing productivity.

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Evaluation of Nitrate Leaching in Soil Amended with Organic Fertilizer Treated with Biochar. M. Irfan*, M. Madlyn, K. Kpomblekou-A, and F. Quarcoo, College of Agriculture, Environment and Nutrition Sciences, Tuskegee University, Tuskegee, AL 36088.

Dissolved nutrients' downward movement in soil with percolating water constitutes major losses for farmers. Especially, nitrate (NO_3^-) leaching in agricultural soils is a global concern that poses risks to both environmental quality and human health. Thus, strategies must be developed to reduce NO_3^- losses in soil. Research has shown that the effects of biochar application vary with application rates, but factors affecting the losses in different soils are not fully understood. The objectives of the study are to investigate the effect of biochar on NO_3^- leaching and okra (*Abelmoschus esculentus*) yield in organic fertilizer-amended soil. The study was conducted on a Marvyn sandy loam soil (fine-loamy, kaolinitic, thermic Typic Kanhapludults) at Tuskegee University Organic Agriculture Institute Research Farm, using Clemson Spineless organic okra seed variety. The field plots were arranged in a Randomized Complete Block Design and included four treatments: control (no fertilizer, no biochar), organic fertilizer alone, biochar alone, and biochar-organic fertilizer combination (1:1 ratio). The fertilizer used was a poultry manure-based organic fertilizer (5-4-3). The fertilizer application rate was 150 kg N/ha (based on soil testing recommendation), split-applied at two and six weeks following transplant. Before transplant and at harvest, soil samples were collected at 0-5, 5-10, and 10-5 cm depths to determine NO_3^--N and ammonium (NH_4^+-N) concentrations to infer NO_3^--N and NH_4^+-N distribution and mobility within the soil profile under different treatments. These data and those collected on weekly okra height, daily okra pods harvest, total yield, and their relationships will be presented.

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The Impact of Training in Financial Basics on Small-Farm Producers' Knowledge in Selected Alabama Black Belt Counties. E.K. Waweru*, Department of Agricultural and Environmental Sciences, Tuskegee University, Tuskegee, AL 36088.

Financial literacy plays a crucial role in helping small-farm producers plan effectively for the future and achieve their farming goals. However, limited research has been conducted on financial literacy training among small-farm producers in Alabama, particularly within the Alabama Black Belt region. This region is home to many small and limited-resource farmers, and tailored financial training programs can significantly enhance their decision-making and farm-management practices. The purpose of this study was to assess the impact of financial literacy training on the knowledge of small-farm producers in selected Alabama Black Belt counties. Data was collected from a convenience sample of participants who attended two sets of workshops. Descriptive and comparative analyses were conducted to evaluate the impact of the training. The findings revealed that participants were mainly part-time farmers, predominantly male, and primarily Black, with most being middle-aged or younger. Overall, the results showed a clear improvement in participants' understanding of key financial concepts, such as balance sheets and financial ratios, after training. The workshops proved effective in enhancing financial literacy and increasing participants' confidence in managing farm finances.

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Silicon (Si) Mitigates the Incidence of Tip Burn in Hydroponically Grown Lettuce under High Temperature Stress. B. Ahmed*, D.G. Mortley, D. Mwazembe, J. Mweta, K. McAlmont, S. Willis, and G. McPherson, College of Agriculture, Environment and Nutritional Sciences, Tuskegee University, Tuskegee, AL 36088.

Lettuce is a leafy vegetable with high economic value that is widely grown both in the field and in controlled-environment greenhouses nationwide. Despite its benefits, hydroponic lettuce production presents challenges, due to the complexity of the hydroponic environment and the specific growth characteristics of lettuce. Tip burn is a

physiological disorder caused by low Ca levels within the plant. Addressing these challenges requires an understanding of cultivar-specific responses and environmental management in hydroponic systems, including the addition of amendments, such as Si to enhance plant resilience. To evaluate the effect, five lettuce cultivars (Green Oak Leaf, Green Sweet Crisp, Monte Carlo, Rex, and Salvius) were grown in nutrient film technique (NFT) using a randomized complete block design with a 5 x 3 factorial treatment arrangement and three replications. The treatments comprised a control and Si levels of 50 and 75 ppm. The pH levels were regulated between 6.0 and 6.5, while electrical conductivity (EC) was maintained within a range of 1.8-2.0 mS/cm. Greenhouse conditions included 310C, RH 89%, photoperiod of 16/8 hrs light/dark, and photosynthetic photon flux (PPF) of 200 µmolm-2s-1. The incidence of tip burn was cultivar-related as well as significant interactions of cultivars and Si levels. Salvius showed the highest tip burn incidence following Monte Carlo. Green Sweet Crisp had the lowest incidence, following Green Oak Leaf.

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Impact of Salinity Stress on Turnip (*Brassica rapa* L.): A Comprehensive Study of Growth, Yield, and Associated Morpho-Physiological and Phytochemical Responses. A. Rahman*and M. Gebremedhin, 1890 Land-Grant Program, Kentucky State University, Frankfort, KY 40601; M.S.U. Bhuiyan and S. Sultana, Department of Genetics and Plant Breeding, Sylhet Agricultural University, Sylhet-3100, Bangladesh.

Soil salinity is a major abiotic stress limiting global agricultural productivity. The development of salt-tolerant cultivars is essential for sustaining crop production. Turnip (*Brassica rapa* L.) is a nutrient-rich root vegetable, but its tolerance mechanisms under saline conditions remain inadequately characterized. This study aimed to systematically evaluate the effects of varying salinity levels on turnip at different growth stages by assessing morphological, physiological, biochemical, and anatomical changes in both saline and non-saline conditions, to identify potential tolerance thresholds and key stress-mitigating traits. The results showed that seed germination and seedling development were only mildly affected under moderate salinity, while higher concentrations increasingly restricted growth and biomass accumulation. As the plants matured, salinity had more negative effects on growth and yield. Physiological indicators such as photosynthetic pigments and membrane stability showed progressive declines under higher stress. Biochemical analyses revealed enhanced oxidative stress at higher salinity, accompanied by increased activity of major antioxidant enzymes and greater accumulation of osmoprotectants and secondary metabolites. These biochemical adjustments indicated an active defense strategy, although it was insufficient to fully counteract the detrimental effects at elevated salt levels. Anatomical observations further demonstrated structural alterations in vascular and mesophyll tissues under high salinity, reflecting impaired internal functioning. Overall, turnip shows moderate tolerance under low to moderate salinity, but higher salinity levels significantly reduce growth and yield. This study revealed the specific responses of turnip to varying salinity levels, offering important insights for the development of salt-tolerant cultivars and promoting sustainable agricultural practices in areas prone to salinity.

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Identification, Genetic Characterization, and Fermentative Assessment of Wild Yeast Endemic to Florida Muscadine Grapes. E. White*, A.F. Humphries, A. Mohamed, C. Kruis, M. Cleveland, and V. Tsolova, Center for Viticulture and Small Fruit Research, College of Agriculture & Food Sciences, Florida A&M University, Tallahassee, FL 32308.

Commercial *Saccharomyces cerevisiae* dominates wine fermentations, yet genetic uniformity can constrain flavor expression in non-*Vitis vinifera* fruit such as Florida's *Muscadinia rotundifolia* (muscadine). This project established a regional repository of wild yeasts and evaluated their enological potential for muscadine wine innovation. Fresh juice from 'Floriana,' 'Noble,' and 'Carlos' was allowed to ferment spontaneously; daily isolates were identified by colony PCR, gel electrophoresis, and sequencing. We recovered >250 accessions spanning five genera – *Pichia*, *Saccharomyces*, *Starmerella*, *Hanseniaspora*, and *Nakaseomyces* – and screened representative isolates in 50-mL pure-culture fermentations of muscadine juice. A composite quality index considered ethanol formation, residual sugar, glycerol, and volatile acidity to compare performance with a commercial *S. cerevisiae* control. Notably, native *Saccharomyces* strains – *S. cerevisiae*, *S. mikatae*, and *S. paradoxus* – consistently exhibited strong fermentative performance in muscadine must, achieving efficient sugar depletion with favorable metabolite profiles. Among non-*Saccharomyces* yeasts, *Pichia terricola* and *Starmerella stellimalicola* also performed well, characterized by comparatively elevated glycerol and restrained volatile acidity, while maintaining desirable kinetics. These findings verify the presence of diverse, autochthonous yeasts adapted to Florida vineyards and identify promising strains for

tailored fermentations that enhance authenticity and stylistic range in muscadine wines. The curated culture collection and associated genotypic/phenotypic records provide a foundation for future strain selection, mixed-culture strategies, and technology transfer to regional producers.

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Integrative Physiological and Molecular Insights into Salinity Tolerance Mechanisms in Grapevine Rootstocks. P. Gajjar*, A. Ismail, and I. El-Sharkawy**,** Center for Viticulture and Small Fruit Research, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32308.

Salinity is a major abiotic stress that limits plant growth and agricultural productivity, particularly in arid and semi-arid regions. It disrupts key physiological processes such as photosynthesis, nutrient and water uptake, and energy production, while inducing excessive reactive oxygen species (ROS) that cause oxidative damage. Grapevine (*Vitis* spp.), an economically important crop often grown in salt-affected soils, mitigates salinity damage through grafting onto tolerant rootstocks. This study investigated the responses of two grapevine rootstocks, 140 Ruggeri (RUG) and Millardet et de Grasset 420A (MGT), to salinity stress. Physiological analyses revealed that RUG maintained higher levels of photosynthetic pigments (Chl-T, Chl-a, and Chl-b), soluble sugars, and antioxidant enzyme activities (CAT, GPX, and SOD) compared to MGT, indicating superior ROS detoxification and osmotic adjustment. Complementary transcriptome profiling of RUG under salt stress and recovery conditions uncovered extensive transcriptional reprogramming, including genes involved in signaling, hormone regulation, photosynthesis, carbohydrate metabolism, and ROS homeostasis. Overall, the results highlight ROS homeostasis as a central regulatory mechanism that enables grapevine adaptation to salinity stress and suggest molecular targets for improving rootstock tolerance in salt-affected vineyards.

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Comparative Analysis of Insect Diversity in Roselle's (*Hibiscus sabdariffa*) Two Cultivars in the Florida Panhandle. A.M.S. Robinson-Baker*, J.S. Cabral, A. Ali, S.O. Laird, and M. Haseeb, Center for Biological Control, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32307.

Roselle (*Hibiscus sabdariffa* L.) is an economically and nutritionally important crop cultivated in tropical and subtropical regions for its calyces, which are widely used in beverages, the food industry, and traditional medicine. However, productivity and quality can be influenced by insect communities functioning as pollinators, herbivores, or natural enemies. Understanding these ecological interactions is essential for developing sustainable pest management strategies and promoting agroecological stability. This study investigated the diversity and functional composition of arthropod communities associated with two roselle cultivars, Black Curly and Red Curly, grown under field conditions in Quincy, FL. Insects were sampled weekly during flowering and fruiting using sticky traps, pitfall traps, and manual inspections. Specimens were identified at the family level and categorized into functional groups: herbivores, pollinators, predators, and decomposers. Data were analyzed using the Kruskal-Wallis test ($p \leq 0.05$) and Tukey's test in R (version 4.3.0). Ten insect families were recorded from Black Curly and nine from Red Curly, comprising 125 and 98 individuals, respectively. The most abundant families were Coccinellidae, Nitidulidae, and Cicadellidae. Diversity indices were similar between the cultivars (H' = 1.30 and 1.25; Evenness = 0.57), although Black Curly showed slightly higher richness (Margalef = 1.86) and greater abundance of predators and pollinators. These results indicate ecological balance between these two cultivars, suggesting both sustain diverse and stable insect communities. Overall, roselle demonstrates strong potential for integration into sustainable and resilient agroecological systems, contributing to pollinator conservation and biological control in the Florida Panhandle.

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Assessing the Role of Soil Microbiome in the Different Generations of Sweetpotato Roots. L. Mukiri* and S.K. Ponniah, Department of Agriculture, School of Agriculture, Fisheries and Human Sciences, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601.

Sweetpotato (*Ipomoea batatas* (L.) Lam.) is the tenth most important vitamin-rich root vegetable that contains crucial nutrients. It is vegetatively propagated and susceptible to viral infections. Viral titers accumulate disproportionately with each planting cycle (generation). These viruses are transmitted by insect vectors: aphids (*Myzus persicae)*

responsible for transmitting potyviruses and whitefly (*Bemisia tabaci*) that transmit geminiviruses and criniviruses. Viral infections significantly reduce both quality and quantity of sweetpotato yield, with potyviruses causing 25-50% yield losses and geminiviruses up to 80-90%. The objective of this study is to quantify the rate of infection of potyviruses in five different generations of sweetpotato, understand any changes in the shape of sweetpotato roots across the various generations, and investigate any differences in yield components. The treatments applied for this study are G0, G1, G3, G4, and G6. The research design used is Randomized Complete Block Design (RCBD). Storage roots harvested from G1 and G6 treatments were randomly sampled for total nucleic acid extraction. The soil samples surrounding the storage roots were collected in triplicate from greenhouse and field conditions. Microbial DNA was extracted from soil and endospheric samples. The DNA samples will be sequenced using 16S Ribosomal RNA (rRNA) and Internal Transcribed Spacer (ITS) on the Illumina platform. Results are expected to indicate that the virus infection reduced microbial diversity and led to microbial community shifts in rhizosphere and endospheric compartments.

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Profitability of Small-Scale Vegetable Production: Case Studies for Beginner Farmers in Kentucky. P. Owolabi and S. Dasgupta, 1890 Land-Grant Program, Kentucky State University, Frankfort, KY 40601.

Small-scale vegetable farming is gaining increasing importance in the U.S. as consumer preferences shift toward fresher, locally sourced, and culturally specific foods. This trend is particularly evident in Kentucky, where growing Asian and African immigrant communities are driving demand for vegetables essential to their traditional diets. Despite this opportunity, beginning farmers often lack access to localized information on production techniques, input costs, labor requirements, marketing, and potential profitability. This lack of data creates financial uncertainty and increases the risks of entering niche vegetable markets. This study aims to evaluate the profitability of small-scale vegetable production for beginner farmers in Kentucky by focusing on fast-growing greens and brassicas suitable for fall and spring production cycles. Using case study locations in Lexington and London, Kentucky, the research will integrate climate and soil data, labor inputs, production costs, and market prices to develop detailed enterprise budgets. These budgets will provide realistic estimates of startup costs, operational expenses, expected yields, and potential seasonal net returns. The outcomes of this research will provide practical guidance for new farmers, outlining effective production strategies and identifying crops with high profitability potential. Beyond individual economic benefits, the study will contribute to the resilience of local food systems by improving access to culturally appropriate fresh produce for diverse communities. Finally, the research fills a gap in the literature by offering replicable enterprise budget models for assessing the economic feasibility of small-scale ethnic vegetable farming, supporting informed decision-making and reducing financial risk for beginning farmers.

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High-Resolution UAV Monitoring of Soybean Using Multispectral and LiDAR Sensors for Optimizing N Timing and Agronomic Decision Support. M. Pandit* and A. Chiluwal, College of Agriculture, Health, and Natural Resources, Kentucky State University, Frankfort, KY 40601.

Soybean plants utilize over 60% of their nitrogen during pod growth and seed developmental stages, making late-season fertilization more impactful than early applications, which often yield minimal benefits. To investigate the optimal time of supplemental N application in soybean, field research was established in a randomized complete block design in Frankfort, KY. Treatments included the application of urea at different growth stages. A UAV equipped with high-resolution multispectral (RGB + NIR) cameras and a LiDAR scanner was used to collect aerial images during different soybean growth stages, and orthomosaic imagery and 3D canopy models were generated. Different vegetation indices (NDVI, NDRE, SAVI), canopy cover, height, and volume were computed from aerial images. Several ground measurements, including leaf chlorophyll (SPAD), leaf area index (LAI), manual plant height, chlorophyll fluorescence parameters (ΦPSII, quantum yield), and final seed yield, were also recorded during aerial phenotyping. Regression and machine-learning models were used to relate UAV-derived indices and LiDAR metrics with SPAD, LAI, and yield, enabling the prediction of final seed yield from mid-season canopy greenness and structure. This integrated approach highlights both the methodological innovation of combining multispectral and LiDAR sensors and the agronomic implications for optimizing N application timing to maximize soybean yield and quality.

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Identifying the Optimal Timing for Supplemental Nitrogen Application to Enhance Soybean Seed Composition. M. Pandit* and A. Chiluwal, College of Agriculture, Health, and Natural Resources, Kentucky State University, Frankfort, KY 40601.

Soybean (*Glycine max* [L.] Merr.) is one of the most important crops for the diet of humans and animals worldwide, as it is one of the richest and cheapest protein sources. Soybean is a multi-product crop, as the byproduct solids after oil extraction are used as protein sources in animal feeds such as soybean meal. Although soybean yield in the U.S. has increased gradually over the past few decades, there has also been a constant decline in seed protein concentration, which has become one of the concerns for the U.S. soybean industry. Recent studies have suggested that nitrogen (N) limitation during seed growth and development is the main reason for lower seed protein concentration in modern high-yielding soybean cultivars. These studies have used Nitrogen application at multiple times throughout the growth stages. Hence, a field experiment was conducted at Kentucky State University's Harold Benson Farm in Frankfort, KY with nitrogen application (80 kg N/ha) during five different reproductive growth stages to identify the optimal time. The study found that the majority of plant growth and physiological parameters were numerically higher when Nitrogen was applied at the R3 stage, while some were significant. Unit seed weight was significantly higher when N was applied at the R3 stage, but yield was numerically higher. N application at R3 and R5 resulted in a significantly higher protein concentration as well as protein yield, but not in oil concentration and oil yield. Definitive results will be given after the two-year data is available for analysis.

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Determination of Critical Nitrogen Dilution Curve in Soybean. P. Paudel* and A. Chiluwal, College of Agriculture, Health and Natural Resources, Kentucky State University, Frankfort, KY 40601.

Critical nitrogen (N_c) dilution curve is a diagnostic approach that relies on the allometric relationship between the dynamics of nitrogen uptake and biomass accumulation during crop growth. The N_c dilution curves have been established under a wide range of nitrogen fertilizations, environments, and management practices in several crops. However, developing critical nitrogen dilution curves in soybeans is challenging due to its ability to acquire nitrogen through biological nitrogen fixation. This study aims to determine the N_c dilution curve for soybean based on shoot biomass using non-nodulating cultivars and to test the feasibility of using the curve in modern commercial nodulating soybean cultivars. The experiment was conducted using two non-nodulating cultivars of soybean under six different nitrogen fertilization rates (0, 50, 100, 200, 300, and 400kg N ha^{-1}) in a randomized complete block design with three replications. Shoot biomass was measured weekly across five growth stages and will be compared by the analysis of variance. Nitrogen treatments will be divided into N-limiting and non-N-limiting groups. The datasets with at least one N-limiting and one non-N-limiting treatment will be used to determine critical nitrogen concentration. The preliminary results show that nitrogen fertilization enhanced total biomass one week after flowering stage, indicating strong N demand during early reproductive growth. Since N concentration analysis in the samples is currently underway, the critical N dilution curve will be determined after its completion. The results will provide critical insights into quantification of the N_c dilution curve in the absence of N fixation in non-nodulating cultivars of soybean.

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Extending Shelf-Life of Pawpaw (*Asimina triloba*) Fruit Using Bee Wax as an Edible Coating. P. Ghimire*, J.D. Lowe, S.B. Crabtree, and K.W. Pomper, 1890 Land-Grant Program, Kentucky State University, Frankfort, KY 40601.

Pawpaw (*Asimina triloba*), a native American tree fruit, has a flavor resembling a blend of pineapple, banana, and mango. The fruit has both fresh-consumption and value-added processing potential; however, its high perishability and short shelf-life limit its potential as a fresh market fruit. Pawpaw can be stored only for about two to five days in non-refrigerated conditions, whereas long-term cold storage results in poor ripening and internal black discoloration. The objective of this study was to determine the efficiency of beeswax as an edible coating to extend the shelf life of pawpaw. Ripe fruit that were beginning to soften were harvested from trees of the cultivar Susquehanna. These fruit were then dipped completely in melted 100% yellow beeswax for approximately 20 seconds. As a control, fruit were also dipped in a hot water treatment for approximately 20 seconds. At least four replicate treated or control fruit were destructively assessed after 7,14, or 21 days of cold storage at 5 °C. Data on firmness, color, sugar content, weight loss, and pH were recorded on days 7, 14, and 21 of storage. Results showed that the firmness of fruit in both yellow beeswax and hot water treatment decreased over the storage period, whereas weight loss was highest for the control

fruit. There was no difference in fruit Brix (%) levels between the treatment and the control. Beeswax treatment can help to protect some quality attributes of pawpaw and shows promise as an edible coating for extending its shelf-life.

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Shade Farming Technology as an Agroforestry Practice: Wild Ginger *(Asarum canadense* L.*).* P. Sharma*, F. N. Onduso, and M. Wilkerson, 1890 Land-Grant Program, Kentucky State University, Frankfort, KY 40601.

Shade farming is an effective agroforestry practice that helps farmers grow shade-tolerant crops beneath tree canopies. This helps in regulating sunlight exposure, improving soil moisture, and supporting beneficial insects for pollination. This research is being conducted in Central KY and focuses on evaluating the effects of different shade levels and slope/soil conditions on the growth of wild ginger (*Asarum canadense*), a native understory plant. Wild ginger patches were identified, flagged, and georeferenced using GPS, and each patch was paired to a control area with similar parameters except the presence of wild ginger. The study is also focusing on wild ginger's vegetative parameters, including leaf area, leaf area index, and plant spread. Soil samples are being collected and assessed for both chemical and physical characteristics. Pollinators and other associated organisms' activities will be monitored through camera recordings and field observations to help determine animals' visit frequencies and diversity across shade levels. Data will be analyzed using paired t-tests to assess differences between test and control plots to determine the effect of shade, soil, and other variables on wild ginger's growth. We hypothesized that moderate shade (around 60%) will show better plant growth, improved soil conditions, and more pollinator activities compared to low or dense shade conditions. We also hypothesized that wild ginger microhabitats (test plots) have more diversity and abundance than the control plots. The results from this study aim to guide sustainable forest farming and agroforestry cropping practices for understory crops in Kentucky and similar temperate regions.

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Assemblage of Macrofungi Associated with Wild Ginger-*Asarum canadense* L. M. Wilkerson*, F.N. Onduso, and P. Sharma, 1890 Land-Grant Program, Kentucky State University, Franklin, KY 40601.

Wild ginger (*Asarum canadense*) has been a treasured herb used for a variety of physical ailments throughout the ages. In the context of forest ecology, its ability to distribute nutrients throughout the soil and avert the growth of pathogen vectors makes its study intriguing. It is an understory species with both commercial and ecological value. The research characterizes the assemblage of macrofungi associated with wild ginger's microhabitats within the Appalachian region of Central Kentucky. Ecological studies on tropical *Asarum* species show consistent associations with *Arbuscular mycorrhizal* fungi, suggesting that temperate wild ginger may also engage in relationships with other macrofungi. Macrofungal associations, specifically with ginger, have not been studied, especially in the study area. The project aims to investigate and highlight mushroom species' frequencies, abundance, and diversity in wild ginger microhabitats. The first hypothesis is that macrofungal frequency, abundance, and diversity will be significantly higher in wild ginger microhabitats than in control plots. The second hypothesis is that wild ginger microhabitats will be occupied by certain macrofungal species. The specimens collected are processed and named through observation of their physical characteristics. The final confirmation identification will be through DNA analysis. The results will inform forest farmers about macrofungi species and their companionship with the ubiquitous wild ginger plant. By finding and understanding these relationships, forest ecosystems can be better managed to promote biodiversity and environmental sustainability. Farmers will also be able to match sites and cultivate understory crops such as mushrooms on their forested lands to achieve economic benefits.

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Identifying the Different Weed Species Hosting Sweetpotato Potyviruses During the Planting Season. A. Ravikumar* and S.K. Ponniah, Department of Agriculture, School of Agriculture, Fisheries and Human Sciences, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601.

Sweetpotato (*Ipomoea batatas* Lam.) is a valuable tuber crop grown globally. Demand and consumption are increasing in the U.S., but production is constrained by viral diseases. Weeds can act as reservoirs of sweetpotato viruses spread through vectors such as aphids and whiteflies, reducing yield and quality. 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. This study aimed to identify common weed species hosting sweetpotato potyviruses across the U.S. We collected weed samples from sweetpotato fields in three locations: Arkansas (172), Mississippi (24), and California (54). Leaf samples were transported in ice coolers and stored in a -80º C freezer on the same day. Total nucleic acids were extracted using the CTAB method, and multiplexed Reverse Transcriptase Polymerase Chain Reaction was performed to detect Sweetpotato feathery mottle virus (SPFMV), Sweetpotato virus G (SPVG), Sweetpotato virus C (SPVC), and Sweetpotato virus 2 (SPV2). SPFMV is dominant among the other four viruses and is commonly found in weed species. Among the other species, Morning Glory, Pitted Morning Glory, and Early Leaf Morning Glory tested positive for SPFMV in both the Arkansas and Mississippi locations; it is closely related with sweetpotato and is also the most dominant weed in sweetpotato growing fields.

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Consumer Perceptions and Purchasing Patterns of Grass-Fed and Grain-Fed Beef in the Alabama Black Belt. I. Murphy* and C. Harris, Meat Science Laboratory, College of Agriculture, Environment & Nutrition Sciences, Tuskegee University, Tuskegee, AL 36088.

Bovine feeding systems are a popular debate topic between producers and consumers. As a result, this has increased interest in alternative agriculture practices due to concerns about animal welfare and health-conscious foods. This study examines consumer preferences and perceptions regarding local organic beef compared to grain-finished beef in the Alabama Black Belt region of the U.S. The focus will be on factors influencing purchasing decisions and overall satisfaction. Through qualitative and quantitative analysis, this study will assess consumer preferences regarding taste, texture, and perceived health benefits. Through multiple methods, including surveys and focus groups, key variables will be identified and will consist of these factors. The research will provide insight into the health and sustainability of organic beef and whether it is considered more nutritious and less chemically altered than grain-fed beef. The sensory panels, surveys, and focus group discussions will determine consumers' perceptions of organic and grain-finished beef. Our findings may offer valuable insights to producers looking to align their production methods to meet consumer expectations and promote sustainable and ethical practices. This study aims to inform producers and those who market the meat about strategies to improve public perception and support of alternative beef feeding systems. Focusing on the Alabama Black Belt region can provide more local insights that can contribute to broader research regarding food production practices in the U.S.

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Evaluating the Oviposition Behavior of Corn Earworm on Hemp. A. Ahmed*, T. Tolosa, B. Jackson, S.A. Henry, and S. Zebelo, Department of Agriculture, Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853.

Selecting an appropriate oviposition site is a critical yet challenging task for female herbivorous insects, as their decision directly affects the survival and development of their offspring. In this study, we examined the oviposition preferences of the corn earworm (CEW), *Helicoverpa zea*, when offered hemp varieties and corn as potential hosts. Both two-choice and no-choice assays were conducted to characterize CEW oviposition behavior. In the two-choice assays, mated female CEW moths were released into black-cloth cages and presented with paired treatments consisting of hemp varieties vs. non-Bt corn. The hemp varieties evaluated were Trump, Mountain Mango, Berry, and Boax. Female CEW moths deposited significantly more eggs on the Trump and Mountain Mango hemp varieties than on corn. In contrast, when offered Berry and Boax, females laid more eggs on corn than on these two hemp varieties. Overall, these results indicate that CEW oviposition preference varies among hemp varieties but generally favors hemp over corn when preferred varieties are available. Plant chemical cues, physical traits, or interactions between the two may influence this preference. To further elucidate the mechanisms underlying these behavioral patterns, we will collect headspace volatiles from the tested plants and assess their roles in attracting or deterring female CEW.

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Efficacy of Field-Collected Pathogens Against Chewing and Sucking Insects. K. Okpah*, T. Tolosa, K. Waters, J. Elliott, and S. Zebelo, Department of Agriculture, Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853.

This research evaluates the efficacy of field-collected entomopathogenic fungi against chewing and sucking insect pests. Fungi isolated from cadaver insects were preliminarily identified by colony color, pink and white, pending molecular confirmation. Test insects, including corn earworm (CEW) and squash bugs, were exposed to the fungal strains using two methods: dipping individuals into fungal suspensions and spiking insect diet with 500 µl of the suspensions. Control groups received water treatments. Insects were monitored every two days until pupation or death. Both the dip and diet-spiked assays showed reduced growth rates in CEW treated with either fungal strain compared to controls. In squash bugs, the dip assay revealed rapid pathogenicity: a 50% mortality rate occurred within three days in both fungal treatments, demonstrating strong potential for managing sucking-insect populations. Plant-damage assessments were also conducted to determine whether fungal exposure influenced feeding behavior. CEW larvae were starved for two hours and then allowed to feed on scanned leaves. Leaf area damage was quantified using image analysis software. Results showed that CEW fed most heavily in the control and pink strain treatments, while feeding damage was lowest in the white strain group. Overall, the findings indicate that these field-collected entomopathogenic fungi suppress insect growth, increase mortality, and reduce plant feeding damage. Their effectiveness against both chewing (CEW) and sucking (squash bugs) pests highlights their promise as biological control agents and supports their potential incorporation into integrated pest management strategies.

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Evaluating Moisture Stress Effects on Amaranth Yield and Companion Crop Performance in Raised-Bed Urban Systems. A Pandey*, J. Mutua, B. Panthi, G. Neupane, B. Dingha, B. Masasi, and L. Jackai, Department of Natural Resources and Environmental Design, College of Agriculture, North Carolina Agricultural and Technical State University, Greensboro, NC 27411.

Raised-bed systems enhance aeration, drainage, and root development, making them ideal for sustainable urban agriculture where moisture extremes often limit productivity. This study examined how a controlled gradient of soil moisture stress from drought to excess moisture affects amaranth yield and crop interactions in a mixed vegetable system. Two amaranth varieties, Golden Giant and Green Callaloo, were grown with companion crops (eggplant, waterleaf, garden huckleberry, and Georgia Southern collard) under three moisture regimes: wet (-29 kPa), dry (-45 kPa), and ambient (control). Leaf yields were recorded across five successive harvests to assess varietal tolerance and interspecific performance. Both amaranth varieties exhibited strong resilience across the moisture gradients. Golden Giant maintained stable yields between 1 and 2 lbs./6 plants under wet and dry conditions, while ambient conditions produced slightly higher but more variable yields. Green Callaloo performed best under wet and ambient regimes, averaging around 2.5 lbs./6 plants, but yielded least under dry conditions (1.3-2.7 lbs./6 plants). Companion crops responded differently: waterleaf and huckleberry thrived under drier conditions, averaging 0.9 and 0.6-1.1 lbs./6 plants, respectively, while Georgia Southern favored ambient moisture. Eggplant yields remained relatively consistent across treatments (1.5-1.7 lbs.). These findings highlight raised-bed systems as effective for amaranth cultivation; they are also an efficient platform for managing moisture variability. Stable yields under both wet and ambient conditions show that amaranth is a resilient, nutrient-dense crop adapted to urban food-production platforms.

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The Market Potential of Specialty Crop Production in North Carolina for Small Farmers: The Case of Vegetable Amaranth. T. Thomas*, K. Jefferson-Moore, and O. Quaicoe, Department of Agribusiness, Applied Economics and Agriscience Education, and L. Jackai, Department of Natural Resources and Environmental Design, North Carolina Agricultural and Technical State University, Greensboro, NC 27411.

North Carolina's agriculture industry was valued at $111.1 billion in 2024. It benefits from favorable climate conditions, diverse soil types, and a wide range of physiographic regions that support both commodity and specialty crop production. Specialty crops, defined as fruits, vegetables, and horticultural products, represent a growing segment of the state's agricultural economy and a promising opportunity for small farmers. This study examines the market potential of *vegetable amaranth* as a specialty crop for North Carolina producers. Amaranth, a nutrient-dense leafy green commonly consumed in African, Asian, and Caribbean cuisines, thrives in North Carolina's environment and offers both nutritional and economic benefits. Data were collected using an internet-based survey, administered by Qualtrics XM to participants across North Carolina to analyze consumers' perceptions of amaranth greens. Findings

indicate there is a growing consumer interest in amaranth. The results suggest that vegetable amaranth can provide a viable source for small farmers if supported through cooperative marketing, targeted outreach, and state or federal specialty crop programs. This research contributes to understanding how underutilized crops can enhance farm diversification, profitability, and food system resilience in North Carolina.

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Breeding and Evaluation of Genetically Diverse *Lentinula edodes* (Shiitake Mushroom) Strains. O.W. Oderinwale*, D. Blum, F.N. Anike, and O.S. Isikhuemhen, Department of Natural Resources and Environmental Design, North Carolina Agricultural &Technical State University, Greensboro, NC 27411.

Lentinula edodes is a globally significant edible and medicinal basidiomycete valued for its nutritional, pharmaceutical, and economic importance. The *L. edodes* (Berkley) Pegler, monokaryons from the six strains in the Mushroom Biology and Fungal Biotechnology Lab culture collection were inter- and intra-bred to produce 566 novel strains that were characterized for superior mycelial growth at 10-30 ℃. Five of the six parents on intra-breeding were found to have a homozygous mating type allele, resulting in a significantly low positive mating rate (<25%), which is expected in a tetrapolar mating system in *L. edodes*. Coincidentally, B_2 mating allele was limited considerably (x^2 (1) = 41.33, p<0.001) in monokaryons in four of these parents. A weak relationship was observed between dikaryons and constituent monokaryon growth rates at 15-30 ℃ (p<0.001- $p=0.0137$, $R^2 = 0.01 - 0.02$), indicating monokaryon growth rate is not a good selection criterion in breeding for improved strains of *L. edodes*. Among the progenies (F1), there were strains with a faster mycelial growth rate ($p< 0.05$), enhanced mycelial vigor, shorter incubation periods, and superior yield potential compared to their parents. These results indicate successful generation of genetically diverse *L. edodes* strains with promising attributes for high yield and different climatic optimums for cultivation. This preliminary study lays the groundwork for future genetic improvement and strain optimization in Shiitake mushroom breeding, tailored to various climatic conditions and seasons in North Carolina.

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Substrate Size and Perforation Affect Mushroom Yield and Morphometrics in *Hericium erinaceus*. C. McEachern*, J.A. Kwon, F.N. Anike, and O.S. Isikhuemhen, Department of Natural Resources and Environmental Design, North Carolina Agricultural and Technical State University, Greensboro, NC 27411.

Hericium erinaceus, commonly known as lion's mane mushroom, is a highly valued medicinal and culinary plant that supports a rapidly growing supplement industry due to its potential neuroprotective and cognitive benefits. Despite its popularity, a significant gap remains in research regarding optimal cultivation conditions in the U.S. This study seeks to enhance the efficiency and consistency of *H. erinaceus* fruit body yield and morphometrics during cultivation. We investigated the effects of substrate size (1kg and 2kg), perforation count (1, 2, and 4 perforations of uniform diameter=13 mm), and strain type (86, 253, and 2205) on commercially relevant factors such as time to colonization, biological efficiency, fresh weight, and fruitbody morphometrics (x, y, and z diameters of fruit bodies). Furthermore, by isolating potential confounding factors in mushroom cultivation, such as humidity and temperature gradients, the experiment aims to clarify the environmental requirements for successful and consistent fruit body production. Master Mix Substrates (Hardwood:Soybean hulls 1:1) were prepared, sterilized, inoculated, incubated at 25 °C, and fruited at 20 ± 2 °C. Although the study is currently ongoing, the results show that increasing the number of perforations decreases the size of individual fruit body yields. Furthermore, the morphometrics of fruit bodies varied considerably among different strains, with strain 86 producing the most oblong fruit bodies and strains 253 and 2205 producing relatively spherical fruit bodies. Ultimately, this research contributes to a more precise understanding of how substrate size and perforation count can optimize commercial lion's mane production.

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Corn Stover Supplemented with Oak Leaves Enhanced Fruitbody Yield and Nutrient Content in *Pleurotus ostreatus.* N.S. Udombang*, F.N. Anike, and O.S. Isikhuemhen**,** Department of Natural Resources and Environmental Design, North Carolina Agricultural and Technical State University, Greensboro, NC 27411.

Substrate supplementation with wheat bran (WB) in mushroom cultivation presents economic and sustainability challenges, as it competes with human and livestock food sources. This dependence raises production costs and limits

access to affordable inputs for small-scale mushroom growers. Identifying alternative supplements is essential for sustainable mushroom production. Oak leaves (OK), an abundant seasonal waste product, could provide an alternative. This study evaluated the effects of WB, OK, and their combinations (WBOK) at seven supplementation levels (0-15% in 2.5% increments) on *Pleurotus ostreatus* cultivated on corn stover substrate. The sterilized substrate was inoculated and incubated at 25 °C, followed by fruit body induction at 20 ± 2 °C. Nutritional analysis was performed on fruit bodies from the highest-yielding treatments. Substrate colonization differed significantly ($P < 0.05$), ranging from 10 to 19 days, with OK2.5% and OK5% colonizing the fastest (within 10 days). Pinning also varied ($P< 0.001$), 36 days in WBOK2.5% compared to 38 days in WB15% and 49 days in OK15%. Biological Efficiency was highest (110%) in WBOK2.5%, followed by OK2.5% (107%), and WB12.5% (102%). Nutritional analysis showed WBOK2.5% contained the highest protein (35.0%) and phosphorus (1300 mg/100 g), while OK2.5% enhanced protein (35.04%) and mineral content (34.84%) compared to the control (26.79%). This is the first report to demonstrate that oak leaves, alone or combined with WB, can sustain high yields and enrich the nutritional quality of *P. ostreatus* fruit bodies. OK supplementation offers a cost-effective, sustainable alternative to WB, supporting waste valorization.

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Effect of Aluminum, Cadmium, Lead, and Zinc on Mycelial Growth and Uptake by Three White-Rot Fungi. E.L. Eshiozemogie*, A. Ali, F.N. Anike, and O.S. Isikhuemhen, Department of Natural Resources and Environmental Design, North Carolina Agricultural and Technical State University, Greensboro, NC 27411.

Heavy metal pollution is a global environmental challenge arising from mining, industrial effluents, pesticides, and improper waste disposal. Although aluminum, cadmium, lead, and zinc generally inhibit fungal growth, white-rot fungi possess mechanisms such as bioaccumulation and biosorption that enable them to tolerate and uptake these metals. Three species, *Agrocybe aegerita, Pleurotus tuberregium,* and *P. ostreatus,* were tested for the effect of metals on their mycelial growth and uptake into fruiting bodies. Metal nitrates were incorporated into potato dextrose agar (PDA) at varying concentrations (0, 1, 10, 20, 50, and 100 ppm), and mycelial growth was assessed by measuring colony diameter. Fruiting bodies, where they were formed, were harvested, dried, and analyzed for metal content using Microwave Digestion and ICP-AES. Data were subjected to ANOVA, and mean differences were determined using the LSD test. Aluminum exhibited a stimulatory effect on mycelial growth (1, 10, 20, and 50 ppm), whereas cadmium strongly inhibited all tested species even at low concentrations. Lead inhibited *Pleurotus* strains at higher concentrations (50 and 100 ppm) but did not affect *A. aegerita*. Zinc enhanced growth in *P. tuberregium* but suppressed *A. aegerita* at high concentration (100 ppm). Metal analysis revealed significant accumulation of aluminum, lead, and zinc in *P. tuberregium* fruiting bodies, while *A. aegerita* showed higher uptake of cadmium and lead. These findings demonstrate that white-rot fungi can tolerate and accumulate multiple heavy metals, supporting their potential use in bioremediation. However, their cultivation on contaminated substrates raises significant concerns about food safety.

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Storage Method, Length of Storage, and Genetic Background Effects on *Pleurotus ostreatus* Spore Germination. J.A. Kwon*, F.N. Anike, and O.S. Isikhuemhen, Department of Natural Resources and Environmental Design, North Carolina Agricultural and Technical State University, Greensboro, NC 27411.

Pleurotus ostreatus produces mushrooms and mycelia of industrial significance. These range far beyond the production of edible oyster mushrooms. *P. ostreatus,* a white rot degrader, produces an array of powerful ligninolytic enzymes (laccases, manganese peroxidases, lignin peroxidases, etc.) that have been used to bleach wood pulp and to degrade long-lasting environmental toxins such as polyfluoroalkyl substances (PFAS). Furthermore, *P. ostreatus* synthesizes numerous pharmacologically active compounds across various chemical classes, including immunomodulatory polysaccharides, statin-like compounds, antibacterial and antifungal quinones, and diverse antioxidants. The uses of this fungus also include the synthesis of construction materials, the bioconversion of agro-wastes into animal feed, and the biological control of agricultural pests. While a wild strain of *P. ostreatus* could fulfill all these roles, these processes must be optimized with specialized strains of this fungus. Therefore, access to genetic material is needed (i.e., spores). Currently, mushroom cultivators store spore prints either at room temperature or under refrigeration. However, little information is available on the effect of storage methods on the germination of *P. ostreatus* spores. In this study, spores from four strains of *P. ostreatus* collected in the wild (two in winter, two in summer) and two obtained from commercial productions were stored for 0 days, one week, three months, and six

months in both room temperature (23°C) and refrigerated conditions (4°C). Afterwards, spores were inoculated onto nutrient media and incubated at 25°C. Results showed that refrigeration preserved spore viability, germination rate, and total germination, regardless of strain origin.

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Effect of Varying Rates of Nitrogen and Sulfur on Seed Yield, Seed Oil, and Seed Protein Content of Winter Canola in Tennessee. S. BK* and J.P. de Koff, Department of Agricultural Sciences and Engineering, College of Agriculture, Tennessee State University, Nashville, TN 37209.

Canola, an oilseed crop, offers high seed-oil content and serves as a biofuel feedstock, pollinator habitat, cover crop, and rotation crop with winter wheat. This study focused on determining how varied levels of Nitrogen (N) and Sulfur (S) application affect seed yield, oil, and protein content in winter canola. The study was conducted at two sites in Tennessee (Ashland City and Springfield) in 2023-2024 (Year 1) and 2024-2025 (Year 2), using a randomized complete block design with nine treatments (combinations of 0, 56, 112, kg N ha^{-1} with 0, 22.4, 44.8, kg S ha^{-1}) and four replications. In Year 2, we used 12 treatments (combinations of 0, 56, 112, 168 kg N ha^{-1} with 0, 22.4, 44.8, kg S ha^{-1}) for the Springfield site. In the Ashland City experiment, significantly greater oil content was observed in treatments of 22.4 kg S ha^{-1}/0 kg N ha^{-1}, the control treatment (no N or S added), and 44.8 kg S ha^{-1}/0 kg N ha^{-1}. Treatments with 44.8 kg S ha^{-1}/112 kg N ha^{-1} and 22.4 kg S ha^{-1}/112 kg ha^{-1} had significantly greater protein content. No significant yield differences were observed at the Ashland City site in Year 1. At the Springfield site, no significant differences were observed for yield, oil, and protein in Year 1. We are considering an additional site year to determine the continued effects of N x S rates. This study optimizes fertilizer application to increase winter canola production, seed oil content, and protein quality.

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Developing a Four-In-One CRISPR-Cas Gene Editing System to Improve Production and Sustainability of Bioenergy in Sorghum. O. Onyemaobi*, A.N. Aziz, and C.A. Ondzighi-Assoume, Biotechnology Research Laboratory, Department of Agricultural Sciences and Engineering, Tennessee State University, Nashville, TN 37209.

Sorghum (*Sorghum bicolor* L.) is a C4 crop of significant agricultural and industrial importance, known for its high biomass yield, drought tolerance, and adaptability to marginal lands. However, the high lignocellulosic biomass content of sorghum, particularly its lignin component, poses a major challenge to efficient biomass conversion. Genetic engineering offers a powerful approach to achieving improvements by targeting the modification of lignin biosynthetic pathways. However, progress has been hindered by the crop's recalcitrance to genetic manipulation, transformation, and regeneration. To overcome these limitations, we developed a four-in-one genetic engineering technology for sorghum by establishing an efficient *in vitro* cell suspension culture system capable of maintenance, cryopreservation, transformation, and regeneration to produce genetically modified plants. Our system has provided a foundation for the application of advanced molecular tools such as CRISPR/Cas9-mediated gene editing to improve sorghum for bioenergy applications. Our study's achievements include successfully establishing embryogenic cell cultures of three varieties of grain and sweet sorghum: Tx430, Topper 76-6, and Dale. Our cell cultures exhibited cell density, viability, and regeneration potential ranging from 10-88%, demonstrating their potential for sustained growth and the capability of genetic manipulation. Regeneration was achieved efficiently from stem-derived calli, reaching up to 76% regeneration efficiency. Furthermore, through *Agrobacterium* tumefaciens-mediated transformation, the three varieties' cell lines exhibited transformation efficiency ranging from 56-78%. Our study provides a robust foundation for future gene-editing efforts aimed at improving sorghum's biomass quality and production of bioenergy.

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Curation of FAMU's Autochthonous Yeast Biorepository to Enhance Muscadine Wine Regionality in Florida. M.S. Cleveland*, A.F. Humphries, A. Mohammed, E. White, C. Kruis, O. Dupe, and V. Tsolova, Center for Viticulture and Small Fruit Research, College of Agriculture and Food Science, Florida A&M University, Tallahassee, FL 32307.

Florida ranks among the top 10 wine-producing states in the U.S. and boasts the second-largest wine-consuming population. Because of Pierce's disease, Florida's wine industry relies heavily on native muscadine grapes

(*Muscadinia rotundifolia*). Despite their unique sensory and nutritional qualities, these grapes are often fermented using commercial *Saccharomyces cerevisiae* strains developed for *Vitis vinifera*, rather than native Florida yeasts. Yeast selection strongly influences fermentation performance and wine character; therefore, preserving and organizing indigenous isolates is critical to future research on regional fermentation practices and the development of new styles of muscadine wine. This project focused on the systematic curation of Florida A&M University's autochthonous Winemaking Yeast Biorepository, which contains over 220 yeast specimens collected from spontaneous fermented juice of *M. rotundifolia* 'Noble,' 'Carlos,' and 'Floriana.' Curation objectives included: (1) cataloging existing isolates with consistent naming and metadata, (2) implementing standardized protocols for cryopreservation, labeling, and revival, and (3) developing a digital inventory for long-term organization and accessibility. Through this process, each specimen was assigned a unique code, linked to its source and isolation date, and preserved in secure -80 °C storage. The curation effort improved traceability, safety, and usability of the collection, transforming it into a stable and searchable resource that supports future identification, fermentation testing, and student research. This undergraduate project demonstrates the importance of data organization and preservation in maintaining microbial collections that underpin regionally distinctive muscadine wine styles and enhance Florida's wine regionality.

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Incidence and Management of Major Insect Pests of Corn in North Florida. M. Mobley*, M.J.S. Cabral, A. Ali, S.O. Laird, A.M.S. Robinson-Baker, G. Bramwell, and M. Haseeb, Center for Biological Control, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32307; M.A. Soares, Departamento de Agronomia, Universidade Federal dos Vales do Jequitinhonha e Mucuri, Diamantina, 9 Minas Gerais 39100000, MG, Brazil.

Corn (*Zea mays* L.) is a major cereal crop in Florida, but its productivity is frequently constrained by insect pests attacking leaves, stems, and ears. Key species include *Spodoptera frugiperda* (fall armyworm), *Carpophilus* spp. (sap beetles), and *Herina nigrina* (picture-winged fly), all of which can reduce yield and grain quality. To assess pest infestation in maize varieties cultivated in Quincy, FL, field trials were conducted under natural conditions during 2024 and 2025. After three months of growth, field surveys and ear inspections were performed, and collected insects were identified in the laboratory. Infestation data were analyzed by year and variety using ANOVA and Tukey's HSD test (α=0.05). Results revealed significant interannual variation. In 2024, *Carpophilus* spp. exhibited the highest infestation levels, averaging over 18 individuals per variety, whereas *S. frugiperda* and *H. nigrina* were recorded at moderate densities. In 2025, *S. frugiperda* declined markedly (<1 individual per variety), while *Carpophilus* spp. remained dominant with approximately 15 individuals. Consistent appearance of *H. nigrina* was confirmed as a corn pest in north Florida. The surveys documented a shift in pest composition: in 2024, *S. frugiperda* and *Diabrotica balteata* predominated, whereas in 2025, stink bugs such as *Nezara viridula*, *Oebalus pugnax*, *Leptoglossus zonatus*, and *Homalodisca vitripennis* were most prevalent. These findings highlight the dynamic nature of maize pest communities and underscore the need for ongoing surveillance and integrated pest management strategies to sustain corn productivity in Florida.

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Comparative Evaluation of Vitamin C Content and Growth Traits in Kale Cultivars under Varying Treatments. H. Anang* and T. Nzramyimana, 1890 Land-Grant Program, Kentucky State University, Frankfort, KY 40601.

Kale (*Brassica oleracea L. var. acephala*) is a nutrient-dense leafy vegetable with significant contributions to human nutrition, particularly as a source of vitamin C. This study evaluated the vitamin C concentration and growth performance of three kale cultivars – Darkibor, Mamba, and Red Russian – across four magnesium treatment levels (12.3, 24.6, 36.9, and 49.2 mg/L). Growth parameters assessed included fresh shoot biomass, number of leaves, and average plant height per plot. Vitamin C content was quantified in mg/g DW equivalents, while morphological traits were measured using standardized field protocols. Results indicated a cultivar-dependent variation in both biochemical and agronomic parameters. Vitamin C concentration was highest in Darkibor (5.53 mg/g) followed by Mamba (4.97 mg/g) and Red Russian (4.78 mg/g). Conversely, Red Russian consistently produced superior biomass (392.66 g) compared with Darkibor (300.16 g) and Mamba (291.23 g). Mamba exhibited the highest mean plant height (11.50 cm), whereas Darkibor recorded the greatest leaf production (48.1 leaves per plot). Treatment effects were also evident, with intermediate levels (24.6-36.9 mg/L) generally enhancing both vitamin C accumulation and vegetative growth compared to the lowest (12.3 mg/L) and highest (49.2 mg/L) treatments. In conclusion, the study demonstrates

trade-offs between nutritional quality and biomass yield among kale cultivars. Darkibor is superior in vitamin C enrichment, while Red Russian favors fresh weight production.

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Assessing the Effect of Potyviruses on Different Generations of Beauregard Sweet potato Variety. R.L. Kylan* and S.K. Ponniah, Department of Agriculture, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601.

Sweetpotato (*Ipomoea batatas* (L.) Lam.) is the most important root vegetable with good fiber. It is vegetatively propagated and susceptible to viral infections. Viral titers accumulate disproportionately with each planting cycle (generation). These viruses are transmitted by insect vectors, Aphids (*Myzus persicae)*, which are responsible for transmitting potyviruses, namely Sweetpotato Feathery Mottle Virus (SPFMV), Sweetpotato Virus G (SPVG), Sweetpotato Virus 2 (SPV2), and Sweetpotato Virus C (SPVC). These viruses are known to reduce both the quality and quantity of sweet potato yields, with potyviruses reducing yields by 25-50%. This study aims to quantify the infection rate of potyviruses in five different generations of sweetpotato, understand any changes in the shape of sweetpotato roots across the various generations, and investigate any differences in yield components. The treatments applied for this study are G0, G1, G3, G4, and G6. The research design used is a Randomized Complete Block Design (RCBD). The treatments used were G0, G1, G3, G4, and G6. Storage roots harvested from treatments were randomly sampled for total nucleic acid extraction. Standard gene-specific primers were used to test the infection rate of sweetpotato potyviruses using reverse transcriptase polymerase chain reaction (RT-PCR). The older generations, G6 and G4, showed higher virus titrations than the younger generations, G0 and G1. Hence, growers are advised to use younger generations rather than older generations to avoid yield loss.

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Is Maypop (*Passiflora incarnata*) a New Crop for Production in Kentucky? D. Flint*, K.W. Pomper, S. Thapa Magar, J.D. Lowe, and S.B. Crabtree, Kentucky State University Land Grant Program, Frankfort, KY 40601.

Small farmers in Kentucky are looking for new crops to sell at farmers' markets and restaurants. The maypop (*Passiflora incarnata*) is a native perennial vine with a fruit that has a tropical-like flavor similar to *Passiflora edulis* (Passion fruit), which only grows in subtropical climates. Maypop is native to Kentucky and has potential as a high-value fruit crop for temperate regions. The objective of this study was to evaluate the performance of two Maypop cultivars, 'PinkPop' and 'SnowPop,' and a wild selection in a field trial at Kentucky State University's Harold R. Benson Research Farm. A randomized complete block design was used to assess fruit size, weight, and seed weight. Fruit from a wild relative were also analyzed for comparison. Plants were established in spring 2024 and emerged again in June 2025. Survival rates were 56% for both 'PinkPop' and 'SnowPop' over the winter. Fruiting of vines was assessed on Sept. 16, 2025. There was a trend for 'PinkPop' to produce more fruit (27.3) than 'SnowPop' (13.5), though the difference was not statistically significant. Both 'PinkPop' and 'SnowPop' had similar-weight fruit at 29.1g and 27.4g per fruit, respectively. Both 'PinkPop' and 'SnowPop' had similar seed weight per fruit at 5.7g and 6.3g, respectively. Both 'PinkPop' and 'SnowPop' had similar diameter fruit at 40.6mm and 37.7mm, respectively. The wild selection produced larger fruit (45.0g, 43.8mm diameter). Overall, both cultivars demonstrated strong potential for commercial cultivation in Kentucky.

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Role of Modern Tools for Increasing the Supply of Seedlings to Community Gardeners in Arkansas. A. Shelby* and S.K. Ponniah, Department of Agriculture, School of Agriculture, Fisheries and Human Sciences, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601.

There are a wealth of emerging issues facing global society. Of these issues, food and social security are among the highest ranking. Many people struggle to afford food as prices soar, and many are dissatisfied with their work and/or social status. This is especially true in low-income communities where crime, drug abuse, and suicidal ideation are likely exacerbated or caused by a lack of food and social security. To these problems, community gardens can present an emerging solution. Community gardens promote better lifestyles by providing potentially inexpensive, healthy food; promoting gentle/intense physical activity for physical health; and fostering a sense of community outlook/networks. Community gardens also improve air quality, increase property value/improve neighborhood

stability, allow for plot reclamation, improve urban soils, reduce the severity of heat islands, and improve surface water retention while reducing surface runoff and enhancing urban biodiversity, including weed/native plants and insects. Community gardens also allow for interpersonal, cross-generational, and multi-cultural interaction, which many other activities do not. The project aims to increase the awareness of community gardeners through the supply of raw materials for the successful growing of green space in Pulaski and Jefferson counties. We will discuss our research experience using hydroponics/vertical farming models and greenhouse spaces to germinate seedlings at the University of Arkansas at Pine Bluff. In addition, we will discuss our observations from the seasonal selection of crops for the community gardeners.

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Characterizing Seed Traits of Grain and Fiber Hemp. Z. McAndrew*, R. Alexi, S. Panahi, and C. Schluttenhofer, Agricultural Research and Development Program, Central State University Wilberforce, OH 45384.

Physical properties (i.e., traits) of seeds are important considerations for crop producers and processors. Differences or variability in seed properties, within or between varieties, can complicate planting, harvesting, and processing. Observations indicate that hemp, *Cannabis sativa* with <0.3% Δ^9-tetrahydrocannabiol, seed traits are diverse, which can lead to challenges with production and processing. Therefore, hemp varieties with specific seed characteristics may be preferable for given applications. Understanding seed traits could also guide breeding efforts to develop hemp varieties better suited to specific uses. Currently, little information exists about hemp seed traits. This work seeks to characterize seed traits for a diverse set of hemp germplasm. Hemp varieties from the U.S., Europe, and China were selected for evaluation. Photographs were taken using a professional photography setup to ensure consistency in lighting and seed distance from the camera. A color reference chart was included to adjust for any lighting variations that might impact seed color analysis. A ruler was included in each image to calibrate measurements. ImageJ was used to autodetect seeds and to measure traits including length, width, depth, color, area, circularity, and solidity. We found considerable variability within and among hemp varieties. Seeds displayed a wide range of lengths, from 2.4 to 7.1 mm, and ranged from 1.8 to 6.3 mm in width and from 1.5 to 5.9 in depth. Most seeds were not highly circular but displayed strong solidity. The findings will help producers identify hemp varieties with desired and consistent seed size. Processors will be able to utilize color information to tailor color-based seed cleaning and seed size to select the best varieties for making products.

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Evaluating Deeper Planting of Primed Soybean and Corn Seeds for Improved Stress Resistance. M. Pillow* and C. Lowell, Department of Agricultural and Life Sciences, and M. Nagle, Agricultural Research and Development Program, Central State University, Wilberforce OH 45384.

Corn (*Zea mays)* and soybeans (*Glycine max)* are among Ohio's most economically significant crops, representing billions of dollars in revenue annually. Increasingly unpredictable weather has amplified concerns around environmental stress impacting crop health, forcing systems to adapt. Conventional agriculture methods recommend planting at a depth of 1.5-2 inches; however, current research suggests increasing planting depth may improve seedling resistance to seasonal environmental stressors such as drought or temperature. This experiment evaluated whether seeds primed by directed energy technology could successfully emerge from deeper planting depths and any advantage conferred in seedling development. Trials were conducted with soybean and corn under controlled conditions. Pre-stimulated seeds were subjected to two directed energy treatments before planting at depths of 1.5, 2.0, 2.5, 3.0 inches in germination mix. A batch of non-treated seeds was included as the control for each species. Treatments were replicated with 4 seeds/pot for a total of 144 seeds/trial. Ten days after planting, percent emergence and plant height were measured; plants were then dried to calculate dry matter. Soybean priming had mixed results at different planting depths. Primed seeds had slightly greater average emergence and dry weight/plant at 1.5 in, while the control was slightly higher for these growth parameters at 3 in planting depth. Corn seed priming slightly increased emergence and dry weight/plant at both 1.5 and 3 in planting depth compared to the control. Seed priming using directed energy technology may affect emergence and dry weight at deeper planting depths, however more research is needed under environmental stress conditions.

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Seed and Seedling Mortality of Tomatoes in Nurseries: The Oomycetous Cause and Responses of Breeding Lines and Commercial Varieties. N. Bugg*, M. Humphries, J. Bucciarelli, S. Ren, and Z. Mersha, Agricultural Research Station, Virginia State University, Petersburg, VA 23806.

Damping-off is among the most destructive disease of seeds and seedlings of tomatoes and many other vegetable, fruit, and agronomic crops worldwide, leading to stand and substantial yield losses depending on the season and management. Because the disease can be caused by a wide range of microbial pathogens and even disorders, accurate diagnosis and characterization are crucial. Evaluating the response of different breeding lines and commercial varieties is also important for developing resistant varieties and guiding growers' choices. In this study, *Pythium aphanidermatum* was identified as the causative agent of tomato damping-off through microscopic, cultural, and molecular diagnostics from a symptomatic plant that was brought from a tomato-breeding research project in May 2025. DNA of isolate TDO-VA25 was amplified with ITS, β-tubulin, and LSU primers, and sequences were deposited in GenBank. Pathogenicity was confirmed, and 40 four-week-old breeding lines and commercial varieties were inoculated in a growth chamber. Seedling mortality was recorded. Four weeks after inoculation, plant height, root length, and fresh and dry biomasses were measured. Damping-off in inoculated plants reached 75% mortality compared to 30% in non-inoculated plants. Growth parameters and root biomasses were likewise reduced with 67-73% of the non-inoculated plants showing greater values than those inoculated once. The study will be repeated, including more treatments to test the efficacy of seedling drenches with biological products. The comprehensive outcomes of the project will support efforts to breed resistant lines to *P. aphanidermatum* and to explore biological control options as preventative or curative tools, helping gardeners and growers sustain resilient tomato crops.

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Seed Priming Effects on Faba Bean Germination and Vigor Under Optimal and Cold Temperatures. J.D. Booker* and S. Torabian, Agricultural Research Station, College of Agriculture, Virginia State University, Petersburg, VA 23806.

Seed priming is an important pre-sowing technique that enhances germination speed and uniformity. This study aimed to evaluate the effects of different seed priming treatments and durations on the germination of faba bean (*Vicia faba* L.) under two temperature conditions: room temperature (optimum) and cold temperature (5 °C). The experiment was conducted using a small-seeded organic faba bean variety. Four priming treatments were evaluated: (1) control (unprimed seeds), (2) hydropriming (soaking in distilled water), (3) halopriming with 100 mM NaCl, and (4) halopriming with 20 mM KCl. Each treatment was applied for three durations (6, 12, and 24 hours) with three replications per treatment. Germination and early growth parameters were assessed after seven days. Under optimal conditions, all seeds germinated within seven days, regardless of priming treatment. However, seeds primed with water or KCl showed the highest germination rates. The greatest shoot weight was observed in seeds primed with KCl for 12 hours and with water for 12 and 24 hours. The longest shoots occurred in seeds primed with water for 12 and 24 hours. Seed priming had no significant effect on root length or weight. Cold temperature significantly reduced both germination percentage and rate compared with optimal conditions. Under cold stress, seeds primed with KCl achieved the highest germination percentage, with the 12-hour priming producing the best results. Overall, the findings indicate that seed priming treatments, particularly KCl and water priming, improve seed germination and seedling vigor under both optimal and cold conditions.

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Ginger Rhizome Storage: Effects of Environment, Container, Disinfection, and Cultivar on Mold and Weight Loss. A.S. Matthews*, M. Humphries, L. Rutto, and Z. Mersha, Agricultural Research Station, Virginia State University, Petersburg, VA 23806.

The U.S. is a leading importer of ginger (*Zingiber officinale*). Losing ginger quality and quantity during storage from microbial contamination and shrivelling is not an option if domestic seed-piece production and reduced import dependency are to succeed. This study aimed to 1) isolate and identify major microbial pathogens of stored ginger, 2) evaluate the efficiency of sand storage and 3) test how environment, disinfection, and container type affect longevity and microbial dynamics. Freshly harvested Peruvian-yellow ginger was either disinfected with 1% NaOCl or left untreated, then stored under five temperature-dependent environments (4°C, 12°C, walk-in cooler, partially controlled greenhouse, room temperature) in paper bags, mesh bags or Ziploc bags. In the walk-in

cooler, Chinese cultivar was added to contrast cultivar effects. In a parallel trial, rhizomes freshly harvested from four cultivars were stored in sand flats (2.25-inch depth) and monitored for percent mortality and weight loss over four months. More than 20 fungal and three bacterial microbial isolates were purified from symptomatic rhizomes. All tested factors influenced storage outcomes. Cooler temperatures consistently reduced mold and produced only moderate weight loss across cultivars. In the walk-in cooler, interactions were for cultivar × container and disinfection × container. Four weeks after storage, Chinese cultivar in Ziplock bags showed 65% mold versus 25% Peruvian yellow in the same container. Sand storage in the greenhouse yielded 82-92% recovery after four months. Optimizing cooler storage, disinfection, and curing, as well as choosing the right container, preserves quality, supports adoption and domestic seed-piece production, and strengthens U.S. ginger supply chains.

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Hydroponic Assessment of Salt-Induced Growth Shifts and Gene Regulation in Legumes. S. Baker*, K. Williams, and A. Todd, Department of Agriculture and Natural Resources, Delaware State University, Dover, DE 19901.

Legumes are a vital crop in global agriculture, contributing to food and feed systems while improving soil fertility through symbiotic nitrogen fixation. However, an increase in variability surrounding extreme weather events, particularly those leading to soil salinization, threaten legume productivity, specifically in common bean (*Phaseolus vulgaris* L.). Due to growing interest in sustainable agriculture and the adoption of soilless systems such as hydroponics, it is important to understand how legumes respond to abiotic stress under controlled nutrient conditions. This study aims to identify the salt-related genes being upregulated and downregulated when facing various salt scenarios in a hydroponic system. To this end, we cultivated legume seedlings hydroponically and exposed them to defined salt stress gradients, measuring traits such as root length, shoot length, biomass allocation, and chlorophyll content (SPAD). To investigate the molecular mechanisms underlying these phenotypic changes, we utilized PCR-based gene expression analysis to source stress responsive genes activated under salt conditions. We observed reduced growth under higher salinity, with an increased root-to-shoot biomass ratio suggesting a stress-induced shift in resource allocation. This work contributes to efforts to develop resilient cropping systems and to inform optimized hydroponic production strategies for future agricultural demands.

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Identification and Characterization of *Sclerotium rolfsii* Causing Southern Blight on Herbs and Leafy Vegetables in Southern Mississippi. A. Meiosha*, A. Popoola, and V. Oliver, Department of Agriculture, Alcorn State University, Lorman, MS 39096; S. Waliullah, Department of Biology, Alcorn State University, Lorman, MS 39096; and E. Ali, Department of Agriculture, Alcorn State University, Lorman, MS 39096.

Sclerotium rolfsii (teleomorph: *Athelia rolfsii*), the causal agent of southern blight, is a destructive soil-borne pathogen. Its persistence through long-lived sclerotia poses a serious threat to crop rotation in Mississippi, yet the risk it presents to the region's leafy green and spice crops remains poorly understood. This study was undertaken to characterize an active *S. rolfsii* infection on a leafy vegetable in southern Mississippi and to evaluate its cross-pathogenic potential. A virulent isolate, designated MS-SR01, was obtained from symptomatic collard greens exhibiting basal stem rot. The pathogen was identified based on morphological features (e.g., hyphae with clamp connections) and confirmed molecularly through sequencing of the Internal Transcribed Spacer (ITS) region. Pathogenicity was verified by fulfilling Koch's postulates using a soil inoculation assay. The isolate's virulence was then assessed against a host panel including mustard greens, kale, basil, and mint. ITS sequence analysis of MS-SR01 revealed 99-100% homology with *Athelia rolfsii*, confirming the morphological identification. The isolate exhibited strong virulence on mustard greens, kale, and basil, causing fatal southern blight, while mint displayed tolerance. The pathogen was re-isolated from all symptomatic hosts, again fulfilling Koch's postulates. This study provides the first molecular and pathogenic characterization of *S. rolfsii* on leafy vegetables in Mississippi, emphasizing its cross-infection risk for diversified vegetable systems.

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Simplifying Plant Disease Diagnosis Through the Application of ImmunoStrip Assays in Vegetable Crops. J. Watson* and S. Waliullah, Department of Biology, and E. Ali, Department of Agriculture, Alcorn State University, Lorman, MS 39096.

Rapid and accurate detection of plant pathogens is essential for effective disease management and for minimizing yield losses in vegetable production. Traditional diagnostic methods such as symptom observation, microscopic examination, and molecular assays are often time-consuming, require laboratory facilities, and demand trained personnel. To overcome these limitations, ImmunoStrip assays offer a rapid, reliable, and user-friendly alternative for field-based pathogen detection. This study evaluated the performance of ImmunoStrip tests in identifying common viral pathogens affecting vegetable crops in Mississippi. Leaf samples were collected from multiple vegetable species, including cucurbits, tomatoes, lettuce, and strawberries, at the Alcorn State University Model Farm (Claiborne County) and local farms in Adams County. The ImmunoStrip test procedure involved extracting leaf tissue in buffer solution, immersing the strip, and visually interpreting the results within 5-15 minutes. The assays successfully detected several viral pathogens such as Cucumber mosaic virus (CMV), Melon necrotic spot virus (MNSV), Squash mosaic virus (SqMV), and Lettuce mosaic virus (LMV). Some strawberry samples displayed symptoms likely linked to abiotic stress or foliar pathogens, warranting further investigation. Our findings demonstrate that ImmunoStrip assays are a practical and reliable diagnostic tool for on-site identification of plant diseases. Their portability, ease of use, and rapid turnaround make them ideal for growers, extension agents, and researchers seeking efficient solutions for plant health monitoring. Future work will expand the survey to other Mississippi counties and additional pathogens to enhance regional plant disease surveillance and management.

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Preliminary Research on the Influence of Impact and Compression Forces on Raw-Product Quality and Shelf Life of Horticultural Produce. G. McPherson*, D. Mortley, College of Agriculture, Environment and Nutrition Sciences (CAENS)**,** Tuskegee, AL 36088.

The preservation of horticultural produce is critical for reducing post-harvest losses and enhancing food security. Bruising and impact damage significantly compromise the quality and shelf life of horticultural produce primarily occurring during harvesting, handling, and transportation. The main contributors to physical bruising are impact, vibration, and compression forces. Effective post-harvest mechanical handling processes are essential to minimize damage and ensure that fresh produce enters the market in optimal condition. Both internal and external bruising leads to tissue softening, increasing vulnerability to diseases, and senescence. A key challenge is to mitigate microscopic damage and microcracks from repetitive impacts and compression forces. This study aims to evaluate the effects of impact and compression energy forces on bruising in summer squash, tomatoes, and sweet potatoes during post-harvest processing. Utilizing Impact Recording Devices (IRD) in a randomized complete block design, we will assess visual internal and external bruising after subjecting the produce to various forces, followed by a 7-14 day storage period to evaluate shelf life. Preliminary literature indicates that high drop heights and prolonged storage correlate with increased bruise area and volume, alongside significant color changes and firmness loss. Additionally, compressive forces contribute varying bruising responses among different crops. The research highlights the importance of distinguishing between damaging and non-damaging impacts, suggesting that modifications such as reducing drop heights or adding cushioning to mitigate damage. Ultimately, this study underscores the potential of instrumented technologies to enhance the shelf life and marketability of horticultural products, thereby reducing post-harvest losses and improving food security.

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Raising Water pH to Combat Iron Toxicity: A Potential Solution for Farming Catfish in Iron-Polluted Water. **T. Bhattacharjee*,** F.I. Fahim, K. Adhikari, M. Jones, H. Knuckles, S. Bhattarai, A. Sinha, Department of Aquaculture and Fisheries, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601.

Iron toxicity is a major challenge in aquaculture systems utilizing groundwater and well water with naturally high iron concentrations. Excessive iron can cause oxidative stress, impair osmoregulation, and reduce growth and survival in fish. To develop a management strategy for such environments, this study investigated whether elevating water pH could mitigate iron-induced toxicity in channel catfish (*Ictalurus punctatus*). A 10-day LC_{50} assay was first conducted to determine the median lethal iron concentration under culture conditions. Subsequently, a two-month experiment

was performed using three pH levels (7.8 as control, 8.3, and 8.8) with or without elevated iron (4.33 mg/L; representing 25% of the 10-day LC_{50}). Catfish were distributed into six groups: Control (pH7.8), pH8.3, pH8.8, pH7.8+Fe, pH8.3+Fe, and pH8.8+Fe. Fish reared under high-iron conditions exhibited significant reductions in weight gain compared to iron-free groups, irrespective of pH. However, at pH 8.3, iron-exposed fish showed improved hemoglobin content, enhanced plasma mineral concentrations, and reduced accumulation of toxic ammonia and plasma iron compared to those at pH7.8+Fe. Furthermore, the higher pH promoted better ammonia excretion capacity, indicating improved physiological resilience. Although elevated pH did not restore growth under iron stress, maintaining water at pH 8.3 effectively alleviated several physiological disruptions caused by iron toxicity. These findings highlight the potential of pH regulation as a cost-effective and sustainable approach for managing iron-contaminated aquaculture systems.

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Antioxidant Potential of Pigmented Rice: Black and Red Rice Using Different Processing Methods. V. Njoku*, N. Montgomery, J. Boateng, E. Baidoo, M. Verghese, Department of Food and Animal Sciences, Alabama A&M University, Normal, AL 35762.

Black and red rice, known for their bioactive components, contribute to their potential antioxidant and health benefits. This study examines the effect of processing methods, including roasting, boiling, and natural fermentation, on the phytochemical and antioxidant properties of black and red rice. Processed rice samples were extracted with 80% ethanol and aqueous solution following standard procedures. Treatments were carried out in triplicate and examined on a dry matter basis. Ferric Reducing Antioxidant Power (FRAP), Trolox Equivalent Antioxidant Capacity (TEAC), and 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assays were used to determine antioxidant capacity. Total phenolic content (TPC) and total flavonoid content were used to determine the chemical profile. The results showed that antioxidant activity and phenolic content varied significantly depending on the extraction solvent and processing method used. Ethanol extracts consistently demonstrated stronger antioxidant activity compared to aqueous extracts. Boiled black rice had the highest FRAP (179.16 ± 1.34 μmol/g d.w.), while fermented red rice had the highest DPPH radical inhibition (89.31%) in ethanol extracts. Aqueous extracts of boiled black rice (817 ± 1.34 mg GAE/100 g d.w.) and boiled red rice (607 ± 2.97 mg GAE/100 g d.w.) showed the highest phenolic content, indicating that heat treatment promotes the release of bound phenolics. In conclusion, processing methods and solvent type have a substantial impact on the antioxidant potential of colored rice. Boiling and fermentation significantly increased phenolic bioavailability, demonstrating the potential of processed black and red rice as a functional food for alleviating oxidative stress-related health problems.

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Chemical and Physiological Response of Sweet Potato to Infestations of Sweet Potato Weevil, Cylas formicarius. J. Grandison*, A. Sharma, L. Kanga, Entomology Department, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32307; A. Gaffke, Insect Behavior and Biocontrol Research Unit, Center for Medical, Agricultural, and Veterinary Entomology, Agricultural Research Service, United States Department of Agriculture, Tallahassee, FL, 32308.

Sweet potatoes are an economically important crop that ranks seventh globally in food production due to their high yield under low-input agricultural systems and their exceptional nutritional value. With culinary, medicinal, and industrial applications, it serves as a staple for food security in many developing countries. *Cylas formicarius*, the sweet potato weevil, is recognized as the most destructive root-feeding insect pest of this crop. Even minor infestations can result in a 60–100% yield loss due to the production of toxic furanoterpenoids, which render storage roots unfit for consumption. Furthermore, the presence of *C. formicarius* often triggers quarantine restrictions that severely limit marketability. Current management strategies rely heavily on insecticide applications and costly sanitation measures. However, certain sweet potato varieties have demonstrated resistance to infestation and differ in their production of furanoterpenoids. Consequently, this study was conducted to identify the source of furanoterpenoid induction following *C. formicarius* infestation, and to evaluate the responses of susceptible and resistant varieties. Our data indicate that the compound inducing the furanoterpenoid is confined to the insect gut. Additionally, it was determined that other insects can induce this response in sweet potatoes, and that the response can be variety-specific. Infestation by the weevil also induces the production of ethylene gas, a phytohormone that impacts dormancy and root growth.

The bases of resistance to *C. formicarius* remain largely unknown; thus, characterizing the interaction between infestation-induced compounds and cultivar resistance may enhance breeding programs.

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Developing Low-Cost Hydroponic Systems and Assessing Plant Growth and Food Safety Risks. D.R. Ford*, E. Duke, V. Chhetri, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32310.

Hydroponics is a system of growing plants without soil, offering enhanced growth and environmental control through various methods. While hydroponic systems hold great potential, the high costs of construction and maintenance remain significant barriers, particularly in developing countries. The objective of this project was to develop a low-cost hydroponic system using readily available materials and to evaluate its effectiveness for crop cultivation and associated food safety risks. A total of 12 Deep-Water Culture (DWC) hydroponic systems (6 outdoors and 6 indoors) with a 40-gallon nutrient solution capacity were constructed. The hydroponic structures included DWC systems, hydro frames, and shade houses. Bok choy (*Brassica rapa*) and spinach (*Spinacia oleracea*) were planted in the systems. Over the course of the study, plant growth and water quality parameters—including light, temperature, pH, and electrical conductivity (EC)—as well as plant growth metrics such as time to maturity, plant height, number of leaves, and biomass, will be monitored. Additionally, microbial food safety risks will be assessed to determine the impact of outdoor versus indoor conditions on microbial growth. The results of this study will be applicable to growers in developing countries, enabling them to design affordable hydroponic systems while mitigating food safety risks.

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Survival and Persistence of *Escherichia coli* in Co-planting Hydroponic Systems. V. Akao*, C. Scales, E. Duke, V. Chhetri, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL, 20307.

Hydroponics is a soilless farming method that grows plants using nutrient-rich water solutions. It has gained popularity for addressing challenges such as urban growth, limited land availability, and water scarcity. However, microbial pathogens may thrive in these systems due to constant moisture, nutrient availability, and the presence of organic matter from root exudates. This study examined the effects of co-planting lettuce, mint, and basil on the persistence and distribution of generic *E. coli* in hydroponic systems. Six Deep Water Culture co-planting systems were inoculated with *E. coli* ATCC 25922, and the nutrient solutions were analyzed for microbial survival and persistence, along with changes in pH and plant growth, over an 18-day period. *E. coli* levels decreased from 3.1 log CFU/mL to below the detectable limit in all treatments by days 2 to 4 post-inoculation. However, the population increased to 2.1 log CFU/mL on day 11. Microbial survival was highest in the lettuce–mint–basil co-planting systems compared to other combinations. *E. coli* populations decreased significantly in the leaves of all tested crops, with the highest die-off rate observed on basil leaves, followed by mint and lettuce. This study highlights the potential benefits of companion planting strategies in reducing food safety risks in hydroponic systems.

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The Effect of a Blueberry (Vaccinium angustifolium) - Collard Greens (Brassica oleracea var. viridis) Amalgamation on Selective Cardiovascular Biomarkers in Obese-Prone Models. M.F.S. Eashat*, N.L. Dawkins, Department of Food and Nutritional Sciences, Tuskegee University, Tuskegee, AL 36088; C. Bradford, Department of Biology, Tuskegee University, Tuskegee, AL 36088.

Obesity, characterized by chronic low-grade inflammation and metabolic dysregulation, is a major contributor to cardiovascular diseases (CVD) such as cardiac fibrosis, hypertension, and hypertrophy. This study aims to investigate the cardioprotective potential of a combined blueberry and collard green (BB+CG) dietary intervention in obese Zucker rats, a model that closely mirrors human obesity and metabolic syndrome. Blueberries are rich in anthocyanins with potent antioxidants and anti-inflammatory properties, while collard greens provide glucosinolates that yield bioactive isothiocyanates capable of activating cytoprotective pathways. The combination may produce synergistic effects against obesity-induced cardiac remodeling. Sixty male Zucker rats will be randomly assigned to six groups (n=10): control (AIN-93), blueberry (4%), collard green (4%), blueberry-collard mix (2% each), blueberry extract (4%), and Ozempic-treated. Over an eight-week intervention period, blood pressure will be monitored biweekly using tail-cuff plethysmography. Post-treatment, cardiac fibrosis will be assessed via Picro Sirius Red staining,

cardiomyocyte cross-sectional area determined by wheat germ agglutinin staining, and cardiac hypertrophy quantified through heart and left ventricular weight normalized to tibia length. Data will be analyzed by one-way ANOVA with Tukey's post hoc test ($p<0.05$). It is expected that the BB+CG group will demonstrate reduced collagen deposition, lower blood pressure, and decreased cardiac hypertrophy compared to obese controls. The findings are anticipated to provide preclinical evidence for a whole-food-based, multi-target dietary strategy to mitigate cardiovascular risks associated with obesity and metabolic syndrome.

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Effect of Blueberry (*Vaccinium angustifolium*) and Collard Green (*brassica oleracea var. Viridis*) Diet on Selective Markers of Obesity of Food. J. Yeboah*, N.L. Dawkins, Department of Food and Nutritional Sciences, Tuskegee University, Tuskegee, AL 36088; C. Bradford, Department of Biology, Tuskegee University, Tuskegee, AL 36088.

Obesity is a major global health challenge, contributing to chronic diseases such as type 2 diabetes, cardiovascular disease, and certain cancers. Conventional treatments, such as pharmacological drugs, are effective but often expensive with potential side effects. Dietary interventions using phytochemical-rich foods offer a sustainable and cost-effective approach to improving metabolic health. This study aims to evaluate the effects of diets supplemented with blueberry, collard green, and their combination on obesity-related biomarkers in obese-rats (Zucker) over an 8-week period. The objective is to assess the impact of the diet on body weight, lipid profile, glucose levels, insulin levels and inflammatory markers. Seven groups of rats are fed with modified chow containing 4% blueberry and collard powder, and extract and blueberry- collard green combination. Ozempic is used as a positive control. The rat groups receiving phytochemical-rich diets will be compared with the Ozempic-treated group to determine whether these natural dietary interventions can elicit metabolic benefits similar to pharmacological treatment currently used to treat obesity and diabetes. It is expected that rats fed with the combination of blueberry and collard green will show reduced body weight gain, reduce cholesterol, reduce blood pressure and decrease glucose and insulin levels compared with normal rat diet. The results are anticipated to demonstrate a synergistic effect of blueberries and collard greens, highlighting their potential as a sustainable dietary strategy for preventing obesity-associated complications.

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The Health Belief Model and the Prevention Motivation Theory in the Prevention of Skin Cancer among Famers. S. Fakolade*, E. Akinola, G. Besona, F. Bebe, Kentucky State University, Frankfort, KY 40601.

Skin cancer remains one of the most preventable, yet increasingly preventable, cancers globally among farmers and farmworkers facing disproportionately high risks due to prolonged ultraviolet radiation exposure. Consequently, understanding the cognitive and motivational factors influencing protective behaviors is important. This review explores how the Health Belief Model (HBM) and Protection Motivation Theory (PMT) have been applied to predict and explain sun protective behaviors, with emphasis on agricultural populations. A scoping review of peer-reviewed studies from 2000 to 2024 was conducted across PubMed, Scopus, and Google Scholar using keywords related to the HBM, PMT, skin cancer prevention, among farmers. Eligible studies were synthesized thematically to compare both theories and their constructs, methodological designs, and behavioral outcomes. The review revealed that use of key constructs such as perceived susceptibility, perceived benefits (HBM), and response efficacy (PMT) enhances the predictive accuracy of behavioral models for sun protection intentions among high-risk occupational groups. However, integrating HBM and PMT provides a more comprehensive understanding of the cognitive and motivational determinants of sun-safety practices. The review recommends developing context specific interventions, including health and community based strategies, to address barriers to behavioral change among farmers and farmworkers.

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Evaluation of Public Health Initiatives for Skin Cancer Prevention in Kentucky. E. Akinola*, S. Fakolade, G. Besona, F. Bebe, Land-Grant Program, Kentucky State University, Frankfort, KY 40601.

Skin cancer is one of the most common cancers in both the United States and Kentucky, where the state ranks seventh nationally in incidence. An estimated 104,960 new melanoma cases are expected in the United States and 1,490 in Kentucky this year. Because of the state's rural economy and large population of outdoor workers, prevention is a

major public health priority. This study reviewed peer-reviewed and gray literature published between 2020 and 2025 to evaluate the effectiveness of skin-cancer prevention initiatives in Kentucky. A total of 169 records were screened, and 17 met the inclusion criteria. The selected studies focused on educational campaigns, workplace and school programs, recreational initiatives, media outreach, counseling, screening, and policy actions. Treatment-only studies or those without measurable prevention outcomes were excluded. Results showed that multi-component strategies combining education, environmental changes, sunscreen access, and communication were more effective than education alone. School and workplace programs improved sun-protective behaviors, and youth tanning restrictions and institutional policies produced the strongest effects. Counseling offered modest benefits, while evidence for routine screening in adults without symptoms remained limited. Although prevention efforts exist, Kentucky still faces gaps in long-term evaluation and consistent implementation. Strengthening evaluation and adopting proven models could enhance future prevention outcomes.

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Evaluation of the Life Cycle, Behavior, and Nutritional Value of Black Soldier Flies *Hermetia illucens* (Diptera; Stratiomyidae) on Varied Diets. J. Daniels*, A. Sharma, Entomology, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32307; A. Gaffke, USDA-ARS, Tallahassee, FL, 32308; O. Sangokunle, Food Science Program, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32307; A. Aderibigbe, CFAES Department of Animal Sciences, Ohio State University, Wooster, OH 44691; L. Kanga, Entomology, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32307.

The black soldier fly (*Hermetia illucens*; BSF) is increasingly used in sustainable waste management and alternative protein production. Its larvae efficiently convert organic waste into nutrient-rich biomass suitable for animal feed and other applications. While globally studied, localized investigations are essential to understand environmental and dietary influences on colony establishment and development. This study investigated wild BSF populations in Tallahassee, Florida, their establishment in the lab colony, and the impact of dietary composition and fatty acid treatments on larval development and oviposition. Wild BSFs were collected from four sites—urban farm, urban forest, mixed farm, and recycling center—using banana, rice bran, and water-based attractants. Larvae were reared on control, carbohydrate-, protein-, and lipid-biased diets, and evaluated for survival, development, and biomass quality. Nutritional composition (proximate, amino acids, fatty acids, and elements) was analyzed. Oviposition behavior was assessed using tetradecanoic acid treatments. Humidity emerged as the key environmental factor influencing larval abundance, with mixed and urban farms yielding the highest collections. Carbohydrate and regular diets promoted the greatest larval survival and growth, whereas protein- and lipid-biased diets resulted in higher mortality. Nutritional analyses confirmed the benefits of a balanced macronutrient composition on biomass quality. Fatty acid treatments reduced oviposition, indicating a concentration-dependent deterrent effect. These results highlight the adaptability of BSF in Florida's environment and emphasize the importance of humidity and diet optimization for successful rearing. The study also provides new insights into BSF oviposition ecology, supporting improved large-scale production and organic waste valorization strategies.

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Bioavailability and Secondary Structure of ACE-Inhibitory Peanut Protein Hydrolysate. S.D. Adebayo*, J. Yu, Department of Family and Consumer Sciences, North Carolina Agricultural and Technical State University, Greensboro, NC 27411.

Food-derived antihypertensive peptides offer natural alternatives to synthetic ACE inhibitors. This study investigated the impact of gastrointestinal (GI) digestion on the ACE-inhibitory activity and structure of peanut protein hydrolysates (PPH) produced via Alcalase hydrolysis of peanut protein concentrate (PPC). PPH and PPC were digested with pepsin, pancreatin, and sequential pepsin-pancreatin treatments at various enzyme concentrations for 1-2 hours, followed by human serum (containing different peptidases) incubation for 10 minutes to 3 hours. The ACE-inhibitory activities of PPC and PPH before and after each digestion were assayed and expressed as IC_{50} (mg/mL), molecular weight distribution was revealed by SDS-PAGE, and secondary structures were analyzed by FTIR. Alcalase hydrolysis significantly reduced the IC_{50} of PPC from 20.3 ± 3.3 mg/mL (PPC) to 3.6 ± 0.1 mg/mL (PPH). Subsequent pepsin and pancreatin digestions further enhanced the ACE-inhibitory activity of PPH. Although sequential digestion initially decreased activity, extended treatment restored and improved ACE inhibition. SDS-PAGE analysis identified two digestion-resistant peptides (~12 and 7 kDa) in the supernatants; however, sequential digestion resulted in

significant degradation. The PPH with/without GI digestion retained their ACE-inhibitory activity after exposure to human serum for 30 minutes. FTIR spectroscopy showed structure and ACE-inhibitory activity correlation: PPC digestion increased α-helix content and decreased β-sheet content, while PPH remained structurally stable except decrease in α-helix and increase in β-sheet/β-turn structures during sequential digestion. These findings suggest that gastrointestinal digestion enhances the bioavailability and antihypertensive potential of PPH through specific structural modifications, positioning PPH as a promising food ingredient for hypertension management.

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Tricetin Biogenic Amination as a Novel Pathway Linking Flavonoid Metabolism to Ammonia Detoxification. J. Sackey*, S. Zhang, S. Sang, Center for Excellence in Post-Harvest Technology, North Carolina Agricultural and Technical State University, North Carolina Research Campus, Kannapolis, NC 28081.

Tricetin is a flavone type of dietary flavonoid found in eucalyptus honey, pomegranate, and wheat with high anti-inflammatory, antioxidant, and neuroprotective activities. However, its role remains largely unexplored in nitrogen metabolism. In this study, chemical and biological amination of tricetin was investigated to elucidate potential pathways linking tricetin metabolism to ammonia detoxification. In vitro, tricetin was reacted with ammonium hydroxide to produce aminated products and reaction progress was tracked by HPLC-DAD. The main aminated product was purified by preparative RP-HPLC and structurally characterized by high-resolution ESI-MS and NMR (^{1}H, ^{13}C, HMBC, and HSQC). The aminated derivative was confirmed as 4′-aminotricetin ($C_{15}H_{11}NO_6$), showing an upfield shift of the ipso carbon ($\Delta\delta C_{4'}$ = -4.9 ppm) and characteristic MS fragments (*m/z* 151.0039, 107.0140) corresponding to retro-Diels-Alder fragmentation of the flavone core. To assess in vivo formation, male CD-1 mice were orally administered tricetin (50-200 mg/kg body weight), and urine and fecal metabolites were analyzed by LC-MS/MS. Aminated tricetin was detected exclusively in fecal samples, indicating microbial or enzymatic catalysis of nitrogen incorporation. Additional tricetin metabolites, including methylated, sulfated, and hydrogenated metabolites, were also identified, indicating that amination occurs alongside conventional Phase I and Phase II biotransformation pathways. The findings provide the first evidence of biogenic amination of tricetin and suggest that tricetin may serve as a transient ammonia acceptor or scavenger to detoxify ammonia under elevated nitrogen conditions. This novel pathway introduces a potential biochemical mechanism linking tricetin and other dietary polyphenols to ammonia detoxification and nitrogen homeostasis in the gut-liver axis.

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The Substitution of Ancient Grain Quinoa (*Chenopodium* spp.) on Physicochemical and Functional Properties of Muffins. E. Amenyenu*, E. Baidoo, M. Verghese, Department of Food and Animal Sciences, Alabama A&M University, Normal, AL 35762.

Quinoa (*Chenopodium* spp.) is an ancient, gluten-free grain known for its high-quality protein, including all essential amino acids, dietary fiber, and bioactive compounds, making it a potential ingredient for functional bakery products. Incorporating quinoa into muffins could potentially improve their nutritional and functional value while influencing physicochemical characteristics such as pH, color, and water activity. This study investigated muffins formulated with 10%, 20%, and 30% quinoa flour substitution compared to a control made with all-purpose flour. Muffins were prepared under standardized baking conditions, and triplicate samples were analyzed for pH, color (L*, a*, b*), and water activity (aw). Results indicated that pH values ranged from 6.19 to 6.41 and water activity from 0.816 to 0.854, with no significant differences among treatments ($p > 0.05$), although higher quinoa levels resulted in a slight increase in pH. Color parameters were significantly affected ($p < 0.05$), with 10–20% quinoa reducing lightness (L*) and 30% quinoa increasing redness (a*) and yellowness (b*), producing visually darker and more intense colored muffins. Overall, substituting up to 30% quinoa flour modified color properties without negatively affecting pH or water activity, suggesting that moderate quinoa incorporation can improve the visual appeal of muffins while maintaining their physicochemical stability. These findings provide valuable insights into bakery product development using quinoa as a potential functional ingredient with possible implications in the prevention of chronic diseases.

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The Effect of Supplemental Nutrition Assistance Program (SNAP) on Food Security in Low-Income Households in Tennessee. G. Wanyonyi*, J. Muriuki, Department of Agricultural Business and Education, College of Agriculture, Tennessee State University, Nashville, TN 37209.

Food insecurity remains a persistent challenge for many low-income households across the U.S., with about 40% of households in Tennessee affected in 2024. The Supplemental Nutrition Assistance Program (SNAP) serves as the nation's primary safety net, providing in-kind transfers that enhance the food purchasing power of low-income families and contribute to community resilience. However, evidence on the effectiveness of SNAP varies across regions and demographic groups, partly due to selection bias in household survey data. This study examines the effect of SNAP participation on household food security in Tennessee using data from the 2019-2023 Current Population Survey Food Security Supplement. Binary and ordered logit models were estimated to evaluate the relationship between SNAP participation and food security while controlling for income, education, household size, and race. The analysis examined eight metropolitan areas including Chattanooga, Clarksville, Cleveland, Johnson City, Kingsport-Bristol, Knoxville, Memphis, and Nashville to capture diverse economic and demographic contexts across Tennessee. Preliminary results show that SNAP participants are more likely to experience food insecurity than eligible non-participants, with consistent negative associations across most metropolitan areas and weaker effects in smaller metros. This pattern aligns with selection bias reflecting the greater baseline vulnerability of households that opt to participate. To better isolate the program's true effect, subsequent analysis will apply propensity score matching to adjust for non-random participation. Findings highlight opportunities to improve outreach and enhance SNAP's role in promoting household resilience and economic sustainability among low-income populations in Tennessee.

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Causal Impacts of SNAP Store Deauthorization on Program Enrollment and Health-Related Quality of Life in Tennessee. **M. Nyambura***, J. Muriuki, Department of Agricultural Business and Education, College of Agriculture, Tennessee State University, Nashville, TN 37209.

Access to affordable, nutritious food is the cornerstone of public health and social well-being. The Supplemental Nutrition Assistance Program (SNAP) plays a central role in advancing food and economic security, but its effectiveness depends on stable retailer networks. Despite SNAP's broad reach, little is known about how structural disruptions such as retailer deauthorization affect household enrollment and community well-being, particularly among low-resource groups. This study examines the causal impact of SNAP retailer deauthorization on program enrollment and health-related quality of life (HRQOL) in Tennessee from 2016 to 2022. Using a staggered difference-in-differences approach, the analysis combines SNAP administrative data with census tract demographic and health indicators to evaluate how policy and retail dynamics influence food access and health outcomes. Preliminary results indicate that overall SNAP participation remained relatively stable following store deauthorization, but participation patterns varied across populations. Female-headed households experienced declines in enrollment after deauthorization, reflecting potential access barriers and mobility constraints. In contrast, households with members living with disabilities exhibited delayed but sustained improvements in participation over time, suggesting gradual adaptation and increased reliance on SNAP benefits. HRQOL analysis is ongoing and seeks to capture broader well-being impacts. This research aims to contribute to understanding how changes in the food retail environment affect access to nutrition assistance programs.

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Development of an Adolescent-Friendly Functional Snack Using Spirulina and Bilberry as Natural Colorants. K. Boyle*, M. Verghese, Department of Food and Animal Sciences, Alabama A&M University, Normal, AL 35762.

Spirulina is a protein-rich cyanobacterium. Bilberry (*Vaccinium myrtillus L.*) is a dark berry known for its medicinal purposes. Overall aim was to use two underutilized ingredients in the food industry to develop an adolescent friendly functional snack food product in the light of food industry trends. Stages of product development, shelf life/physiochemical analysis (texture, pH, color, and water activity) and sensory evaluation were utilized in developing a functional snack cheese cracker. 80% ethanol (ET) extracts of cheese cracker formulations were prepared using standard protocol. Antioxidant potential was determined using 2,2-diphenyl-1-picrylhydrazyl (DPPH) and Ferric Reducing Antioxidant Potential (FRAP) assays. Utilizing a 5-point hedonic scale (1 - Dislike very much, 2 - Dislike a little, 3 – Neither like nor dislike, 4 – Like a little, 5 – Like very much), 3 cheese cracker formulations, were tested

among consumer panelists, with majority of the consumers accepting the product based on color, overall appearance, aroma, texture, and taste. Texture (post peak (N) of the cheese crackers did not vary between each formulation. pH, color, and water activity remained constant over the shelf-life period. Spirulina and Bilberry are underexplored and underutilized in the food industry. Therefore, the significance of this research is to further use Spirulina and Bilberry in functional food product development targeted to adolescents due to their health-promoting properties in addition to their utilization in the current trend of the food industry as it relates to clean labels and utilization of natural colorants.

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Antioxidant Activity and Cytotoxic Effects of Date Seed Extracts on Colon Cancer Cells (HT-29). H Singh*, J. Boateng, R. Kaur, K. Medabalimi, M. Verghese, Nutritional Biochemistry Laboratory, Department of Food and Animal Sciences, Alabama A&M University, Normal, AL 35762.

Date seeds (*Phoenix dactylifera*) are a promising source of bioactive compounds (caffeic acid, apigenin, catechin) known for their antioxidant properties. This study investigates antioxidant activity and cytotoxic effects of date seed extracts on HT-29 colon cancer cells. Date seeds were extracted using 80% ethanol. HT-29 colon cancer cells were cultured in EMEM and 10% FBS and then were treated with varying concentrations (125, 250, 500, and 1000 µg/ml) of extracts for 24 hours. Lactate dehydrogenase (LDH) release was measured as an indicator of cytotoxicity. Cell viability was evaluated via MTT assay, while superoxide dismutase (SOD), glutathione (GSH), and catalase (CAT) activities were measured to assess cellular antioxidant response using standard assay kits. MTT assay indicated a decrease in cell viability with increasing extract concentrations: 82% (125 µg/ml), 78% (250 µg/ml), 73% (500 µg/ml), and 62% (1000 µg/ml). LDH release increased with higher extract concentrations, showing 11.11% (125 µg/ml) to 30.06% (1000 µg/ml), indicating increased cytotoxicity. SOD activity increased significantly from 18.5 U/mg protein (125 µg/ml) to 38.9 U/mg protein (1000 µg/ml). Glutathione levels increased from 5.62 µM to 41.14 µM, and CAT activity showed an increase from 14.08 µM to 95.04 µM with increasing concentrations. Date seed extracts exhibited potent antioxidant activity and dose-dependent cytotoxicity against HT-29 colon cancer cells, enhancing antioxidant enzyme responses. Their upcycling into value-added functional food ingredients highlights their potential in cancer prevention and sustainable innovation by valorizing agro-waste, promoting a circular bioeconomy, and supporting the development of eco-friendly, health-promoting food and nutraceutical products.

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Mechanism of Curry leaves (*Murraya Koneigii*) in Modulation of Antioxidant, Anti-inflammatory, and Apoptotic Pathways in 3T3-L1 Adipocytes for Potential in Anti-obesity Applications. K. Medabalimi*, H. Singh, R. Al Hazaimeh, J. Boateng, M. Verghese, Nutritional Biochemistry Laboratory, Department of Food and Animal Sciences, Alabama A & M University, Normal, AL 35762.

Obesity is a multifactorial disorder linked to inflammation, oxidative stress, and adipocyte hypertrophy. *Murraya koenigii* (curry leaves), rich in bioactive compounds with antioxidant and anti-inflammatory properties, shows strong potential for obesity management. This study evaluated the effects of curry leaves ethanolic extracts on 3T3-L1 adipocytes to determine its impact on cytotoxicity, oxidative stress, inflammation, and apoptosis. 3T3-L1 preadipocytes were cultured and differentiated into adipocytes through induction (Day 0), intermediate (Days 4–7), and maturation (Days 7–10) phases, followed by treatment with curry leaves extracts (125–2000 µg/mL). Cytotoxicity was determined using lactate dehydrogenase (LDH) release, cell viability was determined by MTT (3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium Bromide) and antioxidant enzyme activities—superoxide dismutase (SOD), catalase, and glutathione peroxidase (GPx)—were quantified. Interleukin-6 (IL-6) levels were measured using ELISA to assess inflammation, and apoptotic effects were determined through caspase activity assays and Lipid metabolism was evaluated using Glycerol-3-phosphate dehydrogenase (GPDH) activity assay and Oil Red O staining (Invitrogen and ABCAM kits). Curry leaf extracts induced concentration-dependent LDH release (35–64% during differentiation and 28–52% during maintenance) and reduced cell viability (MTT 72–43% vs. 51–23%), indicating apoptosis/necrosis at higher doses. Catalase (17–13 µM) and glutathione (3.16–2.47 µM) levels were similar across concentrations. These findings suggest that curry leaf extract promotes adipocyte apoptosis while modulating inflammatory and oxidative responses. Overall, *M. koenigii* demonstrates potential as a natural anti-obesity agent by reducing adipocyte viability, mitigating inflammation, and regulating oxidative balance, warranting further investigation into its mechanistic and therapeutic applications in obesity-related disorders.

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Development of Functional Pastry Products Targeting Celiac Disease: Antioxidative Potential of Alternative Flours and Ingredients. K. Bias*, N. Montgomery II, M. Verghese, Department of Food and Animal Sciences, Alabama A&M University, Normal, AL 35762.

Celiac disease and gluten intolerance have increased demand for safe, nutritious, and appealing gluten-free baked products. This study aimed to develop and evaluate functional gluten-free pastry formulations enriched with nutrient-dense and antioxidant-rich ingredients to enhance product quality and sensory appeal. Five gluten-free cinnamon rolls (blueberry, pecan, sweet potato, coconut carrot, and plain) were produced using optimized blends of rice, sorghum, almond, and tapioca flours. Products were analyzed for proximate composition, pH, water activity (Aw), texture profile analysis (TPA), and antioxidant potential using DPPH, FRAP, Total Phenolic Content (TPC), and Total Flavonoid Content (TFC) assays. Among the cinnamon rolls, the plain exhibited the highest antioxidant activity DPPH inhibition of 75.6% and blueberry had the highest reducing potential power of 5.08, while sweet potato and plain showed superior moisture retention and softness. A focus group evaluated appearance, flavor, texture, and overall acceptability. The sweet potato cinnamon rolls were most preferred. These findings indicate that incorporating functional ingredients into gluten-free pastries enhances nutritional quality, antioxidant potential, and consumer acceptance. As consumer demand for gluten-free products continues to rise, this research will contribute to enhancing their accessibility and market viability.

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Selected Synergistic Health Benefits of Spices (Ginger and Turmeric). T. Thatipamula*, H. Singh, K. Medabalimi, J. Boateng, M. Verghese, Department of Food and Animal Sciences, Alabama A&M University, Normal, AL 35762.

Spices [Ginger (G) and Turmeric (T)] contain bioactive compounds that may inhibit carbohydrate and lipid-metabolizing enzymes, contributing to their anti-diabetic and anti-obesity properties. Combining G&T may produce synergistic effects, enhancing bioactivity and utilization in food industry. Objectives were to determine selected health benefits of G&T (pure and in combinations). Total phenolic content (TPC), total flavonoid content (TFC), 1,1-diphenyl-2-picrylhydrazyl radical scavenging activity (DPPH), Ferric reducing antioxidant power (FRAP), Trolox equivalent antioxidant capacity (TEAC), Nitric oxide radical scavenging ability (NORS) and inhibition of α-glucosidase, α-amylase, and lipase enzymes were evaluated. Aqueous extracts (AQE) and 80%Ethanol extracts (ETE) were prepared from samples, 100%Ginger (100G), 75%Ginger + 25%Turmeric (25G+75T), 50%Ginger + 50%Turmeric (50G+50T), 25%Ginger + 75%Turmeric (25G + 75T), and 100%Turmeric (100T). ETE of spices yielded over 5-fold higher amounts of phenolics than AQE. Among ETE, samples with higher turmeric concentration showed elevated TPC (mg G.A.E./100g DW) [100T (3098.22), 25G+75T (2733.66)] and TFC (mg C.E./100g DW) [100T (995.36), 25G+75T (967.06)]. Highest DPPH inhibition (90%) seen by 50G+50T ETE, followed by 25G+75T (87%) and 100G (86%). AQE showed significantly lower DPPH inhibition, from 9-61%. However, TEAC in AQE significantly higher than ETE for pure and combination samples. Samples with higher Ginger concentration had higher inhibition (%) of metabolizing enzymes. Highest % of enzyme inhibition seen by 75G-25T ETE (50.23% by α-amylase and 60% by lipase). Results indicate synergistic effects between G&T. Future research should explore pure and combined spice extracts in cell cultures and develop functional foods or beverages using G&T for chronic disease prevention.

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Whole Genome Sequencing Reveals Resistome & Genomic Diversity of *Shewanella* Isolated from Oysters & Seawater in the Mid-Atlantic Bays. T. Johnson*, A.J. Punchihewage-Don, S. Parveen, Department of Agriculture, Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853; C. Grim, U.S. Food and Drug Administration, Division of Food Safety Genomics, College Park, MD 20740.

Shewanella species are increasingly recognized as emerging pathogens and potential reservoirs of antimicrobial resistance genes (ARGs). This study aimed to characterize the genomic variation, resistome, and phylogenetic relationships of *Shewanella* isolates recovered from oysters and seawater in the Chesapeake and Maryland Coastal bays. We analyzed 104 draft genomes. Species identification followed a FastANI workflow against a reference panel, assigning species when the ANI ≥ 95. Five isolates produced no reportable ANI to any reference and were excluded from species tallies. Among the remaining genomes, 81.7% met the ANI criteria. The most frequent taxa

were *S. zhuhaiensis* (n=30), *S. algae* (n = 19), *S. xiamenensis* (n = 11), *S. seohaensis* (n = 6), and *S. indica* (n = 4). Phylogenetic clustering revealed distinct intra-species and intra-strain variation. A total of 16 ARGs with the most prevalent ARGs coming from the beta-lactam and fluoroquinolone classes. The $bla_{OXA\text{-}SHE}$ resistance gene predominated alpha hemolytic *Shewanella*. Notably, *S. algae* detected the most ARGs in the fluoroquinolone class. Several species showed no detectable ARGs. Fisher's exact test revealed significant variation in ARGs distribution by hemolysin phenotype and isolation source. Genotype-phenotype inconsistencies were observed in a subset of isolates, primarily involving *qnr* genes and ciprofloxacin susceptibility predictions. However, plasmids and virulence properties were not detected in these genomes. These findings underscore the genomic variation and ARG carriage potential of environmental *Shewanella* spp., particularly those associated with seafood. WGS-based phylogenetic and resistome analyses support their inclusion in marine AMR surveillance and food safety risk assessment frameworks.

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Microbiome Analysis of Manure-Amended Soils and Corresponding Produce from Integrated Crop-Livestock Farms on Eastern Shore of Maryland. B. Goodwyn*, A.J. Punchihewage Don, S. Parveen, Department of Agriculture, Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853; P. Millner, USDA-ARS-Environmental Microbial and Food Safety Laboratory, Beltsville, MD 20705; C. Grim, U.S. Food and Drug Administration, College Park, MD 20740.

Although biological soil amendments of animal origin **(**BSAAO) improve soil fertility, they may alter soil microbiota and potentially transfer pathogens from soils to fresh produce, increasing cross-contamination risks. This study aimed to examine BSAAO's effects on soil and produce microbiomes. Using standard methods, 91 BSAAO, soil, and produce samples from three Integrated crop-livestock farms (ICLF) on the Maryland Eastern Shore were collected pre- and post-BSAAO-application and monthly for 180-days thereafter. A DNA library was prepared (Illumina DNA Prep (M) kit) and shotgun metagenomic sequencing (Illumina NextSeq 2000) characterized samples' microbiota. For all samples, bacteria dominated microbial communities (>92%). Alpha diversity was significantly ($p<0.05$) lower in produce than in soil; Beta diversity showed significant ($p<0.05$) differences in microbial communities between BSAAO, soil, and produce samples. Pre-incorporation, ICLF-BSAAO harbored pathogens from the families *Bacillaceae*, *Enterobacteriaceae, and Clostridiaceae* (*Escherichia coli*, *Bacillus cereus*, and *Clostridium botulinum/perfringens*). Relative abundance of archaea and bacteria slightly increased from pre-(0.1%, and 96.2%) to post-BSAAO (0.2% and 97.3%) application, while abundance of eukaryota decreased from 3.7% to 2.5%, respectively. After BSAAO-incorporation, soil *Escherichia coli* abundances slightly increased, while *Salmonella* levels decreased. On days 90 and 120 post-BSAAO incorporation, multiple pathogens within the *Bacillaceae, Enterobacteriaceae, Staphylococcaceae, Clostridiaceae*, and *Listeriaceae* families were present in soils and/or produce, suggesting the need to re-evaluate the current withholding-period's effectiveness. Study findings provide insights on BSAAO's effects on ICLF-soil and -produce microbiomes, and future research is needed to address strategies that optimize BSAAO practices in community ICLFs.

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Engineering Phages with Expanded Host Range: Computational Approaches for Livestock and Zoonotic Pathogen Control. B. Batiste*, A. Ampadu, O. Ogundele, M. Turner, N. James, B. White, D. F. Indihar, Department of Biological Sciences, Alabama A&M University, Normal, AL 35762.

The overuse of antibiotics in livestock has contributed to the emergence of antibiotic-resistant bacteria, posing a serious threat to both animal and human health. Resistant strains originating in agricultural settings can spread to human populations through direct contact, foodborne transmission, or environmental pathways, undermining the effectiveness of existing antimicrobial therapies. Phage therapy is the use of bacteriophages to specifically target and lyse bacterial pathogens, offering a promising alternative or adjunct to antibiotics. Although phage therapy has been used to treat bacterial infections in livestock previously, the narrow host range of many phages limits their utility for broad therapeutic applications in livestock disease management and zoonotic infection control. This project employs bioinformatic approaches to investigate the molecular and structural determinants of phage host specificity, with the goal of generating recombinant phages with expanded host ranges. By analyzing the sequences and structures of phage entry proteins, identifying conserved and variable motifs, and modeling their conformational dynamics through molecular dynamics simulations, this research seeks to determine how modifying or exchanging entry proteins could

alter host range. These analyses provide a framework for rationally engineering phages to recognize a broader set of bacterial hosts. By combining phage biology with computational protein design, this project investigates the application of recombinant phages as a new and innovative antimicrobial strategy that can be applied across livestock and human health contexts. Expanding phage host specificity through recombinant approaches has the potential to enhance the effectiveness of phage therapy in controlling antibiotic-resistant bacteria.

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Temporal Resolution of Aging-Associated Decline in Drosophila and Its Rescue through Dietary Intervention of Capsaicin. P. Kayastha*, J.I. Flores, M. Amirthalingam, R. Saha, U.K. Reddy, Gus R. Douglass Institute, West Virginia State University, Institute, WV 25112.

Aging is a multifactorial process marked by progressive physiological, behavioral, and molecular decline, often associated with gut–brain axis dysregulation. Nutritional interventions targeting this axis hold promise for promoting healthy aging. Capsaicin, the pungent phytochemical of chili peppers, exhibits antioxidant, anti-inflammatory, and metabolic benefits in mammals through both TRPV1-dependent and independent mechanisms. However, its TRPV1-independent effects on aging remain poorly understood. This study utilizes *Drosophila melanogaster*, which lacks a TRPV1 orthologue yet conserves key aging pathways, to elucidate capsaicin's temporal modulation of age-associated decline. Using integrated physiological, behavioral, and molecular assays—including lifespan, locomotor, sleep, and gut integrity analyses—combined with RNA-seq and 16S rRNA microbiome profiling across multiple life stages, we aim to identify molecular and microbial signatures underlying capsaicin-mediated rejuvenation. Preliminary data suggest enhanced stress tolerance, preserved intestinal homeostasis, and activation of redox and metabolic gene networks in capsaicin-fed flies. This integrative temporal framework advances understanding of capsaicin's geroprotective mechanisms and its potential as a dietary intervention for healthy aging.

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Multi-Omics Analysis Reveals the Impact of Curcumin-Supplemented Diets on Gene Expression, Metabolism, and Microbiome Composition in Drosophila melanogaster. A. Behera*, C. Lopez-Ortiz, U.K. Reddy, Gus R. Douglass Institute and Department of Biology, West Virginia State University, Institute, WV 25112.

Curcumin (*Curcuma longa*), a natural polyphenol from the ginger family, is well known for its culinary and medicinal significance, particularly for its antioxidant, anti-inflammatory, and neuroprotective activities. As an important phytochemical, curcumin and its related curcuminoids can modulate gene expression, metabolism, and microbial composition across organisms. This study investigates the molecular and physiological responses of *Drosophila melanogaster* reared on curcumin-supplemented diets using an integrative multi-omics approach, including transcriptomics, metabolomics, and microbiome analysis. Physiological measurements revealed that flies reared on curcumin diets exhibited higher body weights compared to control flies. Metabolomic profiling demonstrated that butanoic acid, erythritol, and ornithine were downregulated, whereas raffinose, dopamine, fructose, and sucrose were significantly upregulated, indicating enhanced carbohydrate and neurotransmitter metabolism. Microbiome profiling revealed developmental stage-specific differences, with adult flies enriched in gram-negative *Proteobacteria*, while larvae displayed higher levels of gram-positive *Firmicutes* and *Actinobacteria*. Furthermore, metabolite–disease interaction network analysis showed that upregulated metabolites such as pyruvic acid, L-leucine, and α-ketoglutaric acid were associated with neurological conditions like schizophrenia, while downregulated metabolites such as ornithine and homocysteine were linked to Alzheimer's disease. Together, these findings reveal that curcumin supplementation influences metabolic pathways, gut microbiota composition, and neuroactive metabolite levels in *D. melanogaster*, providing new insights into the nutrigenomic and neuroprotective potential of dietary phytochemicals.

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Protective Effects of Purified Cyanidin 3-Glucoside Against Forever Chemical-Driven Stress in Human Lung Epithelial Cells. M. Thakur*, D. Mutyala, R. Kondati, G. Dupre, A.A. Amoliga, S. Batra, Laboratory of Pulmonary Immunotoxicology, Department of Environmental Toxicology, College of Agricultural, Human and Environmental Sciences, Southern University and A&M College, Baton Rouge, LA 70813; P. Kim, Department of Biology, Grambling State University, Grambling, LA 71270.

Perfluorooctanoic acid (PFOA), a widespread “forever chemical” present in food and water, has been implicated in airway inflammation and cellular stress in lung epithelium. This study investigated whether cyanidin 3-glucoside chloride (2.5 μM, from Phytolab), a purified anthocyanin abundant in colorful fruits and vegetables such as berries, grapes, and red cabbage, can mitigate PFOA (100 nM)-induced cellular stress in A549 (Homo sapiens) lung epithelial cells. Cells were cultured as submerged monolayers, in 3D air-liquid interface formats, and as MatTek EpiAirway microtissues. Inflammatory signaling, Polycomb group gene regulation, and RNA granule dynamics were assessed using qPCR, western blotting, immunofluorescence, and ELISA, alongside functional readouts from wound-healing and Seahorse XF bioenergetic analyses. PFOA challenge increased inflammatory pathway activation, upregulated Polycomb-associated gene expression, and promoted stress granule and P-body formation. Cyanidin 3-glucoside pre-treatment effectively reduced these effects, restoring inflammatory and epigenetic markers, and supporting recovery of mitochondrial respiration and ATP output, paralleling classical antioxidant interventions. Neither PFOA nor cyanidin 3-glucoside altered wound closure in the acute exposure model. Although cyanidin 3-glucoside and related anthocyanins display moderate oral bioavailability, both the parent compound and its metabolites have demonstrated significant biological activity in vivo. These results suggest that dietary anthocyanins, exemplified by cyanidin 3-glucoside, can counteract pollutant-induced oxidative and epigenetic stress in the lung, supporting their potential role in nutrition-based public health interventions

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Persistent Organic Pollutants Promote Glycolytic Shift and Impair Fatty Acid Oxidation: Bioenergetic Rescue by Pterostilbene. R. Kondati*, M. Thakur, D. Mutyala, G. Dupre, S. Salukuti, S. Batra, Laboratory of Pulmonary Immunotoxicology, Department of Environmental Toxicology, College of Agricultural, Human and Environmental Sciences, Southern University and A&M College, Baton Rouge, LA 70813; M. Contin Ortega, Southern University Agricultural Research & Extension Center, Baton Rouge, LA 70813; W. Dorsey, Department of Biology, Grambling State University, Grambling, LA 71270.

Persistent organic pollutants (POPs) such as pentachlorophenol (PCP), tetrachlorohydroquinone (TCHQ), and hexachlorobenzene (HCB) are known to disrupt redox homeostasis, autophagy, and PANoptosis in human lung epithelial cells (A549), yet their direct effects on mitochondrial bioenergetics and long-chain fatty acid oxidation remain incompletely characterized. In this study, human A549 cells were exposed to physiologically relevant concentrations of PCP, TCHQ, or HCB (25 μM, simulating occupational exposure), with or without pre-treatment using 10 μM pterostilbene for 24 hours. Mitochondrial function and metabolic adaptation were characterized using the Seahorse XF Mito Stress Test, Real-Time ATP Rate Assay, and Long-Chain Fatty Acid Oxidation (LFAO) Assay. All tested pollutants induced marked mitochondrial dysfunction, as indicated by prominent regulation in basal and maximal oxygen consumption rate (OCR), ATP-coupled respiration, and changes in palmitate-driven β-oxidation. Glycolytic ATP production and extracellular acidification rate (ECAR) were induced, revealing a compensatory metabolic reprogramming toward glycolysis. Notably, pre-treatment with pterostilbene restored mitochondrial ATP generation, rescued oxidative phosphorylation efficiency, and recovered fatty acid oxidation rates to nearly control levels, with normalization of the ATP Rate Index and reduced reliance on glycolysis. These results establish that pterostilbene potently counteracts PCP, TCHQ, and HCB-induced deficits and promotes mitochondrial resilience. Pterostilbene, a naturally occurring polyphenolic compound abundant in Indian Kino tree (*Pterocarpus marsupium*) and certain berries, exhibits high oral bioavailability, making it a promising nutraceutical candidate for translational development. The present findings highlight the therapeutic potential of pterostilbene as a bioenergetic and metabolic protector against POP-induced mitochondrial toxicity in lung epithelium.

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Expression Analysis of Recombinant Flavanone 3-Hydroxylase (F3H) Gene in Muscadine Grape Berry. T.A. Clark*, A. Ananga, Food Science Program, College of Agriculture and Food Sciences, Florida A & M University, Tallahassee, FL 32307; V. Georgiev, Laboratory of Cell Biosystems, Institute of Microbiology, Bulgarian Academy of Sciences, 139 Ruski Blvd.,4000 Plovdiv, Bulgaria; V. Tsolova, Center for Viticulture and Small Fruit Research, College of Agriculture and Food Science, Florida A&M University, Tallahassee, FL 32317.

Flavonoids are natural antioxidants that include the groups of notable pigments such as anthocyanins and proanthocyanidins. Flavanone 3-Hydroxylase (F3H) is a key enzyme needed for the biosynthesis of flavonoids, the main ingredients of muscadine grape extracts. This study reports the first successful isolation, cloning and

characterization of F3H gene from *Vitis rotundifolia Michx*. The full-length cDNA of *V. rotundifolia* F3H gene (designated as VrF3H) had an open reading frame (ORF) of 1092 bp encoding 364 amino acids with a calculated molecular mass of 40.8kDa as well as an isoelectric point of 5.60. Comparative and in silico analyses revealed that the cloned VrF3H from muscadine grapes has high identity with F3H from other plant species. The deduced VrF3H protein showed similarities with other available plant F3H proteins, and the conserved amino acids ligating ferrous iron and residues participating in 2-oxo-glutarate binding were found in similar positions comparable to other F3Hs. Furthermore, three-dimensional structure modeling showed that F3H protein had the enzyme core consisting of β-sheet, a typical structure shared by all 2-oxoglutaratedependent dioxygenases including F3Hs. Phylogenetic tree analysis indicated that VrF3H belongs to the Vitis F3H cluster. VrF3H transcripts were found to be abundantly expressed in the in-vitro red cells, véraison and physiologically mature red berries, but not expressed in the skins of the green berries. The isolation and characterization of VrF3H gene will enable further study in the role of VrF3H gene in the biosynthesis of flavonoids in *V. rotundifolia*.

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Variations in Biotic and Abiotic Factors Influenced Microbial Compositions in Lake Talquin. J. Robinson*, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32307; J. Cherry, Department of Biology, Florida A&M University, Tallahassee, FL 32307; A. Strickland, Fish and Wildlife Commission, Quincy, FL 32351; O.C. Betiku, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32307.

Water is the most vital substance known to humankind. It is essential for consumption, providing food, economic stability, and prosperity for communities. The human population relies on surface water for a continuous supply of drinking water and irrigation of farmland. In 2015, about 70% of water used in America came from surface water. Recent human activities have polluted waterways worldwide, harming fish populations and other aquatic organisms. This study evaluated 252 samples containing water, sediment, and two fish types collected across seasons and lake sections in Lake Talquin. The purpose was to assess the presence of toxic substances in sediments and how they differ between summer and winter. Data obtained were analyzed in the laboratory and statistically compared to determine differences in group means. Our study confirms the presence of Hg as one of the contaminants in Lake Talquin. Season and habitat sections were significant factors influencing heavy metal concentrations in the upper and lower lake sections ($P < 0.005$). Temperature ranged from 16.8–27.9 °C and 18.3–27.5 °C in the lower and upper sections, respectively. High and significant pH values were observed during winter in both sections ($P < 0.005$). Likewise, concentrations (mg/kg) of Al, Mg, and Fe differed, with the highest Cu concentration reaching 71.69 mg/kg during winter. Hg concentration also varied significantly between the two fish tissue samples ($P < 0.005$). In conclusion, the results suggest that temporal variation impacts the penetration and bioaccumulation of heavy metals in Lake Talquin, posing a danger to community health.

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Effect of Plasma-Activated Hydroponic Water on *Escherichia coli* and *Listeria innocua*. C.S. Scales*, M. Williams, V. Akao, A. Janen, Food Science Program, Plant and Soil Science Program, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32307; E. Duke, Plant and Soil Science Program, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32310; V. Chhetri, Food Science Program, Plant and Soil Science Program, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32307.

Plasma-activated water (PAW) is an energy-efficient and environmentally friendly form of water that is treated with non-thermal plasma from various gases, including compressed air, nitrogen, and oxygen. Its potential antimicrobial properties have attracted significant attention in the agricultural and food industries, particularly in hydroponic systems. Increased cases of food safety risks associated with hydroponically grown food, especially those related to contaminated water, may benefit from an alternative sanitizer, such as PAW, as a pre-harvest risk management strategy. This study investigated the influence of nitrogen- and air-based PAW treatments on the microbial survival of *E. coli* and *L. innocua* in hydroponic water. The water samples were inoculated with generic *E. coli* ATCC 25922 and *L. Innocua* ATCC 33090 at 6 log CFU/mL and treated with PAW generated with either nitrogen gas (N) or compressed air (CA) for 20 minutes at 25°C. Bacterial reduction was determined using CompactDryTM. Both forms of PAW significantly ($P <0.05$) reduced *E. coli* and *L. innocua* populations, achieving reductions of more than 4 log

CFU/mL. Nitrogen-based PAW was more effective than air-based PAW against *L. innocua*. These findings suggest that PAW is an effective method for controlling the growth of foodborne pathogens in hydroponic water.

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Integrating Nutraceuticals and Functional Foods into a University Teaching Restaurant to Promote Health and Applied Learning. T. Borden*, I.B. Turnipseed, R. Churkoo, J. Drew, T. Holmes, K. Nichols, I.O.B. Tann, College of Agriculture, Virginia State University, Petersburg, VA 23806.

M&M Restaurant, a 50-seat teaching laboratory and full-service dining venue within the Department of Hospitality Management at Virginia State University, is uniquely positioned to serve as a translational platform for health-promoting culinary innovation. This initiative aligns with the College of Agriculture's Health & Nutrition Integration pillar and supports institutional priorities emphasizing student success and community well-being. The project focuses on incorporating nutraceutical and functional food ingredients—such as whole grains, leafy greens (e.g., Brassica oleracea var. acephala), and bioactive-rich herbs—into culturally resonant dishes designed for a predominantly African American campus community that experiences disproportionate burdens of hypertension, diabetes, and obesity. A quarter-time chef instructor will lead implementation, supported by paid student cooks and servers enrolled in a special topics course during the first eight-week session of the Spring 2026 term (January 20–March 17). Weekly operations (3–6 hours per week) will provide an applied learning environment to strengthen culinary, service, and nutrition-communication competencies. Planned evaluation includes assessment of student skill acquisition, feasibility of nutraceutical integration in a teaching context, and customer perceptions related to taste, cultural relevance, and wellness value. Anticipated outcomes include enhanced dining experiences, strengthened workforce readiness, increased awareness of nutritious food choices, and a replicable model for functional food integration in hospitality education. This project aims to demonstrate how academic culinary programs can advance community health while elevating student learning and departmental visibility.

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Yield, Consumer Preference, Nutritional and Antioxidant Properties of Selected Virginia-grown Sweetpotato Varieties. M. Martin*, T. Taghavi, L. Githinji, College of Agriculture, Virginia State University, Petersburg, VA 23806.

Sweet potato (*Ipomoea batatas* L.) growers in Virginia are interested in information regarding the marketability of sustainably grown sweet potato. A study was conducted at Virginia State University's Randolph Farm to evaluate yield, consumer preference, and the nutritional and antioxidant properties of selected sweet potato varieties: Beauregard, Bellevue, Bonita, Burgundy, Covington, Hayman, Murasaki, O'Henry, Orleans, Porto Rico, Purple, Stokes, and Vardaman. The yield experiment was arranged in a completely randomized design with 13 treatments replicated three times. Slips were planted in mid-June and irrigated twice weekly. Roots were harvested at 105 and 120 days after planting. Nutritional and antioxidant attributes, including chlorophyll, anthocyanin, and carotenoid content, were determined using standard analytical methods. Consumer preference was evaluated using a structured survey based on a Likert scale. Data were subjected to appropriate statistical analyses. Overall, differences were observed among varieties in yield performance, consumer preference, and nutritional quality. Some varieties demonstrated higher yields, while others showed favorable consumer appeal and enhanced antioxidant content. Analysis of sweet potato leaves also indicated varietal differences in nutritional and antioxidant properties. The information obtained from this study will be valuable to current and prospective sweet potato growers in Virginia for planning production and marketing strategies aimed at meeting consumer demand for sustainably grown sweet potato and sweet potato leaf products.

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Functional and Antioxidant Potential of *Adansonia digitata* (Baobab) Powder Extracted using Aqueous and 80% Ethanol Solvents. P. Johana*, H. Singh, M. Verghese, Nutritional Biochemistry Laboratory, Department of Food and Animal Sciences, Alabama A&M University, Normal, AL 35762.

Adansonia digitata (Baobab) is a nutrient-dense fruit recognized for its rich phytochemical composition and health-promoting properties. This study evaluated the antioxidant potential and bioactive compound content of Baobab powder extracted using two solvents—80% ethanol and distilled water—to explore its functional food applications. Total phenolic content (TPC), total flavonoid content (TFC), and antioxidant activities were assessed using DPPH (2,2- diphenyl-1-picrylhydrazyl), FRAP (Ferric reducing antioxidant potential), nitric oxide radical scavenging (NORS), and Trolox equivalent antioxidant capacity (TEAC) assays. The ethanolic extract exhibited higher phenolic (589 mg GAE/100 g) and flavonoid (294.79 mg QE/100 g) contents compared to the aqueous extract (580 mg GAE/100 g and 184.17 mg QE/100 g, respectively). Correspondingly, the ethanolic extract demonstrated superior antioxidant activity across multiple assays, with DPPH radical scavenging (81.92%) and FRAP reducing power (105.74 mM Fe (II)/100g) exceeding those of the aqueous extract (51.69% and 93.13 mM Fe (II)/100g). These findings indicate that Baobab powder is a potent natural source of polyphenolic and flavonoid compounds with strong antioxidant capacity, supporting its potential as a functional food ingredient. The higher efficacy of ethanol extraction suggests that solvent polarity influences bioactive recovery and antioxidant performance. Overall, Baobab demonstrates promising utility in the development of nutraceuticals, functional formulations, and innovative functional food products aimed at combating oxidative stress and promoting metabolic health.

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Bioactive and Antioxidant Properties of Capsicum annuum L. (Bird's Eye Chili): A Promising Functional Food Source. A. Watson*, H. Singh, M. Verghese, Nutritional Biochemistry Laboratory, Department of Food and Animal Sciences, Alabama A&M University, Normal, AL 35762.

Capsicum annuum L. (Bird's eye chili) is a pungent spice rich in capsaicinoids, phenolics, and flavonoids, recognized for its health-promoting properties. The present study investigates the influence of solvent polarity on extraction efficiency and antioxidant potential of Bird's eye chili. Extracts were prepared using 80% ethanol and distilled water and were evaluated for total phenolic content (TPC), total flavonoid content (TFC), and antioxidant capacity using DPPH (2,2- diphenyl-1-picrylhydrazyl), FRAP (Ferric reducing antioxidant potential), nitric oxide radical scavenging (NORS), and Trolox equivalent antioxidant capacity (TEAC) assays. The aqueous extract exhibited markedly higher TPC (791.59 mg gallic acid equivalents (GAE)/100 g) and TFC (213.72 mg quercetin equivalents (QE)/100 g) compared to ethanolic extract (471.5 mg GAE/100 g and 126.55 mg QE/100 g), suggesting that a polar solvent is more efficient in extracting phenolic and flavonoid compounds. In contrast, ethanol extract demonstrated stronger DPPH radical scavenging activity (66.52%) compared to aqueous extract (44.99%), indicating that ethanol may extract non-polar antioxidants with higher radical-quenching efficiency. FRAP values further supported enhanced reducing power of aqueous extract (172.21 mM Fe (II)/100g) compared to ethanolic extract (77.01 mM Fe (II)/100g). The results of this study show that Capsicum annuum L, has a high phenolic and flavonoid content that provides high antioxidant activity, suggesting that it could be used as a functional food ingredient. Its bioactive profile indicates that it may be effective in reducing diseases linked to oxidative stress, which will need more in vivo and bioavailability studies in future for nutraceutical applications.

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Beauty With a Purpose: Exploring the Impact of Food-Scaping at Prairie View A&M University. **S.** Evans*, S. Donald, L. Diondra, G. Arianna, L. Carson, R. Griffin, S. Douglas, J. Quinlan, A. Aborisade, K. Gay, B. Khanal, A. Geremew, CAFNR Research, College of Agriculture, Food and Natural Resources, Department of Agriculture, Nutrition and Human Ecology, Prairie View A&M University, Prairie View, TX 77446.

Food-scaping is the practice of integrating edible plants into traditional landscapes. This innovative and sustainable approach to community gardening enhances food security, environmental health, and community resilience. This study will explore the impact of food-scaping on Prairie View A&M University staff and students, using interviews and questionnaires as primary data. The primary objective of this study is to explore the impact of food-scaping on the lives of Prairie View A&M University staff and students. Food-scaping gardens will be established at various locations on campus (the library, the agriculture/business building, and the CARC building). Staff and students exposed to these gardens will be interviewed and asked to answer survey questions. We will use a mixed-methods approach to collect and analyze data from randomly selected participants. The results will help us understand how food-scaping impacts individuals on the university campus and its wider implications for the extended Waller County and beyond.

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Assessing the Contribution of Farmers' Markets to Food Security in North Tulsa, Oklahoma. C. Jones*, D. Carter, and N. Nyairo. Department of Agriculture and Natural Resources, Sherman Lewis School of Agriculture and Applied Sciences, Langston, OK, 73050.

In many parts of the United States, farmers' markets have emerged as a promising strategy to address food insecurity in many communities. North Tulsa, Oklahoma, is one of those areas that faces massive food insecurity, higher than the national average. The challenge of food insecurity has been exacerbated by the closure of grocery stores and limited transportation options among the local citizenry, leaving many residents reliant on convenience stores and fast-food outlets for their food. Farmers' markets offer localized solutions to connect residents directly to fresh produce and support small-scale growers. These markets enhance access to nutritious food while also promoting community engagement and economic development. This study assesses the potential contribution of farmers' markets to food security in North Tulsa, an area that is characterized by food deserts. The study utilizes secondary data obtained from the US Census website to draw pertinent conclusions. The study finds that local initiatives such as the Oasis Fresh Market and the Tulsa Farmers' Market are critical in enhancing local food security. Markets offer culturally relevant produce, accept SNAP benefits, and frequently partner with local organizations to provide nutrition education and cooking demonstrations, which help mitigate the effects of food deserts and empower residents to make healthier choices. This also creates opportunities for local farmers and entrepreneurs, contributing to economic resilience in local neighborhoods. To help sustain these communities, policymakers must intervene by supporting existing local initiatives. Such initiatives are key in overcoming the systemic barriers to accessing fresh and affordable food.

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Theoretical Mapping of Community Wellness Programming: A Study in Partnership with PVAMU Wellness in Houston. S. Cooke*, B. Kendrick, J. Robinson*, K. Sharpe, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Adolescents are facing increased exposure to sugary beverages and foods, which has led to a decline in their preference for and intake of fruits and vegetables. Low physical activity levels are linked to increased risk for chronic diseases such as obesity and type 2 diabetes. Innovative, context-driven strategies are needed to promote healthy behaviors. This study utilized a 1.5-hour session designed to engage teens in learning about nutrition and physical activity through the use of poems, music, videos, and interactive games. The purpose was to improve participants' knowledge, attitudes, and awareness regarding healthy beverage choices, fruit and vegetable consumption, and daily physical activity recommendations. Pre- and post-tests assessed knowledge and attitudes related to healthy beverages, physical activity, and fruit and vegetable consumption. Results showed significant improvements across all areas, including beverage calorie awareness, exercise recommendations, fruit and vegetable knowledge, and beliefs about healthy eating and activity. Findings suggest that integrating creative approaches such as music, poetry, and games can effectively enhance adolescents' nutrition knowledge and motivation toward healthier lifestyle behaviors.

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CBD and the Brain's Secret Switches: Exploring CB1 and CB2 Receptors Difference via computational modeling approach. C. Keyton*, Department of Chemistry and Physics, Alcorn State University, Lorman, MS 39096; H.J. Fan, Department of Chemistry and Physics, Alcorn State University, Lorman, MS 39096.

The endocannabinoid system (ECS) plays a crucial role in regulating physiological processes such as neuroinflammation, pain, mood, and immune function. Its two primary G-protein–coupled receptors, cannabinoid receptor type 1 (CB1) and type 2 (CB2), mediate the effects of endogenous ligands and plant-derived cannabinoids. While CB1 is predominantly expressed in the central nervous system and linked to neuromodulation and psychoactivity, CB2 is mainly found in peripheral immune cells and is associated with anti-inflammatory signaling. Cannabidiol (CBD), a non-psychoactive phytocannabinoid, is known to interact with both receptors in a complex, non-classical manner, often through allosteric modulation or biased signaling. However, the molecular basis of its differential modulation of CB1 and CB2 remains poorly understood. In this study, we use a computational approach such as docking, molecular dynamics (MD) simulations, and binding free energy calculations to investigate the receptor-specific interactions of CBD with CB1 and CB2. Our simulations reveal key differences in binding

conformations, allosteric pocket engagement, and stability of CBD–receptor complexes. These findings can provide a mechanistic understanding CBD's selective modulation of CB1 and CB2 signaling and suggest potential avenues for developing targeted therapeutics for neuroinflammatory disorders.

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Oklahoma's Goat Meat Market: Leveraging Consumer Insights for Effective Marketing and Production. L. Scott*, N. De Silva, S. Giscombe, Department of Agriculture and Natural Resources, Sherman Lewis School of Agriculture and Applied Sciences, Langston University, Langston, OK 73050.

Goat meat production has gained increasing attention across Oklahoma as consumer preferences diversify, and small-scale producers seek alternative markets. Despite growing demand, producers face challenges in understanding consumer purchasing behaviors and identifying profitable marketing strategies. This study examines Oklahoma's goat meat market by integrating secondary and primary data sources to assess opportunities for expanding production and market reach. Data were collected from the USDA's National Agricultural Statistics Service (NASS) for goat inventory and farm counts, as well as retail price data from regional markets in Oklahoma and Texas. To identify potential factors influencing customer preferences, insights, and purchasing behaviors, a Qualtrics consumer survey was administered to Oklahoma residents as part of a structured survey of potential goat meat consumers. Findings reveal that Oklahoma's goat industry remains underdeveloped despite a strong foundation of small producers. Consumers showed high interest in locally sourced, fresh, and processed goat meat products, particularly among middle-income households and those from varied cultural backgrounds. The study highlights the importance of enhancing supply chain coordination, expanding retail access points, and increasing consumer familiarity with goat meat as a long-term protein option. Results suggest that aligning marketing strategies with consumer characteristics and product preferences can enhance both producer profitability and rural economic development. These findings offer actionable insights for farmers, agribusiness marketers, and industry decision-makers seeking to strengthen Oklahoma's small ruminant livestock sector and meet evolving consumer demand in the southern U.S.

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The Impact of Meat Product Labeling on Consumer Behavior and Decision Making: Evidence from Oklahoma Consumers. H. Drake*, N. De Silva, Department of Agriculture and Natural Resources, Sherman Lewis School of Agriculture and Applied Sciences, Langston University, Langston, OK 73050.

Consumer demand for meat products is increasingly influenced by perceptions of product labeling, reflecting a growing public interest in health-related and production-related attributes. This study examines the impact of various meat labeling claims, including "organic," "non-GMO," "hormone-free," "grass-fed," and "product of the USA," on purchasing decisions and consumer understanding of products in relation to these labeling claims in Oklahoma. Using primary survey data collected from grocery shoppers in randomly selected areas of Oklahoma, the research examines the extent to which label awareness, perceived credibility, and individual preferences affect consumer choices. Preliminary findings suggest that while many consumers express strong preferences for certain claims, a notable gap remains between perceived knowledge and actual understanding of label definitions. Product attribute motivations rank among the top drivers of label selection, although confusion persists regarding certification standards and terminology. The study further identifies variations in purchasing behavior across demographic and income groups, emphasizing the role of education and access to information in shaping label interpretation. The results provide valuable insights for producers, marketers, and policymakers seeking to promote transparent labeling practices and enhance consumer literacy. By linking labeling perceptions to behavioral outcomes, this study contributes to strengthening informed decision-making and supporting long-term meat marketing strategies in the U.S. agricultural sector.

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Evaluating the Effectiveness of Intense Pulsed Light in Reducing *E. coli* on Walnut Kernels. M.C. James*, Natural and Computational Sciences, College of Arts and Sciences, Fort Valley State University, Fort Valley, GA 31030; H.L. Degala, R. Gyawali, A.K. Mahapatra, Food Engineering Laboratory, College of Agriculture, Family Sciences and Technology, Fort Valley State University, Fort Valley, GA 31030.

Walnuts are known to be healthy snacks, which are often eaten raw. Recent foodborne outbreaks associated with low

moisture foods, such as tree nuts have raised concern about the safety of walnuts. Conventional nut decontamination methods typically use heat, like roasting or drying, that can negatively affect the quality of walnuts. Intense Pulsed Light (IPL) is a great choice because it kills pathogens by flashing strong light very quickly, without using heat or harsh chemicals. In this study, the effect of IPL in reducing *E. coli* on walnut kernels, and its effect on moisture content and water activity of walnut kernels were evaluated. Walnut kernels were spot inoculated with *E. coli* and treated with IPL for 0 to 30 s at 13.4 cm from the light source. The *E. coli* population on treated and untreated walnut kernels were analyzed. The highest *E. coli* reduction (≈99%, i.e. 1.85 $\log_{10}$ CFU/kernel) was achieved at 30 s IPL treatment. Although the log reduction values showed a numerical increase with treatment time, they were not statistically significant. The treatment did not change the moisture content or water activity when compared with untreated walnuts. The results from this study indicate that IPL is an effective method for walnut decontamination without compromising their quality, making it a promising nonthermal method for treenuts safety.

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Integrating Multiple Dimensions of Diversity to Explain Variation in Aboveground Carbon Storage in Humid Subtropical Forests. O. Fatunsin*, K. Naka, Department of Natural Resources and Environmental Sciences, Alabama A&M University, Normal, AL 35762.

Understanding how interactive effects of forest diversity dimensions influence carbon storage is crucial for biodiversity-based climate mitigation strategies. Past studies examined structural and species diversity effects, the interdependence among multiple diversity dimensions remains unclear. Here, we evaluated the interactive effects of functional dominance, functional divergence, taxonomic diversity, and tree size inequality on aboveground carbon storage (AGC) in oak-pine forests of the southeastern U.S. Data from 946 Forest Inventory and Analysis (FIA) plots across Alabama, Georgia, and Florida (2009–2019). AGC (kg/ha) was extracted directly from FIA, which has pre-calculated the values using species-specific allometric equations. Hypotheses tested were: H1 (Main Effects): Functional dominance (community-weighted mean of maximum height), functional divergence (trait variance weighted by species' basal area), and taxonomic diversity (Shannon index), each positively affects AGC. H2 (Two-Way Interaction): The positive effect of functional dominance on AGC is enhanced under high taxonomic diversity. H3 (Three-Way Interaction): Functional divergence, taxonomic diversity, and tree size inequality (coefficient of variation in height) interact to influence AGC. Results supported H1, positive effects of functional dominance, functional divergence, and taxonomic diversity. H2 was not supported. H3 was supported by a significant three-way interaction, indicating that functional and taxonomic diversity effects on AGC were enhanced by high structural heterogeneity. The model explained 75% of AGC variation. These findings integrate multiple dimensions of forest diversity, particularly dominant traits, trait variation, taxonomic diversity, and structural complexity in forest carbon assessments and offer a transferable framework for sustainable forest management in similar ecosystems globally.

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Comparative Assessment and Statistical Evaluation of Landslide Susceptibility in Eastern Kentucky Using GIS and Machine Learning Models. U. Basnet*, B. Gyawali, L. Yu, D. Zourarakis, K. Paudel, A. Satyal Land Grant Program, Kentucky State University, College of Business, Engineering and Technology, Frankfort, KY, 40601.
Landslides are among the most severe natural hazards, often triggered by various natural factors and human activities. This paper presents initial results from a landslide susceptibility assessment study for an area in Eastern Kentucky using Geographic Information Systems (GIS) and Machine Learning (ML) models, with a statistical comparison of their results to assess their performance and usefulness. The data set constructed contained: a) Primary Data (e.g., soil type, previous landslide occurrence); and b) Secondary data (e.g., vegetation cover, rainfall, soil slope). In all, the data set included parameters such as rainfall, slope angle, soil saturation, vegetation cover, earthquake activity, proximity to water, previous landslide occurrence and soil type for comparing the usefulness of the models studied in predicting the occurrence of landslides the DeLong Test was used to detect significant differences in the values of the area under the receiving operating characteristic curve (AUC; ROC). Thus, the predictive power of the models was assessed to evaluate their accuracy. The susceptible areas were outlined as part of the susceptibility maps for the study region in Eastern Kentucky and provided as potential input data for mitigation measures, community resilience, sustainable infrastructure development and proper land use planning.

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Effects (Short- And Long-Term) of Biopolymers, Cork and *Rhizobium Tropici*-Derived Extracellular Polymeric Substances (EPS) on Soil Microbial Communities. O. Soyinka*, S. Karapareddy, S. K. Sanathanam, Z. Senwo, L. Nyochembeng, E. Moss, V. R. Sripathi, Department of Natural Resources and Environmental Sciences, Alabama A&M University, Normal, AL 35762.
Soil microbes play a crucial role in plant growth and development. Biopolymer amendments, such as cork and extracellular polymeric substances (EPS), may improve soil health but can affect sequencing and subsequent analysis. This study evaluated 48 soil samples from Decatur, Alabama, subjected to four treatments: unamended soil (soil.control), soil with cork (soil.cork), soil with EPS (soil.EPS), and soil with both cork and EPS (soil.cork.EPS). Samples were collected at four time points (0, 24, 48, and 72 hours-after-treatment) with three biological replicates per treatment. We first measured various physicochemical properties of soils, including pH, salinity, electrical conductivity, organic matter content, and available nutrients. Then, we used FastDNA Spin kit for DNA extraction. Microbial biodiversity was assessed by amplicon sequencing (Illumina/NextSeq) targeting the ITS region for fungi and the 16S rRNA for bacteria and archaea. The raw reads obtained were filtered and analyzed using Qiime2/PhyloSeq programs to identify 62,996 amplicon sequence variants (ASVs), with 513 and 467 ASVs commonly present across time points and treatments, respectively. The microbial community was primarily composed of Actinobacteria, Proteobacteria, and Acidobacteria, with Actinobacteria being the most abundant phylum. Core microbiome analysis identified Bacillus and Gaiella as dominant genera, playing key roles in soil ecosystem stability and nutrient cycling. These microbes contribute to carbon sequestration, nitrogen fixation, phosphorus solubilization, improving soil fertility, and plant-microbe interactions. These findings show how organic amendments affect microbial biodiversity and composition, impacting soil fertility and microbial ecosystem stability. These findings contribute valuable information for enhancing soil quality and agricultural productivity.

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Predicting Agricultural Land Conversion in U.S Peri-Urban Areas: Spatial Modeling for Sustainable Land Management and Environmental Stewardship. N. W. Peprah*, H. Grover, Department of Community and Regional Planning, Alabama A&M University, Normal AL, 35762.

Peri-urban areas, the transitional zones between rural and urban regions, are experiencing rapid and largely uncoordinated development that threatens agricultural land, natural resources, and ecological stability. This study, aligned with USDA's Bioenergy, Natural Resources, and Environment priority area, examines how peri-urban expansion contributes to agricultural land conversion and proposes predictive tools to guide sustainable land management. The research develops a land-use change modelling framework that integrates physical, economic, and agricultural indicators to forecast development pressures on farmland. Using Cellular Automata and Artificial Neural Networks, the study simulates spatial patterns of land conversion and identifies high-risk agricultural zones. Results are intended to support planners and policymakers in anticipating and mitigating farmland loss before irreversible environmental and economic impacts occur. By linking predictive analytics to sustainable land management, farmland preservation, and food system resilience, this research advances the USDA's mission to balance growth with environmental stewardship. The findings provide a pathway for integrating spatial modelling into regional planning, enabling communities to maintain productive agricultural landscapes while promoting ecological resilience at the rural–urban interface.

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Impact of Land Use Planning on Community Hazard Exposure. I. Baah*, H. Grover, Department of Community and Regional Planning, Alabama A&M University, Normal AL, 35762.
This proposed study will examine the impact of land use planning on community hazard exposure across selected U.S states, focusing on how planning practices shape vulnerability and adaptive capacity. Land use planning is a crucial instrument for managing development in hazard-prone areas and for stewarding communities towards safer and more sustainable growth. Yet unevenness in policy adoption and implementation have produced inconsistent outcomes across the United States. This research explores how discrepancies in planning systems, institutional capacity, and governance influence exposure and hazard mitigation performance. A mixed-method design integrating plan quality assessment, spatial analysis, and policy diffusion theory will be adopted. A Hazard Mitigation Index (HMI) will be developed to evaluate the quality of land use and hazard mitigation plans based on clarity of goals, strength of fact base, policy coherence, implementation mechanisms, and monitoring procedures. Python- based Natural Language Processing (NLP) will analyze planning documents to uncover common patterns

and assess consistency in hazard mitigation policies. Geographic Information Systems (GIS) will be used to map relationships between planning quality and hazard exposure using data from Federal Emergency Management Agency (FEMA), National Oceanic and Atmospheric Administration (NOAA) and the U.S. Census Bureau. Findings will inform data-driven and equitable planning across the United States.

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Optimizing Algal Turf Technology for Enhanced Nutrient Remediation and Biomass Production in Agricultural Systems K. N. McKinley*, G. Blank, and G. Ozbay, One Health Lab, College of Agriculture, Science & Technology, Delaware State University, Dover, DE 19901.

Algal Turf Scrubber (ATS) technology represents an innovative and sustainable approach for mitigating nutrient pollution in aquatic systems while simultaneously generating valuable biomass. This research investigates the application of ATS systems in aquaculture environments to evaluate their efficiency in nutrient removal and biomass production. The study focuses on quantifying reductions in carbon, nitrogen, and phosphorus concentrations, as well as examining the effects of flow dynamics on algal growth and productivity. Preliminary findings indicate that moderate to high flow rates enhance both nutrient uptake efficiency and algal biomass yield, particularly improving phosphorus removal. Ongoing analyses include assessing algal species composition, chlorophyll content, and the biochemical profile of harvested biomass, with emphasis on lipid and fatty acid composition for potential use in sustainable fish feed formulations. By integrating water quality improvement with bioresource recovery, this work aims to advance the practical adoption of ATS systems among Delaware aquaculture producers, contributing to circular bioeconomy principles and resilient wastewater management practices.

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Optimization of Proton Transfer and Biofilm Stability in a Single-Chamber Microalgal–Microbial Fuel Cell for Agricultural Wastewater Treatment. D. Amoh*, and L. J. Wang, Natural Resources and Environmental Design, North Carolina Agricultural and Technical State University, Greensboro, NC 27411.

Agricultural activities produce significant wastewater with pollutants including organic matter, nutrients, pesticides, and pathogens. Effective treatment is crucial for removing contaminants, protecting ecosystems, and recovering resources. Biological methods such as anaerobic digestion (AD), microalgal cultivation, and microbial fuel cells (MFCs) are sustainable wastewater treatment technologies. The biogas productivity of AD depends on operating conditions and needs long retention times. Microalgal cultivation is limited by light and harvesting costs, while MFCs face challenges with scaling and stability. The integration of microalgae with MFCs has become promising, as they act as oxygen generators to facilitate reactions at the cathode, and efficiently remove phosphorus and nitrogen from wastewater. This study investigates surface modifications of carbon cloth electrodes in a single chamber, membraneless microalgal MFC designed to optimize proton transfer, biofilm stability, and antifouling performance. The research explores hydrophilic and hydrophobic coatings, biochar composites, and electrode geometry, including surface-area-to-volume ratio, to enhance charge transfer and nutrient removal. A controlled temperature and pH gradient across the chamber facilitate directional electron and proton flow, enabling efficient coupling of microbial oxidation and algal photosynthesis. Mechanistic studies on fouling assess the role of surface chemistry, shear, and light cycling. Adaptive light and CO_2 delivery regimes linked to anode biogas rates stabilize pH and promote algal oxygen generation. Machine learning models are developed to predict key performance indicators, including COD, TN, TP removal, biofilm density, and power generation. Overall, the aim is to establish a scalable, self-sustaining single-chamber bioelectrochemical system for integrated wastewater treatment and bioenergy recovery.

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Regional Variation in Soil Properties and Microbiomes of Florida Muscadine Vineyards. A. F. Humphries*, V. Tsolova, C. Kruis, J. Campbell, D. Lenczewski-Jowers, Center for Viticulture and Small Fruit Research, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL, 32308; A. Chauhan, School of the Environment, Florida A&M University, Tallahassee, FL, 32307.

Florida’s warm, humid viticultural zones impose strong environmental stressors that can manifest in shaping the soil microbial community structure and functions pertaining to productive vineyard soils. Yet statewide microbial

baselines for muscadine grape (*Vitis rotundifolia*) vineyard ecosystems remain rather limited. We conducted a stratified soil survey of 11 commercial vineyards spanning the Panhandle and Central Florida to characterize environmental chemistry and microbial analysis using 16S rRNA and ITS1 amplicon sequencing along with functional annotations. Community-level comparisons revealed clear regional differentiation, with fungal assemblages showing pronounced separation between the Panhandle and Central sites and bacteria exhibiting subtler but consistent shifts. Alpha diversity patterns suggested higher bacterial diversity at Central sites, whereas Panhandle soils were comparatively enriched in saprotrophic fungi and oligotrophic bacterial groups. Core microbiome analyses indicated broad overlap of bacterial taxa across regions but greater regional specificity among fungi, consistent with stronger local filtering for fungal communities. Multivariate associations linked pH, calcium, sulfur, and nitrate to variation in community structure and putative functional roles, underscoring soil chemistry as a primary driver of microbial functional potential. Collectively, these results establish a Florida-focused baseline for vineyard soil microbiomes and highlight region-specific soil–microbe relationships relevant to precision viticulture in the southeastern U.S. The findings motivate next steps to couple metagenomics with grape and wine chemistry and to inform targeted soil management that enhances beneficial microbial services while reducing cropping inputs.

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cesCarbon Composition, Thermal Stability, and Nutrient Dynamics in the Post-Hurricane Decomposition of Sand Pine Needles in Chipola Experimental Forest. G. Orji-Nwoke*, L. Ngatia, W. Marechal, G. Bugna, T. Sarker, K. Oduor, Florida A&M University, College of Agriculture and Food Science, Center for Water Resources, FL 32307, USA; I. Nadhirah, Soil & Fertilizer Research Centre, MARDI, 43400 Serdang, Selangor, Malaysia; J.M. Grace III, USDA-Forest Service, Southern Research Station, Center for Forest Watershed Research-Center for Forest Assessment and Synthesis, Tallahassee, FL 32303, USA; S. Holmes, National High Magnetic Field Laboratory, Florida State University, 1800 E. Paul Dirac Drive, Tallahassee, FL 32310, USA.
Litter decomposition is a critical process in forest ecosystems, especially following hurricanes, which introduce large quantities of organic debris that influence nutrient cycling and carbon (C) transformation. This study examines the annual decomposition of sand pine (Pinus clausa) needles following a hurricane, with a focus on carbon (C) structure and nutrient dynamics. Sand pine litter was collected using litter traps, air-dried, and returned to the field in litter bags. It was then retrieved at 0, 1, 2, 4, 6, 8, 10, and 12 months. Carbon functional groups were analyzed by ^{13}C Nuclear Magnetic Resonance (NMR) spectroscopy. Carbon and nitrogen (N) were determined by a CN analyzer, and nutrients were determined by the ashing method. The results indicated a progressive mass loss of litter over time (P = 0.0001*);* cumulatively, 50% of the mass was lost by July 25. Cumulatively, C, N, P, and K release increased significantly at P=0.0001; P=0.0004; P=0.0016; P=0.0001, respectively, during the experimental period. The C: N ratio ranged from 91 to 132 over time, indicating a dominance of immobilization. The ^{13}C NMR indicated the dominance of O-Alkyl C in the initial litter, with a gradual decrease in O-alkyl and an increase in Alkyl C and carboxyl C as decomposition progressed. Carbon thermal stability data indicated a trend of increasing LTSC (<400 °C) and HTSC (>400 °C) as decomposition progressed; this pattern was further supported by an increasing R400 index, which highlights an increase in thermally labile C.

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Modeling Forest Road Runoff and Erosion in the Florida Panhandle Region, USA. K. Light*, Soil and Water Sciences, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL, 32307; J. Grace III, USDA-Forest Service, Southern Research Station, Center for Forest Watershed Research, Tallahassee, FL, 32307; J. Chen, Biological Systems Engineering, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL, 32307.

Studying forest road runoff and erosion is essential for reducing sediment, protecting water quality, and sustaining forest operations. Runoff and erosion in Florida's Panhandle were simulated using the Water Erosion Prediction Project (WEPP) model over a 30-year period to assess six management practices, three soil surface types, and three slope designs on an experimental forest road. Comparative analyses were conducted across four temporal scales using paired t-tests. Results showed that forest buffers were the most effective management practice, reducing runoff by 268.4% and annual erosion by 99.3% compared to non-buffered treatments. Gravel surfaces also significantly reduced erosion by 53.4% and 46% relative to compacted and bare surfaces, respectively. Among slope designs, the U5 topography reduced erosion by 53.1% and 38.3% compared to U3Dev and U10, indicating that uniform, low-gradient slopes offer superior erosion control. Runoff and erosion decreased as precipitation depth increased, with gravel

surfaces consistently producing the lowest yields. The largest precipitation class (>50 mm) generated the greatest portion of total erosion and runoff. These results highlight the importance of integrating road design, surface materials, and slope configurations with local climatic and temporal conditions to optimize forest road planning, erosion control, and environmental protection. Future research should assess the most and least effective road attributes in terms of cost, durability, and long-term performance along road networks.

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Improving Vineyard Productivity Operations Using Field Monitoring Plant Phenotyping & Agroclimatic Data. S. K. Bullen*, Soil and Water Sciences, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL, 32307; W. Liang, Biological Systems Engineering, Panhandle Research & Extension Center, University of Nebraska–Lincoln, Scottsbluff, NE 69361; V. M. Tsolova, Center for Viticulture and Small Fruit Research, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL, 32307; J. Chen, Biological Systems Engineering, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL, 32307.

The grape and wine industry is a significant agricultural sector, producing high-value commodities; however, vineyard management faces challenges such as water scarcity, fertilization needs, pest control, and increasing climate variability. Efficient irrigation is crucial as it directly impacts grape quality and health. About 70% of water consumption worldwide is used for agricultural purposes. However, water scarcity is expected to rise in the coming decades. Additional pressures, including labor shortages and environmental complexities, further highlight the need for high-precision, adaptive technologies. Despite advances in navigation systems, irrigation, and imaging tools, growers continue to struggle with scheduling critical operations due to the scarcity of early- and mid-season data. Without reliable early-season data, key management decisions become uncertain, negatively affecting profitability. The integration of sensor networks offers promising solutions by enabling improved vineyard monitoring, smart irrigation, and data-driven decision-making. These technologies collect large datasets to identify patterns and provide actionable insights. This research explores the integration of Internet of Things (IoT), wireless sensor networks (WSN), agroclimatic data, and imaging technologies primarily for vineyard water management, assessing their effectiveness in improving resource efficiency and decision-making. By utilizing the WSN, we analyze a straightforward soil-water balance model for irrigation. Statistical tests and visualization allow for the identification of key environmental and crop parameters affecting water consumption and yield, and evaluate economic feasibility. By addressing data scarcity and technology adoption challenges, this research provides practical insights for growers, particularly in the southeastern U.S., demonstrating how data-driven approaches can enhance productivity, profitability, and sustainability in precision viticulture.

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From Seeds to Productivity: How Improved Maize Varieties Shape Technical Efficiency and Total Factor Productivity in Nigeria. A. V. Adegbemiro*, M.A. Lachaud, Agribusiness Program, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL, 32307.

High-yielding, improved seed varieties are widely promoted by international development organizations, such as the World Bank, the International Monetary Fund, and the African Development Bank, to boost farm productivity in developing countries. However, empirical evidence on their effects on efficiency and productivity growth remains mixed, partly due to farmers' risk aversion, ambiguity toward new technologies, and the unaddressed issue of selection bias in adoption decisions. This study focuses on yam production in Nigeria—the world's largest producer of yam, Africa's largest economy, and its most populous nation—where about 70% of the population is directly or indirectly engaged in agriculture. The country's agricultural performance is therefore central to regional food security in West Africa. We first apply propensity score matching to create a balanced sample of high- and low-technology adopters. Second, we estimate a selectivity-corrected stochastic frontier model combined with a Difference-in-Differences approach to account for unobserved selection effects and heterogeneity. The analysis relies on a nationally representative two-period panel dataset from the World Bank's Living Standards Measurement Study–Integrated Surveys on Agriculture (LSMS-ISA) for Nigeria (baseline = 2010; endline = 2018), which includes detailed household, agricultural, and community-level information. Preliminary results indicate that improved seed adopters achieve significantly higher technical efficiency than non-adopters after controlling for selection bias. The findings underscore the productivity potential of improved seeds and highlight the need for policies that expand access to these

technologies, strengthen agricultural extension, and improve credit availability to close the technical efficiency gap between traditional and improved seed adopters.

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Extra Floral Nectaries of *Paulownia elongata* and *P. fortunei*: The Unsung Heroes of Plant Defense. A. Basnet*, Seethapathy G Saroja, and N. Joshee, Agricultural Research Station, Fort Valley State University, Fort Valley, GA 31030.
Paulownia genus is known for fast-growing tree species with significant ecological and economic value. Plants contain extrafloral nectaries (EFNs) on the leaves and tender stems and their role is poorly understood. This study presents the first comprehensive morphological, anatomical, and histochemical investigation of EFNs and the chemical analysis of their secretion. Development and structural organization were studied using light, scanning electron microscopy (SEM), and histochemical analyses. Chemical profile of nectar secretion was studied by Thin Layer Chromatography (TLC) and Nuclear Magnetic Resonance (NMR) techniques revealing the presence of complex sugar mix. Location, distribution, and tissue organization of EFNs across different developmental stages of Paulownia leaves, petioles, and stems were characterized. Developmental analysis indicated that EFN formation initiates during early leaf expansion, with secretory activity peaking in young to intermediate stages before declining in mature leaves. Histological staining of EFN tissues demonstrated the anatomical structure of EFNs, while histochemical assays confirmed the presence of lipids, proteins, phenolics, and defense-related enzymes involved in reactive oxygen species management. These results suggest that *Paulownia* EFNs actively participate in protective functions by producing compounds that attract mutualistic insects and deter herbivores. By integrating anatomical and histochemical approaches, it establishes a baseline for future biochemical and molecular studies of nectar secretion and anti-herbivore / antifeedant mechanisms in woody perennials. This research provides foundation for understanding plant-insect interactions in this economically important multipurpose tree and opens avenues for future molecular and biochemical investigations of nectar secretion mechanisms.

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Investigating Vegetation Recovery and Surface Temperature Dynamics on Reclaimed Mine Lands in Martin County, Eastern Kentucky Using Sentinel-2 NDVI and Land Surface Temperate (LST). A. Akwemoh*, B. Gyawali, D. Zourarakis, D. Oli, M. Parajuli, K. Paudel, A. Akinleye, and A. Satyal, 1890 Land-Grant Program, Kentucky State University, Frankfort, KY 40601.
Reclaimed mine lands in Eastern Kentucky exhibit heterogeneous vegetation recovery following surface coal mining, yet the relationship between vegetation regrowth and local microclimate remains poorly understood. This study examines temporal patterns of vegetation vigor and surface temperature on reclaimed sites in Martin County. *Sentinel-2* imagery is used to derive NDVI time series as a proxy for vegetation health, while thermal remote sensing provides Land Surface Temperature (LST) data to characterize microclimate conditions across the study area. This research tests the hypothesis that areas with faster vegetation recovery exhibit lower surface temperatures due to increased shading and evapotranspiration, and conversely, that high surface temperatures are associated with delayed vegetation establishment. Validation leverages *USGS* land cover datasets, and the *National Land Cover Database (NLCD)*. Preliminary results are expected to reveal spatial and temporal correlations between vegetation dynamics and surface temperature, highlighting the potential for NDVI–LST integration as a cost-effective method to assess ecological recovery and microclimate regulation on post-mining landscapes. This approach provides insights into how reclamation strategies influence both vegetation regrowth and thermal characteristics, offering guidance for optimizing land management in Appalachian coalfield regions.

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Integrating LiDAR Vegetation Structure with SWAT+ for Mapping Soil Loss Hotspots in Eastern Kentucky's Wolf Creek Watershed. A.S. Akinleye*, K. Paudel, B.R. Gyawali, D. Zourarakis, M. Parajuli , M. Gebremedhin, A. Satyal, A. Akwemoh, 1890 Land-Grant Program, Kentucky State University, Frankfort, KY 40601.
Disturbances from surface mining in Appalachian watersheds have led to severe soil erosion due to vegetation loss. This study integrates the SWAT+ watershed model with LiDAR-derived metrics to assess soil loss and post-mining vegetation recovery in the Wolf Creek watershed of Eastern Kentucky. SWAT+ – a restructured SWAT model with enhanced spatial representation of landscape processes – is used to simulate runoff and sediment yield under various land-cover scenarios. High-resolution LiDAR data provide fine-scale terrain and forest structural parameters,

including canopy height percentiles and cover, to improve identification of erosion-prone areas. Notably, areas of short vegetation (LiDAR 95th percentile height < 5 m) indicate reduced sediment retention capacity. By incorporating LiDAR-based vegetation metrics into SWAT+ inputs and analyses, we enhance the model's ability to pinpoint erosion hotspots that might be overlooked with coarser data. Previous studies suggest that LiDAR-driven erosion risk indices align closely with SWAT+ predictions of sediment yield (with ~87% agreement between a LiDAR-derived erosion control index and SWAT output). This agreement underscores the reliability of the integrated approach. Furthermore, literature indicates that vegetation re-establishment can account for over 80% of long-term erosion reduction, highlighting the importance of monitoring regrowth. The combined use of SWAT+ modeling and LiDAR remote sensing offers a powerful tool for mapping erosion regulation in reclaimed landscapes, thus guiding targeted soil conservation measures and informing land restoration strategies in post-mining Appalachian watersheds.

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Medium-Term Effects of Biochar on Soil Properties in Silty Loam Soil of Kentucky. S. Kandel* and A. Chiluwal, College of Agriculture, Health and Natural Resources, Kentucky State University, Frankfort, KY 40601.

Globally, agricultural productivity is under threat from soil degradation, and there is growing interest in sustainable soil amendments, such as biochar, to restore soil health. Biochar is a stable carbon-rich byproduct of biomass pyrolysis and has shown a positive impact on improving soil physical, chemical, and biological properties. However, medium-term field studies examining the effects of biochar on fertile silt-loam soils, the predominant soil type across many Kentucky croplands, remain underexplored. To address this gap, we conducted a field trial at Harold R. Benson Research and Demonstration Experimental Station, Frankfort, Kentucky. The study was conducted in a split-plot randomized complete block design with four replications, where biochar was the main plot factor and cultivars were the subplot factor. Soil samples were collected from each plot in the third year after biochar application under a continuous soybean cropping system. Key soil parameters assessed included pH, EC, bulk density, aggregate stability, cation exchange capacity, C and N content, and permanganate-oxidizable carbon (POXC). Biochar application, variety, and soil depth did not significantly influence bulk density, WSA, pH, EC, or POXC, indicating strong inherent soil stability and buffering capacity. These results highlight biochar's slow but steady nature, soil interactions, and the need for long-term management and monitoring to capture its cumulative benefits for soil health.

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Assessing Flood Hazard Potential in Eastern Kentucky Through Machine Learning- Enhanced GIS Analysis. A.Satyal*, B.Gyawali, D.Zourarakis, M.Parajuli, K.Paudel, U.Basnet, D.Oli. Land Grant Program, Kentucky State University, College of Agriculture and Natural Resources, Frankfort, KY 40601.
Flooding is a common natural disaster in the Commonwealth of Kentucky. The complex topography of this state, including river basins such as the Mississippi River in the West, the Ohio River, and the valley in the Appalachian valley in the East makes this area more prone to flood hazards. The costly natural disasters including major flood events in 2022, 2023, and 2025, highlight the need to study predicting flood-prone and vulnerable areas in Eastern Kentucky. Our study assesses flood risk in the Wolf Creek watershed and adjoining watersheds using GIS-based flood susceptibility modeling with a random forest model and historical flood inventory maps created from satellite imagery data. The model incorporates key physical factors such as elevation, slope, rainfall, and distance from rivers to predict flood-prone areas. The study aims to produce a high-resolution flood risk map which will be statistically validated against historical flood events and current knowledge such as the National Flood Hazard Layer. Model performance will be assessed using accuracy to measure overall correctness and Matthews Correlation Coefficient (MCC), calculated to evaluate the model's reliability when working with imbalanced data. This will lead to the identification of a flood risk index that clearly shows communities with the highest potential for flooding. The generated map is expected to serve as a vital decision-making tool for disaster management and city planners enhancing community resilience and targeting infrastructure investment in flood-prone areas.

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Integrated On-Farm Waste Management Strategies for Missouri Small-Scale Farms: Reducing Operational Costs Through Resource Conversion. B. Owusu*, C. Sanchez, H. Salinas-Gonzalez and A. Ayele, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101.

This study investigates the best ways to produce biogas and biomethane from agricultural residues and animal manure collected at Lincoln University's research farms in Missouri. Poorly managed farm waste can damage the environment, but it also represents a valuable, underused resource for sustainable energy. The main goal is to find the most efficient co-digestion ratio of available feedstocks, including various crop residues and livestock manure (cattle, goats, sheep, and poultry), to maximize biogas production and methane (CH4) quality. Initial analyses will include measuring Total Solids (TS) and Volatile Solids (VS), along with elemental analysis to determine the amounts of carbon, hydrogen, oxygen, nitrogen, and sulfur (CHON-S). The animal manure collected will serve as the control in anaerobic co-digestion experiments conducted with laboratory-scale bioreactors. After identifying the optimal co-digestion mixture, the raw biogas will be upgraded by removing impurities to produce high-purity biomethane. The findings from this research will guide the design and construction of a small-scale biogas system on the research farms. This sustainable system is expected to generate alternative energy sources for heating campus greenhouses. Additionally, the nutrient-rich liquid digestate by-product will be used as organic fertilizer, creating a circular waste management and resource recovery system at the university farms. This project provides a pathway for small farmers and ranchers from Missouri to move toward self-sufficient, net-zero energy operations.

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Physiological and Molecular Determinants of Carbon Fixation, Storage and Sequestration in Industrial Hemp (C*annabis sativa* L.). P Koirala*; S.H. Mahadi; S. Sharma; N. Kudiabor, S. Padyana; C. Carson and B. Valliyodan, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101.

Industrial hemp (*Cannabis sativa* L.) is a promising carbon-negative and resilient crop due to its rapid growth, extensive root system architecture (RSA), and high biomass. This study integrates a flux-trait-gene approach to quantify carbon dynamics in industrial hemp. Eight hemp varieties and a cover crop were cultivated in a randomized complete block design. Continuous gas (GHG) fluxes were measured using soil chambers with infrared gas analyzers and an eddy covariance system. The environmental parameters were monitored using HOBO RX3000 weather station. Physiological and photosynthetic parameters were measured with LI-COR systems, and total carbon content of plant tissues and soil were analyzed. The results showed peak CO_2 uptake period coincided with the highest photosynthetic activity and biomass accumulation, confirming hemp's net carbon fixation capacity during active growth. Methane (CH_4) fluxes were highly variable early in the season but shifted to net CH_4 uptake during the active growing season. Correlation and PCA indicated that root biomass, aboveground biomass, stomatal conductance, and RSA traits significantly influenced carbon accumulation. Physiological traits (net assimilation, electron transport, and water-use efficiency) were positively associated with carbon fixation. Furthermore, carbon storage was strongly linked to morphological, physiological, and RSA traits, suggesting multi-trait contributions to carbon balance. Industrial hemp farming demonstrated a dual role as a CO_2 and CH_4 sink, with potential for GHG mitigation and carbon sequestration. Key genes associated with carbon fixation and transport were characterized, and these molecular markers will be employed for breeding high-carbon-capture hemp varieties.

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UAS LiDAR Assessment of Declining Oak Trees and Decline Factors in Missouri's Ozarks. E. Ocibo* and X. Zhang, Cooperative Research, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University, Jefferson City, MO 65101.

Oak decline is one of the most persistent forest health issues in Missouri's Ozarks since the 1970s. Typically, droughts have been followed by widespread instances of decline. Oak forests are experiencing decline, which is mostly determined by Oak crown dieback, a common indicator. This research uses drone-based LiDAR to detect and assess the amount of Oak trees dying in the Ozark forests High-resolution LiDAR point clouds are produced to delineate canopy structures to identify crown density loss and reductions in biomass associated with decline symptoms Heterogeneity of growing patterns helps distinguish healthy trees from stressed or dying ones due to the stunted vertical and lateral growth from declining trees. Data collected by ground truthing will be compared with the data detected of dying trees from the LiDAR sensor, and the percentage accuracy of the remote sensor will be determined. Preliminary results show that certain forest areas have a faster decline than others, which could be caused by management practices or other factors that have yet to be determined. In conclusion, tree decline can be detected at an early stage, and countermeasures can be taken to prevent them from drying off.

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Evaluating the Growth and Yield Response of Tomatoes to Water Under Humid Conditions. O. T. Somefun*, and B. Masasi, Department of Natural Resources and Environmental Design, North Carolina Agricultural and Technical State University, Greensboro, NC 27411.

Effective water management practices are essential for maximizing tomato yield while mitigating the risks associated with extreme weather events and ensuring environmental integrity. This study evaluated the effects of different irrigation levels on the performance of tomatoes. Treatments included initiating irrigation at soil matric potential reached 15 kPa and 45 kPa, with a control based on the crop's condition. The experiment followed a randomized complete block design on raised beds at North Carolina A&T State University campus during the 2024 and 2025 growing seasons. Data on agronomic, plant health, and yield parameters were analyzed using analysis of variance (ANOVA) and linear mixed-effects models. Results showed that the irrigation levels investigated in this study had no significant effect ($p > 0.05$) on plant height, number of leaves, stem diameter, and yield. Tomato yield ranged from 33.7 to 41.7 kg in 2024 and 18.7 to 22.4 kg in 2025, with no significant differences among treatments. SPAD values declined from flowering to harvest, indicating chlorophyll reduction during senescence, while NDVI peaked at fruit set before decreasing toward harvest. Growth stage significantly affected both indices ($p < 0.05$), but the effects of irrigation level remained minimal. Overall, tomato growth and yield were not statistically different across irrigation regimes, indicating strong resilience to moderate variations in soil moisture. The 45 kPa threshold maintained canopy vigor and yield while reducing irrigation frequency, suggesting improved water-use efficiency. Thus, starting irrigation at 45 kPa matric potential offers a practical, water-saving strategy for tomato production under humid subtropical conditions.

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Assessing Soil Nitrogen Transformations and Key Drivers of Gaseous Flux in Integrated Fiber Hemp Production Systems. M. Lee*, D. Rai, B. Ghimire and A. Bhowmik, Department of Natural Resources and Environmental Design, North Carolina Agricultural and Technical State University, Greensboro, NC 27411.

Identifying integrated soil fertility management strategies that reduce nitrogen losses from soil and sustain plant productivity is essential for agricultural systems in the southeastern United States. The combined use of organic and inorganic fertilizers has emerged as a promising approach, however, several challenges remain in optimizing ratios of organic and inorganic amendments and understanding the key drivers of CO_2 and N_2O gas flux under regional soil and climate conditions. This study evaluates whether an integrated fertilization strategy can maintain plant productivity and soil nitrogen (N) cycling while reducing cumulative gas fluxes in fiber hemp (*Cannabis sativa* L.). A randomized complete block design field experiment was conducted at the NC A&T University Research Farm with four replicates and three N fertility treatments applied at 180 kg N ha^{-1}: Control (no N applied), Inorganic (Urea), and Integrated (Organic:Urea at 60:40 ratio). Gas fluxes were measured daily and weekly over the growing season using Eosense automated flux chambers with a portable gas analyzer (GT 5000 Terra). Soil water-filled pore space (WFPS), soil temperature, and soil mineral N were routinely measured to identify key drivers of soil N transformation and fluxes. We hypothesize that integrated fertilization will reduce cumulative N_2O fluxes compared to urea fertilization alone through moderated mineral N supply and WFPS interactions, without reducing stem biomass/ fiber yield while CO_2 responses are expected to be mediated by the environmental conditions and substrate availability. Our findings will advance regionally tailored soil fertility management practices that balance productivity, soil health and environmental sustainability.

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Bioaccumulation and Translocation of Short- and Long-Chain PFAS Mixtures in Common Vegetable Crops Grown in North Carolina. M. A. H. Mollah*, N. Aryal, Department of Natural Resources and Environmental Design, North Carolina Agricultural and Technical State University, Greensboro, NC 27411.

Per- and polyfluoroalkyl substances (PFAS) are persistent environmental contaminants with potential entry points into the human food chain through agricultural crops. This study investigates the bioaccumulation and translocation of short- and long-chain PFAS mixtures in selected vegetable species under controlled greenhouse conditions. A factorial completely randomized design (2×3) was employed using two PFAS mixture concentrations (low and high) and three crop species—lettuce (leaves and stems), radish (roots), and bell pepper (fruits)—each with corresponding PFAS-free

control treatments. The PFAS mixture included four commonly detected compounds—PFPeA and PFHxA (short-chain), and PFOA and PFDA (long-chain)—introduced as a uniform blend. The experiment aims to (i) evaluate how PFAS mixture concentration affects overall bioaccumulation, (ii) compare uptake and translocation patterns among plant species, (iii) examine whether concentration effects depend on species type, and (iv) assess the differential movement of short- and long-chain PFAS compounds from roots to aboveground tissues. Bioaccumulation factors (BCFs) and translocation factors (TFs) will be calculated for each PFAS compound to capture both uptake intensity and internal mobility. Data will be analyzed using two-way ANOVA and repeated-measures models to account for within-mixture variation across tissues. This research will provide new insights into the contrasting behaviors of short- and long-chain PFAS within agro-ecosystems, revealing how exposure level, plant physiology, and compound properties shape PFAS transport. The outcomes will inform risk assessments for food safety and contribute to sustainable strategies for managing persistent chemical contaminants in agricultural systems.

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Urban Farm School: A Seed-To-Sale Experiential Training Model for Beginning, Small-Scale, Urban Farmers in North Carolina. C. Richard*, N. Aryal, and B. Dari, College of Agriculture and Environmental Sciences, North Carolina Agricultural and Technical State University Greensboro, NC 27411.

Large-scale farm acreage is reducing annually in Forsyth County, an urban county in the northwest piedmont of North Carolina. Additionally, access to fresh food in this and many other urban US counties is inconsistent, underscoring the need for urban and peri-urban food production training through the North Carolina Cooperative Extension (NCCE). To meet these needs, we developed a training program from NCCE Forsyth County Center that provides new and beginning small farmers with research-based, hands-on training in small-scale market gardening practices. Our goal was to equip them with skills and resources to grow and sell their products out of small urban spaces to supplement participant income and increase local food access. Our "Seed-to-Sale" extension training curriculum, taught annually, provides classroom-style lectures and in-field hands-on crop management, culminating in a student-led farmer's market. Our analyses of the pre-and post-program evaluations revealed significant increases ($p<0.001$) in self-reported knowledge as well as significant increases ($P<0.05$) in active adoption of a variety of on-farm best management practices. At the time of graduation, 56% of participants anticipated increasing personal revenue through implementation of program lessons, and 53% anticipated saving money on household food expenses by growing their own food. Further, since 2022, the shared skills and knowledge from the program have reached over 1400 additional community members through learner-led peer-to-peer outreach.

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From Access to Adoption: Evaluating Conservation Stewardship Program (CSP) and Environmental Quality Implementation Program (EQIP) Across North Carolina. S. Y. Relangi*, College of Agriculture and Environmental Sciences, North Carolina Agricultural and Technical State University Greensboro, NC 27411; N. Ranells; C. Edens, NC State Extension, North Carolina State University, Raleigh, NC 27695; T. Wood, N. Aryal, and B. Dari, College of Agriculture and Environmental Sciences, North Carolina Agricultural and Technical State University Greensboro, NC 27411.

Sustainable agriculture remains central to addressing environmental degradation and resource inequality in U.S. farming systems. The Natural Resources Conservation Service (NRCS) implements key assistance programs, namely the Conservation Stewardship Program (CSP) and the Environmental Quality Incentives Program (EQIP), to promote adoption of conservation practices among diverse farmer groups. Our study focuses on understanding conservation practice implementation patterns and barriers among four priority groups in North Carolina: 1890 Stakeholder, New and Beginning, Veteran, and Limited-Resource farmers. Using both quantitative and qualitative datasets collected through the NRCS and NC Cooperative Extension collaboration, we analyzed conservation practice implementation status, program participation rates, and budget allocations across counties and practice categories. Quantitative analyses examine the distribution and completion status of implemented practices, while qualitative insights capture the contextual challenges influencing adoption, such as technical assistance access, awareness, and financial capacity. We expect to identify significant disparities in practice adoption rates and funding distribution among farmer groups, with Limited-Resource farmers facing comparatively greater implementation constraints. The results are anticipated to reveal how program design, outreach mechanisms, and verification processes influence equitable conservation outcomes. These findings will inform targeted Extension strategies and policy recommendations aimed at improving

the accessibility, efficiency, and long-term sustainability of NRCS conservation programs in North Carolina. Overall, this study contributes to a broader understanding of how federal conservation initiatives can be optimized to meet the needs of historically under resourced farmer populations and strengthen the state's agricultural resilience.

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Assessing Future Drought Impacts on Major Texas Crops Using Machine Learning and Climatic Indices. Md. Islam*, A. Fares, A. Veettil, and R. Awal, A. Ahmed, A. Rahman, Cooperative Agricultural Research Center, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Texas, the second-largest contributor to the U.S. gross domestic product with a population of 30.5 million, is also the nation's second-largest agricultural contributor after California, accounting for roughly 12% of all U.S. farms. Drought poses one of the most significant challenges to agricultural sustainability in Texas. Texas's six major climatic divisions (High Plains, Low Rolling Plains, North Central, South Central, Upper Coast, and Lower Valley) contribute three-quarters of the cultivated area and experience varying degrees of drought severity and frequency. For example, historical droughts, including those from 1933 to 1940 and 1950 to 1957, serve as significant benchmarks in Texas. However, the 2010–2014 drought ranks as the second-worst and second-longest statewide drought on record. In this study, we evaluate the projected impacts of future drought conditions on the yields of key row crops (cotton, corn, sorghum, and winter wheat) using a combination of Multiple Linear Regression (MLR) and Random Forest (RF) models. By integrating long-term climate, remote sensing (NDVI, EVI), and crop yield datasets, the research will characterize historical drought–yield relationships and simulate future climatic impacts under CMIP6-based Shared economic Pathways (SSP2-4.5 and SSP5-8.5). Model performance will be validated using R^2, RMSE, and MAE metrics. The outcomes will identify spatial variations in drought vulnerability and yield loss potential across Texas, supporting the development of adaptive management strategies and policy recommendations for resilient agriculture. The study also establishes a framework for integrating artificial intelligence and remote sensing to enhance predictive drought assessment and sustainable resource planning.

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Algal Cultivation as a Bioremediation Strategy for Goat Manure Wastewater Treatment. M. Celestine*, A. Rahman, and A. Fares, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Effective wastewater management remains a critical challenge as conventional treatment technologies are often costly, energy-intensive, and prone to generating secondary pollutants. Based on previous studies, it can be hypothesized that when applied to the wastewater treatment process, algal-based systems can offer a sustainable alternative for the wastewater treatment process by coupling nutrient removal with biomass generation. This study investigated the potential of indigenously sourced microalgae (*Chlorophyta*) for the remediation of goat manure wastewater through integrated cultivation. Experimental treatments included undiluted goat manure wastewater and 1:1 diluted goat manure wastewater, each supplemented with an algal inoculum (0.33 L in 2.97 L medium) under continuous magnetic agitation and a 12-hour light–dark cycle. Algal performance and water quality dynamics were assessed through measurements of optical density (OD), dry weight (DW), ash-free dry weight (AFDW), chlorophyll pigments, total nitrogen (TN), total phosphorus (TP), nitrate (NO_3^-), reactive phosphorus, ammonia (NH_3), chemical oxygen demand (COD), pH, electrical conductivity (EC), and dissolved oxygen (DO). Results demonstrated substantial reductions in nutrient and organic load, confirming algal uptake and assimilation as primary mechanisms for pollutant removal. Higher algal growth rates, reflected in OD, AFDW, and pigment content, were observed in undiluted wastewater, indicating adequate nutrient availability and adaptability of the algal community to high-strength effluents. These findings demonstrate the potential of integrating algal cultivation into livestock wastewater treatment systems for simultaneous nutrient recovery and biomass valorization. Further optimization of nutrient ratios and hydraulic retention times may enhance process efficiency and facilitate downstream applications in biofuel or biofertilizer production.

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Integrating Remote Sensing and Weather Data with Machine Learning to Assess Drought Effects on Climatic Divisions in Texas. Md. Islam*, A. Fares, A. Veettil, and R. Awal CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Texas, the second-largest contributor to the U.S. gross domestic product with a population of 30.5 million, also leads the nation in agriculture, accounting for 12% of all U.S. farms (Veettil et al., 2024; Morgan et al., 2022). Most of the state faces challenges from recurring severe droughts. For example, historical droughts, including those from 1933–1940 and 1950–1957, serve as significant benchmarks in Texas (Veettil et al., 2024), but the 2010–2011 drought remains one of the state's most economically damaging natural events (Nielsen-Gammon, 2012). As drought frequency and severity increase in Texas, understanding how these conditions affect agricultural production and water use is essential (Veettil et al., 2022). In this study, we investigated the application of remote sensing and gridded climate products to assess the historical Texas drought using a machine learning approach. The specific objectives of this research are (i) to apply MLR (Multiple Linear Regression), and RF (Random Forest) machine learning models to quantify meteorological drought across the ten climate divisions of Texas and (ii) to investigate the driving factors of the Texas drought at those climate divisions. The drought index considered in this study is the Palmer Drought Severity Index (PDSI). Using PDSI as a consistent benchmark, we quantified the drought variability and uncovered the division scale's dominant climatic and land-surface drivers. The resulting insights can strengthen early-warning systems and guide division-specific water management, agricultural planning, and drought mitigation policies in Texas.

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Investigation and Characterization of Two Novel *Gordonia* Bacteriophages from North Alabama. J. Williams*, S. Posey, J. Ray, K. Miles, M. Hayes, D. F. Indihar, Department of Biological Sciences, Alabama A&M University, Normal, AL 35762.

Bacteriophages (phages), viruses that infect and replicate within bacteria, play critical roles in microbial ecology and are increasingly being explored as alternatives or adjuncts to antibiotics through phage therapy in response to the rise of multi-drug-resistant bacteria. Characterizing novel phages is essential for understanding their biology, infection dynamics, and potential therapeutic utility. As part of the Howard Hughes Medical Institute (HHMI) SEA-PHAGES program, two previously uncharacterized bacteriophages were isolated from soil samples collected in Huntsville, Alabama, using *Gordonia rubripertincta* as the host bacterium. Following isolation, plaque morphology was documented to assess lytic activity and infectivity. Transmission electron microscopy revealed capsid and tail structures, allowing classification of structural morphology. Plaque characteristics and genomic analysis were used to infer whether the phages exhibit temperate or lytic replication strategies. The genomes of the novel phages were annotated and compared to those of previously discovered phages, revealing evolutionary insights into genetic diversity, conserved functional domains, and potential mechanisms underlying host specificity and infection strategies. The discovery and characterization of novel *Gordonia*-infecting phages expand the catalog of phages associated with Actinobacteria and enhances our understanding of phage diversity and evolution. Because *Gordonia* species occur in diverse environments and can act as opportunistic pathogens, phages infecting these bacteria may have applications in biotechnology and targeted antimicrobial approaches. This work underscores the importance of systematic phage discovery in advancing both fundamental phage biology and applied phage therapy research.

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Evaluation of Seasonal Dynamics and Concentrations of Poly- and Perfluoroalkyl Substances in Influent and Effluent Water at the Huntsville Spring Branch WWTP. K. Johnson*, J. Whisenhunt, E. Moss, Department of Natural Resources and Environmental Sciences, Alabama A&M University, Normal, AL, 35762.

Poly- and perfluoroalkyl substances (PFAS) are a class of more than 4,700 fully synthetic compounds that have been widely used in industrial applications and consumer products. Their chemical stability and resistance to degradation have made them persistent environmental contaminants of growing concern due to their potential impacts on human health and ecosystems. Previous studies indicated that PFAS, often termed “forever chemicals,” could occur in municipal wastewater systems even in the absence of direct industrial discharges. Likely non-industrial sources included household wastewater, local commercial activities, and residual PFAS in community drinking water. This study investigated seasonal variations and average concentrations of PFAS in influent and effluent water from the Huntsville Spring Branch Wastewater Treatment Plant (WWTP). Samples were analyzed monthly following U.S. Environmental Protection Agency (EPA) Method 537.1 to quantify PFAS levels. The research sought to identify seasonal trends, evaluate treatment process efficiency, and explore opportunities to enhance sustainability and

regulatory compliance. Results revealed measurable concentrations of perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA)—the two most widely studied PFAS—along with several short-chain and polyfluorinated compounds. These findings improved understanding of PFAS dynamics in non-industrial municipal systems and provided essential data to inform local and regional water quality management. The outcomes supported future mitigation strategies and contributed to the development of sustainable wastewater treatment practices designed to protect public health and the environment in Huntsville, Alabama, and similar communities.

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Litter Decomposition and Nutrient Dynamics in Longleaf Pine Forests. K. Powell*, L.Ngatia, K. Oduor, W. Marechal, G. Orji-Nwoke, Florida A&M University, College of Agriculture and Food Science, Center for Water Resources, FL 32307, USA; J. M. Grace III, USDA-Forest Service, Southern Research Station, Center for Forest Assessment and Synthesis, Tallahassee, FL 32303

Litter decomposition regulates nutrient cycling in forest ecosystems, yet short-term nutrient dynamics in longleaf pine (*Pinus palustris*) forests remain poorly understood. This study assessed the decomposition and nutrient release patterns of longleaf pine needle litter at the Chipola Experimental Forest in Florida. Freshly fallen needles were collected using litter traps, air-dried, weighed, and then placed in litter bags. The bags were returned to the field, randomly placed on the soil surface, and retrieved after 0 (control), 1, 2, 4, 6, 8, 10, and 12 months. At each collection, litter samples were weighed to determine mass remaining and analyzed for carbon (C), nitrogen (N), phosphorus (P), and potassium (K) concentrations. From these data, C:N, C:P, and N:P ratios and cumulative nutrient release were calculated to characterize nutrient cycling patterns during the decomposition process. Litter decomposition progressed rapidly, with mass remaining declining significantly ($P < 0.0001$) from 7.1 g at initiation to 5.3 g after 12 months. Carbon and N concentrations varied significantly over time ($P = 0.0028$ and $P = 0.0058$), respectively. Potassium concentration decreased consistently ($P < 0.0001$), whereas P concentrations exhibited moderate variation ($P = 0.0524$). variation was also observed for C: N ($P= 0.0193$), C:P ($P= 0.0179$) and N:P ($P= 0.0034$) ratios. Cumulative C, N, and K release increased ($P < 0.0001$), reaching 29, 31, and 70% respectively. These findings demonstrate rapid litter decomposition and nutrient mineralization within one year, highlighting the role of needle litter in sustaining nutrient cycling and soil fertility.

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Regional Analysis of Urbanization and Population Dynamics in the Southern United States: A 20-year Geospatial Study. J. Thomas*, Biological Systems Engineering, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL, 32307; J. Chen, Biological Systems Engineering, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL, 32307.

Urbanization across the southeastern United States has accelerated over the past two decades, reshaping landscapes, altering ecosystems, and intensifying resource demands. This research expands on prior Florida-focused studies by examining urbanization trends across 12 southeastern states: Florida, Georgia, South Carolina, North Carolina, Alabama, Tennessee, Mississippi, Louisiana, Arkansas, Virginia, West Virginia, Kentucky, and Missouri. Using the Multi-Resolution Land Characteristic Consortium National Land Cover Database (NLCD) in conjunction with Geographic Information System (GIS) tools, we analyzed land cover changes from 2001 to 2021 at five-year intervals, focusing on shifts in high-, medium-, and low-intensity developed lands and open spaces. To contextualize these changes, U.S. Census Bureau County level population data from 2000, 2010, and 2020 were integrated to explore correlations between demographic growth and land cover dynamics. By comparing urban expansion and population patterns across different ecological and economic regions, this study highlights spatial variations in the pace and intensity of development. Additionally, the research evaluates the environmental implications of increasing impervious surfaces, particularly impacts on watershed function, water quality, and ecosystem services. Findings from this regional-scale analysis provide a foundation for more targeted urban planning and resource management strategies, offering insights into balancing population growth with sustainability in one of the fastest developing regions of the United States.

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Mapping Mosquito Control Capacity in the Gulf South USA: A County-Level Assessment of Surveillance Infrastructure and Gaps C., Neal*, A., Sharma, Entomology, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32307-4100, USA; C., Riegel, City of New Orleans Mosquito, Termite, Rodent Control Board, New Orleans, LA, United States; R., Baldwin, University of Florida, Department of Entomology and Nematology, Gainesville, Florida; and P., Koehler., University of Florida, Department of Entomology and Nematology, Gainesville, Florida.

Effective mosquito control programs are essential for reducing mosquito-borne disease risks such as West Nile virus, dengue, and Zika. While previous national assessments have characterized vector control capacity, county-level information for the Gulf South region remains limited. This project focuses on mapping the presence and surveillance capacity of mosquito control programs across counties in Florida, Alabama, Mississippi, Louisiana, and Texas. Data were compiled through a structured literature review, public health databases, and information available from mosquito control associations, county websites, and the CDC. Each county was categorized based on the presence of a mosquito control program, staffing levels, surveillance activity, laboratory diagnostic access, and reported arboviral monitoring. The data are being analyzed using GIS to visualize spatial patterns and highlight disparities in program capacity across the region. Preliminary results indicate notable differences among counties and states. Several counties, particularly in coastal and urban regions, maintain strong surveillance and diagnostic capabilities, while many rural areas lack organized mosquito control infrastructure. The mapping highlights geographic clusters of both well-resourced and other regions. This project provides one of the first fine-scale visualizations of mosquito control capacity across the Gulf South USA. The findings can inform state and local agencies, guide funding allocation, and support future initiatives aimed at strengthening mosquito and disease surveillance capacity in high-risk areas.

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Inferring Kentucky Soil Moisture Characteristics with Long-Term Mesonet Data. S. J. Graham*, M. Gebremedhin, P. Obura, Land Grant Program, Kentucky State University, Frankfort, KY, 40601; T. Ghezzehei, University of California-Merced, Merced, CA, 95343; J. Brotzge, Western Kentucky University, Bowling Green, KY, 42101.

Soil moisture plays a vital role in regulating the planet's water, energy, and carbon cycles, but reliable ground-based observations are limited. In Kentucky, Mesonet stations provide valuable long-term soil moisture data, but their ability to represent plant-available water (PAW), the fraction of soil water accessible for plant use, is unclear. This study evaluates the relationship between Kentucky Mesonet soil moisture observations and field- and laboratory-derived estimates of field capacity (θFC) and permanent wilting point (θPWP) across five Mesonet sites throughout Kentucky differing in soil type, elevation, and land cover. Soil samples collected from 0–100 cm depths were analyzed using the Hyprop and WP4C systems to construct full soil moisture retention curves. These results will be compared statistically with long-term Mesonet data using metrics such as RMSE, MBE, NSE, and R^2 to assess accuracy and bias. Preliminary expectations suggest Mesonet percentiles (95th and 5th) will correlate with laboratory thresholds but will show systematic overestimation depending on soil texture and depth. By refining how Mesonet data are interpreted in terms of PAW, this study aims to enhance the reliability of soil moisture information for agricultural water management, drought prediction, and soil health monitoring in Kentucky. The findings may also inform modeling approaches that translate Mesonet data into actionable estimates of plant-available water, benefiting farmers, hydrologists, and environmental decision-makers.

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Comparative Analysis of Growth and Yield Performance of Lettuce Cultivars in Aquaponic and Soil-Based Systems. T. Ivey*; A. Compere; S. Moreno; I. Williams; J. Jones; H. Fontenet; J. Price; K. Thames; L. Kibet; and K. Gosh. Department of Agriculture and Natural Resources, Langston University, Langston, OK 73050.

Aquaponics integrates aquaculture and hydroponics to establish a sustainable food production system where fish waste provides nutrients for plant growth through microbial conversion of ammonia to nitrates. This study evaluated growth performance and yield of two lettuce (*Lactuca sativa*) cultivars—Black-Seeded Simpson and Romaine—cultivated in aquaponic systems compared to traditional soil-based systems. In Phase I, Black-Seeded Simpson lettuce was grown

in an aquaponic system coupled with goldfish (*Carassius auratus*) and compared with soil-grown counterparts. Phase II examined Romaine lettuce (*Lactuca sativa var. longifolia*) cultivated in a channel catfish (*Ictalurus punctatus*)-based aquaponic system relative to traditional methods. Experimental fish were reared under controlled conditions and fed daily at 3% of their body weight. Water quality parameters were monitored to maintain optimal nutrient balance. Results indicated that goldfish paired with Black-Seeded Simpson lettuce achieved an average fish weight of 14.94 ± 4.25 g across 21 samples. Lettuce biomass varied widely, ranging from 1.95g to 34.91 g, reflecting system variability. Romaine lettuce grown with channel catfish exhibited steady growth, increasing from 6.6–13.9 g in late February 2025 to an average of 17.7 g by March 2025. Comparative data from traditional systems indicated average head lettuce yields of 36,200 lb/acre in field production and approximately 4,752 units per 30 × 96 ft greenhouse space under standard hydroponic spacing. These findings suggest that aquaponic systems could support sustainable fish and lettuce production. Ongoing comparisons with soil-based cultivation will further clarify potential of aquaponics as an alternative model for resource-efficient, year-round leafy green production.

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Effect of Organic Practices on Atmospheric Releases from Grain Sorghum Cropping Systems in Eastern Texas. M. Clark*, R. Awal, A.V. Veettil, A. Fares, A. Elhassan, and B. Thapa, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX, 77446.

Agriculture contributes significantly to the shift in air temperature, accounting for approximately 10–12% of global anthropogenic gas releases. Effective management practices, such as organic amendment applications, play a crucial role in mitigating emissions. However, the nexus between organic amendment applications and reductions in soil atmospheric releases remains poorly established and is influenced by soil conditions, substrate composition, and management practices. This study hypothesizes that the type and rate of organic amendment significantly impact soil gas releases, particularly at higher manure rates. To test this hypothesis, a randomized block field experiment was conducted at the Prairie View A&M University Research Farm. The experimental design was a factorial Randomized Complete Block Design (RCBD) with three replications. Treatments consisted of two rates of biochar **(**2,268 and 4,536 kg ha^{-1}**),** two types of organic manure (chicken and dairy manure), and three nitrogen application rates (0, 180, and 360 kg total N ha^{-1}) under the sorghum cropping system. The results revealed that higher manure rates significantly increased soil gas releases, with chicken manure emitting more gas than dairy manure at equivalent rates. Biochar amendments, particularly at the higher rate, were found to reduce gas release relative to manure treatments, supporting its potential as an organic amendment. These findings highlight the importance of amendment selection and application rate in mitigating atmospheric releases in agricultural systems. Future research should explore the long-term impacts of these amendments on soil gas sequestration and their scalability under diverse weather and soil conditions.

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Optimizing the Biochar–Manure Synergy: A Tailored Formulation for Enhanced Soil Nutrient Dynamics and Pollution Reduction. D. Guthrie*, A. Shembo, A. Geremew, R. Ray, and Laura Carson, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Agricultural intensification is essential for meeting global food demands but often leads to soil degradation and elevated heat-trapping gases from synthetic fertilizer use. Although organic manures improve soil fertility, they can still release CO_2, CH_4, and N_2O during decomposition. Biochar (BC), a carbon-rich material produced through biomass pyrolysis, has gained attention for its potential to enhance nutrient retention, improve soil structure, and suppress release of heat-trapping gases. Combining BC with organic amendments may offer a synergistic approach to sustainable soil management. This study aimed to evaluate how biochar integrated with organic manures influences soil nutrient status and discharge of heat-trapping gases in mustard (*Brassica juncea*) cultivation. Sixteen treatment formulations composed of BC, chicken manure, cow manure, and chitosan were applied at recommended rates across 51 randomized plots, replicated three times. Over eight weeks, CH_4, CO_2, and N_2O release were quantified using a Li-COR smart chamber system. Soil fertility and plant growth indicators, including chlorophyll content, leaf area, pH, electrical conductivity (EC), ion chromatography (IC), and inductively coupled plasma (ICP) spectroscopy, were measured. Among all treatments, the BC–cow manure blend demonstrated superior performance, increasing soil nutrient content by 24–32% and reducing CH_4 release by 24% ($p < 0.05$). This formulation also yielded the lowest

CO_2 and N_2O release. Findings highlight biochar–manure blends as a promising strategy for improving soil health, enhancing crop productivity, and mitigating agricultural atmospheric impacts.

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Evaluating the flood control performance of Horne Wetland Park. N. Aiken*, G. Gibson, T. Nyatta, and H. Dakshinamurthy, 1890 Research and Extensions, South Carolina State University, Orangeburg, SC 29117.
The Horne Wetland Park in Orangeburg, South Carolina, stands as both a major tourist destination and an ecological treasure. Renowned for its distinctive Cypress-Tupelo wetland ecosystem, scenic boardwalk, and vibrant rose garden, the park attracts 600,000+ visitors each year. Yet, beyond its aesthetic appeal, the wetland serves a vital environmental function in natural flood control and water management. The North Fork Edisto River flows directly through the park, collecting runoffs from more than eight upstream tributaries. During periods of heavy rainfall, the wetlands function as a natural sponge; absorbing, filtering, and gradually releasing excess water rather than allowing it to accumulate and cause flooding. From our preliminary study we identified that the nearest U.S. Geological Survey (USGS) monitoring station upstream of the wetland park is located at a significant distance. We deployed a HOBO MX20L water level measuring sensor network of water sensors to collect localized data. This enables a comparative analysis of water level and retention throughout the park during storms and dry periods. The data collected from these sensors will be organized into spreadsheets and analyzed using Python to generate visual graphs that depict fluctuations in water levels over time. These visualizations will not only enhance our understanding of how the wetlands respond to varying rainfall patterns but will also serve as valuable educational tools. By presenting this information to tourists and residents, we can raise awareness about the ecological significance of the Horne Wetlands and encourage community involvement in preserving this vital natural resource.

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From Below-Ground to Above-Ground: Rebuilding Soils to Expand Tree Canopy Cover in Nashville. T. Stansberry*, Y. Chen, and D. Young, Department of Environmental Sciences, College of Agriculture, Tennessee State University, Nashville, TN 37209.

Urban forests provide a wide range of benefits to communities (e.g., cleaning air, providing shade/cooling, mitigating stormwater runoff). Despite Nashville's adequate tree canopy cover, urban heat islands, poor air quality, and other environmental issues persist, exacerbated by urban sprawl and a changing environment. This study aimed to identify underutilized permeable lands in Nashville that can be repurposed for expanding the urban tree canopy, thereby mitigating heat and improving the environment. A bird's-eye analysis of Nashville and Davidson County using Geographic Information Systems (GIS) was conducted to locate underutilized permeable land, such as memorials (e.g., Fort Negley), golf courses (e.g., Ted Rhodes), highway interchanges (e.g., US-70S and I-440), parks (e.g., Centennial Park), and sports fields (e.g., Vanderbilt University practice fields). Additionally, opportunities for green roofs and reforestation of unused parking lots were evaluated. The analysis revealed that Nashville has extensive permeable but underutilized lands. A targeted tree canopy expansion across identified sites could increase urban tree coverage by 15%, helping to mitigate heat and improve air quality. However, any efforts to sustain and expand the city's urban tree canopy must recognize the importance of urban soil management, as demonstrated by the Nashville Long-Term Urban Soil Rehabilitation study. Accordingly, we are also examining the effects of Soil Profile Rebuilding and biochar-based urban soil management practices on tree growth (i.e., tree canopy area, height, and trunk-cross-sectional areas). Our findings underscore the need for strategic urban planning and greening and especially the importance of taking a holistic approach – from below-ground (soils) to above-ground (trees).

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Cyanotoxin in Surface Water in and Around Nashville, Tennessee. T. Stansberry*[1], A. Joyner[1], A. Cotton[1], R. Archer[1], and T. Byl[1,2]; [1]Department of Environmental Sciences, College of Agriculture, Tennessee State University, Nashville, TN 37209; [2]U.S. Geological Survey, Nashville, TN.

Cyanotoxins released from harmful algal blooms are becoming a major threat to drinking water sources, aquatic recreation, and ecosystem health. With a rapidly growing population, the Nashville area has many surface waterbodies that are becoming more eutrophic from non-point source pollution. The goal of this study was to characterize the spatial and temporal occurrence of microcystin in several of these waterbodies and to perform basic water chemistry

to discern if there is a predictable pattern. Sites selected included two urban wetlands, two ponds often used for fishing, a large river, and a major reservoir. Water and passive samplers were used to monitor microcystin over a five-month period (June-October) in 2025. Microcystin (MC), anatoxin, and saxitoxin were measured using Enzyme Linked ImmunoSorbent Assays (ELISA). MC was the most common cyanotoxin in the samples. Preliminary results found more dynamic MC concentrations in smaller bodies of water, with the river and the reservoir showing more consistency throughout the study period. MC concentrations ranged from less than 0.15 ug/L to above 5 ug/L in the synoptic water samples, although most samples were at or less than 0.3 ug/L (EPA's advisory limit). The passive samplers had concentrations ranging from less than 1 ug/L to over 200 ug/L for the two-week deployment periods. The greatest passive sampler concentrations were found in the river; the reservoir, ponds, and wetlands had the lowest concentrations. These results indicate that different cyanotoxin monitoring strategies can be used on different types of waterbodies.

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Determining Whether a Nashville, TN Wetland Captures or Releases Microplastic. K. Mitchell*[1], A. Cotton[1], and T. Byl[1,2]; [1]Department of Environmental Sciences, College of Agriculture, Tennessee State University, Nashville, TN 37209; [2]U.S. Geological Survey, Nashville, TN.

The 38-acre wetland on Tennessee State University's research farm receives storm runoff – which includes nutrients, sediments, and litter – from much of north Nashville, the research farm itself, and the campus. Every spring, student volunteers collect more than 25 large garbage bags of plastic bottles and debris along the wetland's edge, yet plastic often remains trapped in the vegetation or sitting on the bottom of the wetland. Another challenge for this wetland is harmful algal blooms caused by nutrients from storm runoff. This study's aim was twofold: 1) To determine whether the wetland is sequestering plastic or allowing it to break down into microplastics that are then released into the Cumberland River, Nashville's source of drinking water, and 2) To determine if microplastics might be facilitating cyanotoxin transport through sorption processes. The project looked at microplastics entering the wetland, in the mid-wetland, and released below the wetland. Water samples were collected at four sites along the flow path of stormwater into and through the wetland; preliminary viewing confirmed the presence of microplastic. Our sorption study used 0.025 grams of polyethylene terephthalate (PET), filament-based plastic (FBP), and polypropylene (PP) plastic placed in water containing 5 ppb microcystin. The PET sorbed a significant amount of microcystin within 24 hours. The PP sorbed a significant amount after 48 hours. The FBP did not sorb microcystin within the study's timeframe. The findings suggest the possibility that PET bottles can facilitate transport of microcystin from the wetland even if the residence time is only 24 hours.

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Does The Use Of Analogy Change Angler Attitudes More Than Scientific Evidence Alone? I. C. Atoe*, S. E. Lochmann, Aquaculture and Fisheries Department, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601.
Scientists are moving away from the deficit model of communication. Simply sharing science with the public has resulted in less than satisfactory outcomes. There is a movement toward strategic approaches to science communication. One such strategy is the use of analogy. Is the use of analogy really more effective than providing scientific evidence alone? We used a before-after-control-intervention study design to examine the change in attitude regarding the practice of catch and release before and after reading an article on the subject. A control article provided evidence that catch and release is not always appropriate for a fishery. Treatment articles provided the same evidence but included one of two analogies to reinforce the evidence. Pre- and post-intervention surveys were analyzed to determine the change in survey respondents' attitudes toward harvest and toward catch and release as a conservation practice. Overall, angler's opinions regarding harvest and catch and release as a conservation practice did change, but there was no treatment effect, meaning a well-written article relying on science alone was as effective as science and an analogy. However, when parsed by respondent demographics, some demographic groups experienced a greater change in opinion regarding catch and release as a conservation practice. Trout anglers, anglers ages 21-40, anglers making more than $90,000 and anglers who fished 6-10 days per year demonstrated a treatment effect, with greater change in opinion when science was combined with an analogy. This work provides empirical evidence of the influence of analogies on effectively communicating messages with some anglers.

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A Qualitative Study on Role of Extension in Enhancing Farmers Preparedness for Extreme Weather Events in Kentucky. S. Adhikari* and B. Gyawali, School of Agriculture and Natural Resources, Kentucky State University, Frankfort, KY 40601.
Extreme **weather events have become a major emerging challenge for humankind in the 21st century.** Kentucky is one of the states in the United States experiencing such events that have affected its farming practices. While existing research highlights the agricultural vulnerability and the growing need for weather adaptation systems, the path to effective adaptation depends on a stronger role for extension services to support these efforts. The purpose of this qualitative research is to understand how extension service providers perceive changes in weather events and their level of preparedness to respond, which can help bridge the gap between research and actions. Data was collected through key-informant interviews with Extension personnel. The results from interviews with fifteen extension staff members in Kentucky summarize their perceptions, responsibilities, and readiness to act during weather events. Findings show that flooding and severe storms are the most prevalent weather events in Kentucky, disrupting the normal functioning of agricultural crops. Although extension staff have provided various workshops to farmers to prepare them for such extreme weather events, funding and limited staffs are the major barriers to supporting farming communities during these events. Additional training on the causes and impacts of adverse weather, adaptation measures, and associated data collection, and enhanced social media outreach are needed to increase the program's visibility. This will help reach more farmers and ultimately strengthen the role of extension services.
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Marketing Channels of Small and Medium-sized Vegetable and Fruit Farms in the U.S. Y. Guan* and Y. Su, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101.

Small and medium-sized vegetable and fruit producers play a vital role in the U.S. agricultural landscape, especially in local food markets. However, these farmers often encounter barriers to marketing their products profitably. Some barriers include insufficient financial capital, a lack of market information, the perishable nature of the products, and adverse weather conditions. The purpose of this study is to identify the marketing channels used by these farmers, understand the factors influencing their choices, comprehend their challenges, provide relevant information to these farmers, and assist them in making informed marketing decisions to enhance their profitability. A structured questionnaire was designed and used as a key instrument for data collection. The questions include farmers' available marketing channels, choices of marketing channels, the challenges they face, and demographics. The survey was distributed to 2000 randomly selected small and medium vegetable and fruit farmers across the U.S. by mail from May to October 2025. Descriptive statistics and regression will be used for analyzing the survey data. The analysis will identify the popular marketing channels used by small- and medium-sized U.S. vegetable and fruit farmers, the factors influencing their choices, their marketing strategies, and the common obstacles they face. The findings will provide recommendations for farmers, policymakers, agricultural support organizations, and local food systems to enhance the profitability of small and medium-sized vegetable and fruit farmers through informed marketing choices. In addition, the findings will contribute to the broader discourse on local food systems, rural development, and sustainable agriculture.

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The Impact of Farm-to-Food-Bank Programs on Farms' Postharvest Losses in the Southeastern U.S. M. Li*; R. Chen; and L. Asare-Baah, Department of Agricultural and Environmental Sciences, Tuskegee University, Tuskegee, AL 36088; and Y. Sun, Department of Electrical and Computer Engineering, Auburn University, Auburn, AL 36849.

Farm-to-Food-Bank (F2FB) programs aim to reduce agricultural food waste through donation, potentially providing an outlet for farmers to mitigate postharvest losses (PHL). This study examines the impact of F2FB participation on PHL in the southeastern United States, using an in-person survey of 213 farmers. We employ a generalized ordered logit model to analyze how F2FB participation, farmer and farm characteristics, and the adoption of PHL reduction technologies affect PHL. A key finding is the significant interaction between F2FB participation and farm size. Although F2FB participation shows no overall effect, it is associated with a statistically significant lower risk of severe PHL, specifically for small-scale farms of less than 50 acres. Beyond the focus on F2FB participation, results also indicate that farms with higher total production and longer distances to market are consistently associated with greater PHL. In contrast, factors such as higher educational attainment, smaller landholdings, vegetable farming, and the use of PHL technologies are consistently associated with lower PHL. These findings inform policies to reduce PHL by

creating targeted pathways for small-scale farms to participate in the F2FB program, prioritizing investments that shorten farm-to-market distances, and expanding financial and technical support for PHL-reducing technologies (e.g., the USDA Farm Storage Facility Loan program).

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Supply Chain Demands and Challenges at Farmers' Markets and Local Grocery Stores in Kentucky. G. Shittu*,, S. Dasgupta, S. Sarr, 1890 Land-Grant Program, Kentucky State University, Frankfort, KY 40601.

Farmers' markets and local grocery stores are vital components of Kentucky's local food system. They promote economic growth, community well-being, and environmental sustainability by providing income for producers, improving access to locally grown food, and encouraging sustainable agricultural practices. Despite these benefits, both face major challenges that affect farmers, consumers, and community development. These include limited finances, shifting consumer preferences, strong market competition, high operating costs, seasonal limitations, and transportation barriers. This study examines the supply chain demands and challenges of farmers' markets and grocery stores as community-based strategies for sustainable development. Using a mixed-methods design, the project combines surveys and interviews to assess demand patterns, transaction costs, and marketing barriers in urban and rural markets. As urban markets become saturated with vegetable suppliers, more farmers are turning to rural outlets, raising questions about profitability and access. The study also explores the potential of smaller grocery stores as alternative markets for local produce. Data collected from over 300 participants, including farmers, consumers, market managers, and grocery store owners across Kentucky, will guide policy and practical recommendations to help beginning and small-scale farmers choose where to sell - urban or rural markets, or local grocery stores - based on booth availability, costs, location, and consumer demand. Ultimately, this research aims to strengthen Kentucky's local food networks and support sustainable community development.

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Estimating The U.S. Cotton Trade Potential. E. Barnes*, Department of Agriculture, Alcorn State University, Lorman, MS 39096; and D.T. Adu, Department of Agriculture, Alcorn State University, Lorman, MS 39096.

The United States has historically been the world's largest exporter and a leading producer of cotton, with the industry playing a vital role in the global economy. However, rising tariffs, trade wars, evolving trade policies, and growing competition from countries such as Brazil have eroded U.S. dominance in the global cotton market. This study analyzes the trade potential of U.S. cotton using a gravity model estimated through the Poisson Pseudo Maximum Likelihood (PPML) method, which effectively addresses heteroskedasticity and zero trade flows in trade data. The findings provide insights into U.S. cotton trade patterns, identify emerging market opportunities, and offer policy-relevant recommendations to help strengthen the competitiveness of the U.S. cotton industry in the global marketplace.

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Comparative Performance of Neutral Networks and Traditional Models for Forecasting U.S. Cotton Prices. L. W. Njoroge*, S. Wright, J. Frazier, S. Tubene, and Y. N. Chi, Department of Agriculture, Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853.

Cotton price volatility significantly impacts global agricultural markets, necessitating accurate forecasting models for informed decision-making. This study evaluates the performance of traditional statistical models against neural network and hybrid approaches in forecasting U.S. cotton prices using daily data from August 1972 to February 2025. Employing R-based tools, the analysis incorporates equal-weight and cross-validation error metrics to assess model accuracy. Results demonstrate that the Neural Network Autoregression (NNAR) model outperforms traditional models (Root Mean Square Error) by effectively capturing nonlinear trends, seasonality, and heteroskedasticity inherent in the data. Cross-validation across four temporal phases (1972–1995, 1995–2010, 2011–2021, 2022–2025) further validates NNAR's robustness, achieving the lowest error metrics in volatile periods ($1\text{-}166204e^{-02}$). Hybrid combinations showed moderate improvements but were less consistent than standalone NNAR. These findings provide stakeholders (i.e., producers, traders, policy makers, etc.) with critical insights for managing risk along the value chains while emphasizing the potential of machine learning, particularly neural networks, in commodity price forecasting.

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Enhancing Rice Sector Resilience in Liberia Through Neural Network-Based Forecasting of Production and Market Trends. S. Wright*, and Y. N. Chi, Department of Agriculture, Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853.

Rice is a dietary staple and an economic cornerstone in West Africa, especially in Liberia, where it is the most consumed food commodity. Despite its importance, Liberia faces ongoing challenges in rice production, including unpredictable rainfall, limited mechanization, underdeveloped irrigation, and volatile market prices. These factors have slowed growth despite gradual increases in domestic output. The long-term goal of this research is to improve food security and promote comprehensive economic growth through agriculture-led development. This study examines rice production and market trends in Liberia from 1961 to 2023 using FAO data and advanced time-series models. It highlights regional differences, key drivers of production, and the effects of policy measures. Findings emphasize the urgent need for investment in high-yield seed varieties, robust environmental infrastructure, and transparent market regulations to boost food self-sufficiency. Liberia's strong dependence on rice imports makes developing a resilient local rice value chain essential. Increasing domestic production can reduce external pressure and support rural livelihoods. By linking historical patterns with future strategies, this research provides evidence-based insights to guide national agricultural policy reform. Aligning government policies with local conditions—such as land use, rainfall patterns, and access to finance—is vital for building a resilient rice sector.

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The Impact of Brexit on U.S.–U.K. Agricultural Trade Relations. K. Gibbs Jr.*, Department of Agriculture, Alcorn State University, Lorman, MS 39096; and D.T. Adu, Department of Agriculture, Alcorn State University, Lorman, MS 39096.

Brexit, the United Kingdom's (U.K.) withdrawal from the European Union (E.U.) in 2020, intro-duced new tariffs, regulatory barriers, and trade agreements, reshaping global trade patterns. While much research has focused on U.K.–E.U. trade, little attention has been given to U.S.–U.K. agricultural trade despite the United States being a major global exporter. This study fills that gap by analyzing how Brexit has affected agricultural trade flows between the two countries. Using Gravity Models and Difference-in-Differences (DID) methods, the study examines changes in trade patterns before and after Brexit to identify shifts in market access, competitiveness, and trade costs. The findings will provide evidence-based insights for policymakers and agricultural exporters, offering strategies to strengthen U.S.–U.K. trade relations in the post-Brexit era.

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The Impact of Emotional Intelligence, Self-Efficacy, and Study Habits on College Students' Academic Performance. B. Farrington*, E. Jones, Department of Family and Consumer Sciences, Alabama A&M University, Normal, AL 35762.

Academic performance (AP) refers to the measurable success of a student's educational achievements, typically evaluated through grades, exams, and statistical analysis. Numerous factors influence AP, including mental and emotional well-being, stress, nutrition, extracurricular involvement, health, social media use, and personal circumstances (Significance of Academic Performance, 2024). *Emotional intelligence* (EI) is defined as the ability to recognize, express, regulate, and utilize emotions effectively in oneself and others (Costa, 2022). *Self-efficacy* (SE) refers to one's belief in their capacity to achieve goals, particularly under challenging circumstances, and is shaped by experience, encouragement, observation, and health (Costa, 2022). While previous research has linked EI to academic success, limited attention has been given to SE and study habits, and their combined effects remain unclear. This study explored the relationship between EI, SE, study habits, and academic performance in college students. Participants completed self-report surveys measuring EI, SE, GPA, and study habits. Results indicated no significant relationship between EI or SE and academic performance, contradicting earlier findings. Instead, study habits emerged as the only significant predictor of academic success. The use of self-reported data may have influenced outcomes, highlighting the need for further investigation using more objective measures. Despite the unexpected results, this study offers

important insights. It encourages students to evaluate how their emotions and self-beliefs influence their academic behaviors. For educators and institutions, the findings emphasize the complexity of academic performance and the need to explore additional psychological and behavioral factors that may better predict student achievement.

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The Economic Feasibility of Dairy Production for Small-scale Farmers in Kentucky. M. Ibans*, S. Sarr, and M. Bernard, Kentucky State University, Frankfort, KY 40601.

Small-scale dairy farms play an essential role in Kentucky's agricultural economy, yet their numbers have steadily declined in recent years due to rising input costs, volatile milk prices, and increased competition from larger, capital-intensive dairy operations. This study will assess the economic feasibility of dairy production for small-scale farmers in Kentucky by evaluating farm-level profitability, major cost drivers, and the structural challenges that affect long-term viability. A mixed-methods research design is used to collect quantitative and qualitative data from dairy farmers across the state. Survey questionnaires will measure production costs, revenue streams, market access, and financial performance, while semi-structured interviews with farmers, cooperative leaders, and extension agents will explore perceived barriers, institutional support, and adaptive strategies. Quantitative data will be analyzed using descriptive and inferential statistics, and qualitative responses will be thematically analyzed. Anticipated results will identify key factors influencing profitability, including feed costs, labor, herd size, price volatility, and cooperative participation and highlight constraints that limit competitiveness. Findings will help guide targeted support programs, market interventions, and policy strategies aimed at strengthening the sustainability and economic resilience of small-scale dairy farms in Kentucky.

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From Graduation to College: Exploring Regional Economic and Educational Influences in West Virginia. N. Fout* and S. Bandara, Department of Business and Economics, West Virginia State University, Institute, WV 25112.

This study examines regional patterns of college enrollment in West Virginia from 2001 to 2020, exploring how economic and educational factors shape students' transition from high school to higher education. Using county-level data aggregated into five regions: Metro Valley, Mid-Ohio Valley, Mountain Lakes, Greenbrier Valley, and Potomac Highlands, we analyze the effects of high school graduates, average household income, number of high schools, employees in education services, and the share of college degree holders on college-going rates. Preliminary observations suggest that Metro Valley and Mid-Ohio Valley consistently outperform other regions in educational outcomes, reflecting persistent regional disparities. Employing panel data methods, this study aims to quantify these relationships and provide evidence for targeted policy interventions to enhance college access and regional workforce development. The findings will offer insights for educators, policymakers, and researchers interested in bridging regional education gaps.

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Built Environment and Community Health: A Data-Driven Analysis of Walkability and Air Quality in Huntsville, Alabama. R. A. Rimi***,** F. Dutt, Department of Community and Regional Planning, Alabama A&M University, Normal, AL 35762.

Walkable, healthy, and connected neighborhoods play a vital role in shaping family well-being, youth engagement, and community vitality. This study explores the relationship between neighborhood walkability, ambient air quality, and economic well-being in Huntsville, Alabama, using both social media-derived and traditional geospatial datasets. Specifically, Instagram geo-tagged locations are analyzed to identify popular community activity spots and correlate them with walkability and air quality indices. The analysis integrates the American Community Survey, Walk Score database, Sentinel-5P satellite observations for air quality indicators, and parcel-level land-use data from local GIS repositories. A spatial statistical approach was applied to evaluate correlations among walkability, air quality, and family-oriented economic indicators, including median household income, education levels, and population density. Results reveal that areas with higher walkability and vegetation coverage are generally associated with lower air pollutant concentrations and stronger indicators of social well-being. Conversely, car-oriented neighborhoods exhibit degraded air quality and limited pedestrian infrastructure, disproportionately affecting vulnerable families. The

findings underscore how improving walkability and environmental quality can jointly enhance public health, strengthen community engagement, and stimulate equitable economic growth. This secondary-data-driven approach provides a replicable framework for sustainable community planning, aligning with USDA's mission to support resilient, inclusive, and family-centered community development.

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Funding Restoration: The Role of Nonprofit Investments in Communities impacted by Hypoxia throughout the Gulf Coast. R. Easly*, Southern University Agricultural Research and Extension Center, Baton Rouge, LA 70813.

The hypoxic zone in the northern Gulf of Mexico, commonly referred to as the "dead zone", is one of the largest recurring low-oxygen marine areas in the world. This phenomenon is largely attributed to nutrient pollution discharged from the Mississippi River Basin. While scientific and policy responses focus on reducing nutrient loads and increased environmental monitoring, there is less discussion given to the role that nonprofits play in supporting coastal communities most affected by hypoxia. This study explores how philanthropic dollars are distributed along the Gulf Coast negatively impacted by oxygen-deplete waters, with a particular focus on Louisiana. With publicly available grant data, tax form 990s, and institutional analysis, this study examines which organizations receive philanthropic investment, what are the priority areas of investment (environmental restoration, workforce development, disaster relief), and identifies critical gaps. Guided by the Institutional Analysis Development Framework (IAD), this study also investigates how administrative protocols, the action arena and its actors, and attributes of the community drive philanthropic investments and programmatic outcomes. As Director of Advancement for the Southern University Agricultural Research and Extension Center and the College of Agricultural, Human, and Environmental Sciences, Easly brings a unique perspective to land-grants and their capacity to bridge science, policy response, and community development through philanthropic investment. This research contributes to an enhanced understanding of how philanthropic investments can drive environmental resilience and community development in coastal communities. Additionally, it offers practical insights to funders, policymakers, and fundraising professionals seeking to grow their capacity to respond to hypoxia.

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Modeling Food Insecurity Determinants on Maryland's Eastern Shore: A Multilevel Analysis. J. Frazier*, and Y. N. Chi, Department of Agriculture, Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853.

Food insecurity remains a critical challenge on Maryland's Eastern Shore, where several counties report the state's highest poverty rates despite abundant agricultural resources. This study aims to identify economic and geographic determinants of food insecurity across nine counties using a hybrid approach that combines real and synthetic household-level data (3,600 synthetic households, calculated by rurality and demographic profiles). Descriptive analyses, chi-square tests, and multilevel logistic regression with county random effects were applied to examine associations between food insecurity and predictors such as income-to-FPL ratio, SNAP participation, rurality, and housing cost burden. Food insecurity prevalence was 41.9%. SNAP participation was higher among food-insecure households (47.4% vs. 31.0%). Among households below the federal poverty line, 55.4% were food insecure, and rural households accounted for 44.2% of food-insecure cases, underscoring income and geographic differences. Findings highlight the need for targeted interventions addressing both financial instability and spatial access barriers. Synthetic data proved valuable for supplementing gaps in real-world datasets without compromising privacy.

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Assessing Drought Impacts on Forest Systems and Forest Carbon Sequestration in Alabama. J. K. G. Amonoo*, J. E. Quansah, and S. Fall, Dept. of Ag. & Envi. Sciences, College of Agriculture, Environment and Nutrition Sciences, Tuskegee University, AL 36088.
Alabama's forests, which cover roughly 70% of the state, are pivotal regional carbon sinks. However, they face mounting risk from increasingly frequent and intense droughts driven by rising temperatures and variable precipitation in the Southeast. Focusing on Alabama's national forests, this research uses geospatial techniques, integrating land use/land cover data and a suite of satellite indices (EVI, ESI, NVDI, VOD, and NDWI(Gao) to quantify the impacts of extreme and exceptional drought on forest systems (forest carbon sinks and sequestration)

from 1995 to 2025. Specifically, it uses a base, no drought year of 1998 to compare with the extreme and exceptional drought years of 2000, 2011, and 2025 to determine impact on above-ground biomass and soil organic carbon. It also seeks to determine the relationship between forest health and forest soil carbon. Forest soil samples will be collected from each study county at multiple depths (0-10cm, 10-30cm, 30-100cm) to create vertical profiles. The GPS locations of each sampling point will be recorded for ground-truthing. A minimum of 200 soil samples distributed proportionally across strata will be collected. Laboratory analysis will be conducted to determine Soil Organic Carbon (SOC) concentration using dry combustion method. These results will be compared with the results of satellite data analyses and the relationships determined. Anticipated outcomes include forest vulnerability profiles, and open, reproducible geospatial products to guide drought-resilient forest management in the region.

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Empowering Public Awareness On Programmable Plant Systems And Plant Morphogenesis Through Educational Pamphlets. S. Critchlow*, G. Aguti, M. Egnin, G. Bernard, T. Nobles, J. Eaves, M. Okoma, I. Ritte, College of Agriculture, Environment and Nutrition Sciences, Tuskegee University, Tuskegee, AL 36088; C. Bigman-Galimore, Department of Communication, University of Illinois Urbana-Champaign, Urbana, IL 61801; A. Gruber, D. Melvin, and A. Stroock.; Center for Research on Programmable Plant Systems (CROPPS), Cornell University, Ithaca, NY 14850.
Programmable plants represent a transformative innovation in agriculture, enabling crops to respond to environmental stimuli through engineered communication mechanisms that drive morphogenesis. Though these systems hold significant promise for improving plant management and sustainability, public understanding of programmable plants remains limited. This study examined the effectiveness of an educational pamphlet designed to empower public knowledge and perceptions of programmable plant systems. A structured survey was conducted among a diverse group of participants (n=86) at Tuskegee University, including undergraduate and graduate students, as well as staff. Respondents represented multiple academic disciplines: agriculture (44%), education (39%), media (7%), and others (10%). The majority were female (57.1%) and aged 18−24 (62.5%), with racial representation comprising 54.9% Black/African American, 4% White, and 24% Asian participants. Following exposure to the pamphlet, knowledge scores rose significantly from 19.5% to 82.3%, demonstrating its substantial educational impact. Additionally, 95.5% of participants expressed willingness to recommend programmable plant systems. The mean impact rating was 3.2±1.3 on a 5-point Likert scale. Participants preferred receiving agricultural information through social media (36%), academic institutions (25%), and government websites (20%). Views on patent ownership were nearly divided between individual (49.3%) and corporate (41.0%) controls. These findings emphasize the critical role of targeted science communication in promoting informed public engagement and improving public awareness of programmable plant technologies.

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Extreme Weather Events in Alabama: Trends, Variability, and Vulnerability. M. Franklin*, S. Fall, J. Quansah, College of Agriculture, Environment, and Nutrition Sciences, Tuskegee University, Tuskegee, AL 36083.
In recent decades, extreme weather events have intensified in frequency and magnitude, creating significant risks for natural ecosystems and human communities. Understanding local vulnerability to these events is essential for developing effective adaptation strategies. This study develops a composite vulnerability index for the State of Alabama (USA) at the county level to support the design of adaptation and mitigation strategies that strengthen community resilience and promote sustainable development. Twenty-seven extreme weather indices were calculated to determine trends and variability of weather extremes from daily precipitation and temperature data using RClimDex. Among these, exposure indices—warm spell duration, consecutive dry days, consecutive wet days, and frost days—were selected for their relevance and impact on agricultural systems and local livelihoods. Eleven indicators were categorized into exposure, sensitivity, and adaptive capacity. The resulting sub-indices were aggregated into a composite index depicting vulnerability to extreme weather events. Multivariate analysis was used to assign factor loadings and weights to indicators, and the results were mapped using Geographic Information Systems (GIS). The vulnerability index captured increases in warm spell duration (heat wave indicator) and consecutive dry days (drought indicator), while frost days and consecutive wet days (flooding indicator) declined during the study period. The model serves as a planning tool for identifying regional hotspots of vulnerability and supporting targeted adaptation and mitigation strategies across Alabama.

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Effects of Light and Liquid Organic Fertilizer on Germination and Growth of Lettuce Seedling in Controlled Environment. J. Chand*, M. R. Reza and M. Chowdhury, 1890 Land-Grant Program, Kentucky State University, Frankfort, KY 40601

Liquid organic fertilizer (LOF) is increasingly being explored as an alternative to synthetic fertilizers in soilless plant production due to its environmental sustainability. However, its effectiveness during propagation remains unclear because of variable nutrient-release patterns and the potential for microbial proliferation. This study aims to evaluate the combined effects of LOF and light spectrum on seed germination and early seedling development of lettuce (*Lactuca sativa* L.) under controlled growth chamber conditions. A completely randomized design will be implemented using factorial combinations of light treatments (fluorescent (control), fluorescent + UV, and red–blue LED) and fertilizer types (synthetic (control) and liquid organic). Seedlings will be destructively sampled after 14 days of seeding, and germination and physiological parameters will be recorded. Multivariate and univariate statistical analyses will be used to assess the main and interaction effects among factors. The expected outcomes include identifying treatment combinations that improve seedling vigor while reducing fungal incidence under LOF-based fertigation. It is anticipated that responses will differ across light environments, with UV supplementation potentially enhancing seedling health by limiting early fungal development. Overall, this study will provide practical insights into optimizing LOF use for sustainable seedling production in organic soilless agriculture.

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UAV-Based Estimation of Nitrogen Content in Soybean Using Multispectral Vegetation Indices. S. Adhikari* and A. Chiluwal, College of Agriculture, Health and Natural Resources, Kentucky State University, Frankfort, KY 40601.

Efficient monitoring of nitrogen (N) dynamics is essential for optimizing fertilizer use and improving crop productivity in soybean cultivation. This study aims to evaluate the potential of unmanned aerial vehicle (UAV)-based multispectral imagery for estimating nitrogen content in soybeans. Two soybean cultivars were planted in a randomized complete block design with three replications, and nitrogen was applied at rates of 0, 50, 100, 200, 300, and 400 kg/ha, split between the V2 and V6 growth stages. Aerial imagery is being captured biweekly using a DJI Matrice 300 RTK equipped with a multispectral sensor synchronized with destructive biomass sampling throughout the soybean growing season. Simultaneously, chlorophyll content is measured in the field using a SPAD meter. Nitrogen concentration will be determined through laboratory analysis of oven-dried ground biomass samples. The relationship between vegetation indices (VIs) derived from multispectral images, SPAD-based chlorophyll measurements, and laboratory-measured nitrogen concentration will be analyzed to assess the effectiveness of UAV based aerial phenotyping in detecting nitrogen status in soybean. Data collection and analysis are currently in progress, and the findings will be presented and discussed upon completion.

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Identifying Optimal Planting Date for Different Maturity Groups Soybean Cultivars in Kentucky. A. Timilsina* and A. Chiluwal, 1890 Land-Grant Program, Kentucky State University, Frankfort, KY 40601.

Soybean (*Glycine max [L.] Merr.*) is a major grain crop in Kentucky, yet optimal planting dates for maximizing yield and seed quality across different maturity groups (MG) remain under researched, particularly under changing environmental and management conditions. This ongoing study evaluates the influence of five planting dates (from mid- April to mid- June with around 15 days interval between each) on three soybean cultivars representing MG2, MG3, and MG4, in a split plot randomized complete block design. Plant growth (plant height, leaf area index) and physiological parameters (chlorophyll content, leaf photosynthetic efficiency) were recorded at multiple time points during crop growth. The composition of the harvested seeds was analyzed using near-infrared spectroscopy (NIRs). In the first year of the experiment in 2024, the highest yield, protein content and oil content were observed in late May, April, and Mid-June plantings, respectively. The study is being repeated in 2025, and results will be presented and discussed after analyzing combined data from both years.

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Assessment of Pollen Viability in Cultivars of Pawpaw (*Asimina triloba L.*). M. Arslan*, K. W. Pomper, J.D. Lowe, and S. B. Crabtree, 1890 Land-Grant Program, Kentucky State University, Frankfort, KY 40601.

Pawpaw (*Asimina triloba*) is a tree fruit that belongs to the Annonaceae family. It is native to North America and is gaining in popularity due to its unique flavored fruit, high nutritional value, and value added potential as a crop. Pawpaw fruit set can be limited in orchard settings, possibly due to pollinator limitation, inadequate pollen viability, and self-incompatibility. To enhance breeding and pollination practices, as well as develop more productive varieties, a better understanding of reproductive variables is needed. The objective of this study was to assess the pollen viability of four pawpaw cultivars, i.e., Sunflower, Susquehanna, KSU-Benson, and Shenandoah. The 2,3,5-triphenyl tetrazolium chloride (TTC) staining method will be used to detect pollen viability in pawpaw. TTC is colorless, viable pollen contains active dehydrogenases that reduce TTC to a red-colored formazan. Viable pollen stains red or deep pink, whereas non-viable pollen remains unstained. Pollen viability of pawpaw cultivars will be compared as the flowers open and age, and differences among cultivars in pollen viability will be documented. Pollen viability of different cultivars can affect fruit set in orchards. Results will be discussed on how the timing of pollen viability can provide a framework for breeding and orchard design to improve pollination efficiency, fruit set, and genetic improvement strategies.

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Status and Prospects of Soilless Farming Systems in Kentucky. A. Gautam* and S. Upadhaya, 1890 Land-Grant Program, Kentucky State University, Frankfort, KY 40601

Agriculture plays a vital role in food production systems, contributing nearly 4% of the global GDP. However, as increasing global challenges such as land degradation, water scarcity, and food insecurity emerge, soilless agriculture systems, including hydroponics, aquaponics, and aeroponics, are gaining attention as sustainable alternatives to traditional soil-based farming methods. In these systems, crops grow without soil, and nutrients are supplied through water or mist in controlled environments. By recirculating water and supporting compact, vertical farming systems, soilless systems use land and water more efficiently, enabling production even in limited land areas. Kentucky, with its diverse agricultural landscape and access to water resources, generates approximately $6.9 billion from various farm commodities, including crops and livestock. This environment presents significant opportunities for introducing innovative farming systems. However, the adoption of soilless agriculture in Kentucky remains limited, with only 11 aquaponics farms currently operating in the state. This study examines the current state of soilless farming in the state of Kentucky. Its goal is to provide an overview of how these systems function and how farmers and stakeholders perceive opportunities and challenges. The research employs a mixed-methods approach, combining a review of existing data, surveys, and interviews, to inform future research and policy discussions on the potential role of soilless agriculture in developing more sustainable and resilient farming systems in Kentucky.

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Improving Depth-Specific Soil Moisture Forecasts Using Machine Learning and Remotely Sensed Data. E. Olakanmi*, J. Quansah, and S. Fall, Department of Agriculture & College of Agriculture, Environment & Nutrition Sciences, Tuskegee University, Tuskegee, AL 36088.

Accurately and timely estimating soil moisture at crop rooting depths is essential for improving irrigation scheduling and enhancing crop yields. However, continuous monitoring using in-situ sensors is costly and spatially limited, and most hydrological forecast models are not tailored to agricultural needs. This study developed; (1) a machine learning framework that uses Global Ensemble Forecast System (GEFS) data to predict “in-situ” soil moisture at multiple depths and (2) satellite-derived moisture indices that correlate with in-situ measurements within the Alabama Black Belt Region (ABBR). GEFS forecasts at six-hour intervals, accessed via the NOAA AWS cloud repository, were paired with in-situ soil moisture observations obtained from sensors deployed across five farms in the ABBR. The training dataset spans two years (2023 - 2025), with observations taken at depths of 15, 20, 25, and 30 cm. XGBoost machine learning models, configured as site-specific and global, were trained using dual-depth GEFS inputs (10 cm and 40 cm). Results yielded R^2 values of 0.5-0.7 in site models and 0.84 in the global model across depths. To complement the forecast model, harmonized Landsat 8/9 and Sentinel-2 imagery were used to derive two biophysical moisture indices (NDMI and MSI). Pixel values were extracted at sensor locations and evaluated against in-situ data. Results showed stronger correlations at deeper depths, with 30 cm performing best. These findings underscore how machine learning and remote sensing can be used to enhance soil moisture prediction. Such tools can provide farmers and stakeholders with early insights into soil moisture conditions to guide irrigation.

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Drought-Based Composite Index System for Informed Decision-Making and Risk Management for Alabama's Farmers. S. Gutierrez-Diaz*; J. Quansah; and S. Fall, Department of Agriculture & College of Agriculture, Environment & Nutrition Sciences, Tuskegee University, Tuskegee, AL 36088.

Drought poses a significant challenge to agriculture, especially in rural areas, where the ability to adapt to weather disturbances depends heavily on demographic and economic factors. Alabama's agricultural sector has been severely affected by the rising frequency and intensity of extreme weather events, especially drought, which threaten crop yields and overall agricultural productivity. This project aims to develop a drought-based composite index system tailored for informed decision-making and risk management for farmers and rural communities in Alabama. The index integrates USGS IWP drought duration metrics, agricultural, demographic, and economic factors at the county level, providing a comprehensive assessment of drought-related vulnerabilities across Alabama's agricultural regions. Multivariate statistical methods were employed to evaluate the relevance of selected variables, while multinomial regression techniques were used to construct the composite index. To incorporate local perspectives and ground truth in the index, a survey was conducted with farmers from southeastern Alabama counties to capture their perceptions of drought impacts and adaptive strategies. These survey insights are essential to validate and refine the index, ensuring it aligns with farmers' real-world experiences and needs. The project resulted in the development of a county-level drought composite index that effectively combined climatic, agricultural, demographic, and economic variable to assess drought vulnerability across Alabama. The findings highlighted regional variations in drought risk and can be used as a decision support system or practical tool to guide policymakers, stakeholders, extension personnel, and farmers in enhancing drought resilience, supporting long-term agriculture, and improving risk management strategies across the state.

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Spatiotemporal Variations of Daily and Seasonal Air Quality Index (AQI) in Alabama. S. Sapkota*, Integrative Bioscience, Tuskegee University, Tuskegee, AL, 36088; G. El Afandi; C. Bradford; M. Irfan; S. Ibrahim; A. Moustafa; and R. Algendy, Department of Agricultural & Environmental Sciences, Tuskegee University, Tuskegee, AL, 36088

Fine particulate matter is recognized as one of the most hazardous air pollutants, posing significant threats to human health and environmental integrity. The Air Quality Index (AQI) is a critical standardized tool for conveying exposure risks; however, regional variations within Alabama have not been extensively investigated. This research leverages daily data obtained from the U.S. Environmental Protection Agency (EPA) covering the years 2019 to 2024 to compute and spatially map AQI across various Alabama regions. Utilizing EPA methodologies, daily concentrations were translated into AQI sub-indices and scrutinized on both daily and seasonal bases. Spatial analyses revealed pronounced temporal variability, where daily assessments captured transient pollution spikes, while seasonal averages reflected broader atmospheric trends. Data indicates that the summer months correlate with heightened AQI values, whereas winter months typically exhibit lower AQI readings. Notably, urban areas presented a higher frequency of moderate to unhealthy AQI days relative to rural regions. This analysis highlights the necessity for high-resolution air quality monitoring to discern both short-term fluctuations and long-term trends in pollutant levels. By comparing daily and seasonal AQI data throughout Alabama, this study elucidates pollution dynamics, thereby providing critical insights for supporting evidence-based public health initiatives and informing environmental policy development.

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Differences in Solar Radiation and Animal Immunity between Southern-Pine Silvopasture and Open Pasture During Summer S. Acharya*, U. Karki, A. Acharya, and M. Dumre Department of Agricultural and Environmental Sciences, Tuskegee University, Tuskegee, AL 36088

Trees in silvopasture block excessive solar radiation in summer and provide comfortable environment for grazing livestock that may enhance animal immunity. However, information related to such potential of silvopasture is limited. The objective of this research was to evaluate the differences between silvopasture and open pasture in solar radiation and immunity of grazing hair sheep (Ovis aries). Katahdin-St. Croix ewes (n=19) were divided into two uniform groups: one group was allowed to graze in silvopasture (n=9) and another in open pasture (n=10) plots for 70 days

during summer, 2025. Solar radiation was measured diagonally across each plot fortnightly after grazing with 10 transects per plotusing light sensor logger connected to a sensor rod. 2 ml of whole blood was collected fortnightly in EDTA treated tube from jugular vein of each animal using vacutainer. Concentration of immune cell was determined by complete blood count (CBC) technique using hemato-analyzer. Solar radiation and immune cell concentration data were analyzed using mixed procedure and multivariate analysis of variance (MANOVA) with generalized linear model (GLM), respectively. Solar radiation in silvopasture was significantly lower (79.36%, $p<0.0001$) than that in open pasture. Ewes grazing silvopasture had higher WBC count (13.82%, $p<0.05$), higher lymphocyte count (28.71%, $p<0.001$), higher eosinophil count (28.57%, $p<0.05$), and higher lymphocyte percentage (10.48%, $p<0.01$), but lower neutrophil percentage (16.24%, $p<0.0001$).

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***In Vitro* Maturation of Microspores Across Different Developmental Stages for Pollen Germination Responses from Sweet Sorghum (*Sorghum bicolor* (L.) Moench) Varieties.** C. Kurapati* and A.N. Aziz, Department of Agricultural Sciences and Engineering, College of Agriculture, Tennessee State University, Nashville, TN 37209.

Sweet sorghum (*Sorghum bicolor* (L.) Moench) is a vital biofuel crop with immense agricultural significance. This study aimed to provide a foundation for crop-improvement efforts in sweet sorghum. Previous research has established that pollen studies during gametophyte development stages can facilitate plant-breeding endeavors. Establishing *in vitro* maturation of microspores as well as pollen-germination protocols can help in the development of strategies for gametophytic enhancement through plant molecular genetic approaches. Our study investigated the responses of microspores harvested at five developmental stages (early uninucleate, mid uninucleate, late uninucleate, early binucleate, and mid binucleate) from different portions (Basal, Post-Basal, Median, Pre-Distal, and Distal) of sweet sorghum panicles. Microspores from five sweet sorghum varieties (Achi Turi, Dale, Dasht Local, Sugar Drip, and Topper 76-6) were isolated under aseptic conditions. For *in vitro* maturation, microspores from different developmental stages were cultured on semi-solid Murashige and Skoog media (MS5501) supplemented with organic components like sucrose, casein hydrolysate, kinetin, coconut milk, L-proline, and L-glutamine. Maturation responses varied by microspore developmental stages across different varieties; some exhibited pollen formation, while others showed no *in vitro* continuation of gametogenesis pathway. Subsequent *in vitro* pollen germination was assessed on semi-solid media containing sucrose, calcium chloride, and boric acid. Rates were lower in magnitude than in the *in vivo* controls, when total pollen tube development and budding germination percentage were considered across varieties. These findings provide a foundation for using *in vitro* matured pollen after establishing the feasibility of manipulating the gametophytic genomes towards crop improvement in sweet sorghum.

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Agronomic Performance of Dual-Purpose Wheat Varieties in Tennessee. H.K. Sahani* and P.O. Hinson, Department of Agricultural Sciences and Engineering, College of Agriculture, Tennessee State University, Nashville, TN 37209.

In Tennessee, winter wheat has traditionally been grown either as a cover crop or harvested for grain. However, its potential as a dual-purpose crop – providing both forage grazing and wheat grain – is yet to be fully explored by producers in the state. One major roadblock to the adoption of a dual-purpose wheat system is the identification and availability of wheat varieties adapted to Tennessee's unique production system. The objective of this research is to conduct a comprehensive evaluation of 12 genetically diverse soft red winter wheat varieties commonly grown in Tennessee to identify those best suited for dual-purpose use and recommend them to producers in the state. A field trial is being conducted at Tennessee State University's research farm in Nashville, TN to assess a range of agronomic traits, including crop phenology, canopy development and architecture, forage production and nutritive value, and grain yield and quality. In addition to evaluating varietal performance, this project will analyze the variation, relationships, and tradeoffs among measured traits, and this will generate critical insights to guide the development of superior dual-purpose wheat varieties for Tennessee and surrounding states. First-year data collection (2025-2026 winter growing season) is currently underway, and the results of this study are forthcoming.

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Induction of Stress Memory through Mild Iron Pre-Exposure Enhances Tolerance in Juvenile Catfish. N. Kafle*, K. Adhikari, T. Bhattacharjee, F. I. Fahim, S. Bhattarai, S. Jahanbin, R. Lochmann, A. K. Sinha, Department of Aquaculture and Fisheries, University of Arkansas at Pine Bluff, Pine Bluff, AR, 71601.

Iron serves as a key micronutrient in fish physiology, yet excess levels trigger oxidative stress, hinder growth, and weaken immune function within aquaculture settings. Approaches to counteract iron toxicity and bolster fish resilience are essential for advancing sustainable practices in food and agriculture. This investigation explored the impact of mild iron pre-exposure on developing stress memory in juvenile channel catfish (Ictalurus punctatus), aiming to boost tolerance to later lethal and sub-lethal iron challenges. Juvenile catfish received pre-exposure to sub-lethal iron levels over 21 days, alongside a control group without such treatment. After pre-exposure, all fish recovered in clean water for 7 days to resolve immediate stress, prior to exposing recovered groups and fresh naïve controls to lethal or sub-lethal iron for another 21 days. Such pre-exposure markedly improved resilience to ensuing iron stress, where greater pre-exposure intensities produced stronger benefits. Compared to naïve controls, pre-exposed fish displayed enhanced survival and superior growth metrics, reflecting a dose-related mechanism for establishing stress memory. Overall, targeted sub-lethal iron pre-exposure fosters stress memory that promotes survival and growth in juvenile channel catfish facing iron toxicity. This method holds promise for strengthening ecological resilience and economic viability in iron-prone aquaculture operations, aligning with innovations for sustainable production.

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Reducing Cost of Capital Investment for Affordable Homestead Tilapia Culture. Durowaiye, I.*, Warner, J., Daleiden, C., and Novelo, N., 1890 Land-Grant Program, Kentucky State University, Frankfort, Kentucky, 40601.

Affordable production systems are essential for expanding homestead aquaculture, particularly for Nile tilapia (*Oreochromis niloticus*), a widely farmed species valued for its fast growth and strong market acceptance. However, commercial recirculating aquaculture tanks remain financially inaccessible to small-scale farmers. Low-cost Intermediate Bulk Containers (IBC totes) can reduce total system costs while maintaining performance suitable for household level production. IBC totes are food-grade, structurally reinforced containers that can be easily modified for aquaculture, offering a reliable alternative without compromising system integrity. Cost analysis shows that a complete IBC-tote culture unit approximately $893 per tank. In contrast, a comparable Polytank system requires about $1,550 per culture unit once stands and filtration vessels are included, reflecting a significant reduction in capital investment. For production context, tilapia grown in low-cost IBC-tote systems may reach marketable sizes at 4 g/d under 100 d grow-out conditions in Kentucky. While retail prices for tilapia in many regions are relatively high, farm-gate prices are typically lower because producers sell directly to consumers, and local markets. Even at these lower farm-gate values, small-scale production can provide cheaper and feasible means to grow local food particularly by reducing initial investment required for system construction, while improving household nutrition and supporting community-level food security.

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Functionalizing Chitosan Nanoparticles Against *Aeromonas hydrophila* in Catfish, A Potential Antibiotic Alternative. S. Reed*, Department of Chemistry and Physics, University of Arkansas, Department of Aquaculture and Fisheries, University of Arkansas at Pine Bluff, Pine Bluff, Arkansas, 71601.

Aquaculture is a growing global industry. *Aeromonas hydrophila* causes significant economic loss to fish farmers. The FDA approved drug to treat this bacterial disease is Oxytetracycline. The excessive use of this drug has caused bacterial resistance and antibiotic residual problems in fish tissues. As a result, there is an urgency to find alternative therapeutics and prophylactics to treat this fish bacterial disease. Plant spice materials have antimicrobial compounds that have therapeutic potential to treat diseases. *Syzygium aromaticum,* Clove plant, is safe to use and has no significant side effects when tested for the ability to induce cytotoxicity, genotoxicity or effect cell growth in CCO cells. Crustacean shells also have antimicrobial benefits that has the potential to treat diseases. The bactericidal effects *of Syzygium aromaticum,* Clove, and Chitin from Crustacean shells against *Aeromonas hydrophila* was significantly higher or equivalent to oxytetracycline. Chitin from crustacean shells and eugenol oil extract from the clove plant have a synergistic relationship where they complement each other and work very well together. In this research we used

Chitin and eugenol encapsulation to make nanoparticles. Nanoparticles are materials ranging from 1 to 100 nanometers in size. They cross cell and tissue barriers. This allows them to be used in drug delivery.

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Evaluation of accuracy of sex identification and male to female sex ratio of two genetically improved strains of Nile tilapia (*Oreochromis niloticus*). E. Annang *, J. Warner , and N. Novelo, Aquaculture Research Center, Kentucky State University, Frankfort, Kentucky, 40601.

This study evaluated accuracy of manual sorting for visual sex identification based on external physical differentiation of sexual dimorphism of two Nile tilapia (*Oreochromis niloticus*) strains – the Genetically Improved Farmed Tilapia (GIFT) maintained at Kentucky State University, and the Silver strain (from a global commercial hatchery, GF-Hatchery™ and Gårdsfisk® in Sweden). Fish were manually sorted as male or female based on external sex morphology from each strain (n = 15/strain). They were euthanized and dissected to identify sex by presence of testes or ovary, and the observed phenotypic male to female ratio was recorded and evaluated for goodness of fit to expected 1:1 theoretical distribution using a Chi-Square Test. The GIFT strain showed complete match between external and internal inspection, but error rate of visual inspection for sex identification of the Silver strain was high. Evaluation of male to female observed ratio revealed a significant deviation from theoretical ratio for the GIFT strain, but not the Silver Strain. Overall findings show that sex identification based on external morphology varies and may have a high error rate. This highlights the need to engage non-lethal alternative approaches, such as the use of ultrasound imaging or molecular markers for more accurate and reliable sex identification of valuable fish such as genetically improved NT broodstock strains.

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Effect of Manna Oligosaccharides on Growth Characteristics, Nutritional Profiles, and Intestinal Morphology of Channel Catfish (*Ictalurus punctatus*). R. L. Gayle* and O. C. Betiku, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL, 32307, USA.

The United States' seafood imports from China, Indonesia, and Canada are among the highest. The demand for fish is rising, driven by population increase and high per capita income, requiring sustainable aquaculture. The U.S. catfish industry, the largest aquaculture sector, faces high feed costs, limited broodstock reproduction, labor constraints, and competition from imported frozen products. Disease-related mortality also hinders production. Conventional soybean diets often contain antibiotics to boost catfish immunity; however, concerns include antibiotic residues in fish fillets and the potential for human drug resistance. Mannan oligosaccharides (MOS), a prebiotic that boosts gut flora, improve digestive health and nonspecific immunity, making them a safer antibiotic option. In this study, channel catfish were fed normal soybean diets supplemented with four levels of MOS: None (Diet A), Low (Diet B), Medium (Diet C), and High (Diet D). Three replicates per diet were randomly distributed among twelve recirculating tanks with 75 channel catfish (average weight 5.6 g). Water quality, feed intake, and weight were observed while fish were fed ad libitum twice daily. Ideal pH and temperature were maintained. Diet B led to the highest weight increase ($p<0.005$), whereas feed conversion, survival, and feeding rate were not significantly different. Detailed information and other findings will be presented at the symposium.

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The Development of Triploidy Induction Methods for Sunshine Bass Production in Commercial Aquaculture. S. García-Vázquez*, D. A. Perera, Aquaculture and Fisheries Center of Excellence, The University of Arkansas at Pine Bluff, Pine Bluff, AR 71601; B. Brown, University of New Hampshire, Durham, NH 03824; D. L. Straus, Stuttgart National Aquaculture Research Center, USDA/ARS, Stuttgart, AR, 72160.

Sunshine Bass are hybrids produced by crossing White Bass (*Morone chrysops*) females and Striped Bass (*Morone saxatilis*) males. Bass hybrids have a wider tolerance to environmental variables, better growth rates, and disease resistance than their counterparts. The production cycle typically ranges from 10 to 20 months to reach a marketable size of 0.6–1.0 kg. During this time, females can become sexually mature and produce eggs. When stressed these females can release eggs which in turn can adversely affect water quality. It is also thought that feed energy is directed toward egg production relative to muscle growth. Controlling reproduction is critical to optimize growth and energy

efficiency. Triploidization offers an effective method to produce sterile fish. This study evaluated induction methods for producing triploid Sunshine Bass, with emphasis on maximizing embryo survival while achieving high triploidy rates. Hydrostatic pressure shocks were tested at 5000, 6000, 7000, and 8000 PSI for durations of 1.5, 2, 3, 4, and 5 minutes, all administered 4 minutes post-fertilization. Thermal shocks were tested at 3 and 4 minutes post-fertilization: cold shocks (2°C, 4°C) for 10 and 15 minutes post-fertilization, and heat shocks (36°C, 38°C) for 2 and 3 minutes post-fertilization. The produced fry were evaluated for triploidy using flow cytometry. The results indicated that a high pressure shock (8000 PSI) applied for a short period of time (2 minutes) and a low temperature shock (2°C) applied for a prolonged period (15 minutes) will produce the highest survival of larvae with the highest percentage of triploidy.

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Establishment of Fibroblast Cell Lines from Fetal and Adult Tissues and Their Use for β-Lactoglobulin Gene Editing in Bovine. V. Nguyen*, S. Hareem, X. Ma, A. Moawad and M. Singh, Fort Valley State University, Fort Valley, GA, 31030.

The goal of this study was to establish bovine fibroblast cell lines for creating β-lactoglobulin (BLG) gene knock out animals to eliminate bovine milk allergenicity in humans. We established fetal and adult fibroblast cell lines from skin tissues from abattoir by explant culture technique previously optimized in our lab. The outgrowing cells from each tissue were cryopreserved in 20 cryovials ($1x10^5$ cells/vial) and used for further experiments. Post cryopreservation recovery was 80-95% in both cell types. Immunofluorescence analysis of cells using mouse anti-vimentin-FITC antibodies were 100% positive for both fetal and adult tissue derived cells suggesting their fibroblastic nature. Growth profile of cells was assessed using CCK-8, a colorimetric assay, in 96 well plates. Absorbance was recorded at 450 nM on alternate days up to 21 days. Mean ± SD were plotted against time using Excel, which shows a typical S shaped curve, with a doubling time of 32.02 h. Fetal fibroblast cells grew comparatively faster which is consistent with our earlier observations on sheep and goat cells. We also designed three single guide RNAs (sgRNAs), two from Exon I and one from Exon II as well as 3 sets (forward & reverse) of PCR primers to amplify target CRISPR loci in BLG gene. Amplification of DNA isolated from bovine tissues revealed single bands of 460, 968, and 541 bps, validating the target specific primer sets. Transfection of sgRNAs and cas9 nucleoproteins is underway. These biological reagents will be useful to create β-lactoglobulin edited cattle in our future studies.

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Establishment of a Granulosa Cell Line from Bovine Ovaries to Study Reproductive Processes between Oocyte and Granulosa Cells in an *In-vitro* Culture System. R. Alluri*, R. Polasa, V. Nguyen, X. Ma, A. Moawad and M. Singh, Fort Valley State University, Fort Valley, GA, 31030.

Granulosa cells play an important role in oocyte maturation, steroid hormone production, follicular growth, differentiation and fertilization. Regulatory mechanisms of these reproductive functions are still not very well established. *In-vitro* culture of these cells has been suggested to gain more insight into these processes; however, the cultures of these cells do not last for long. The goal of this project is to establish an immortalized granulosa cell line to study oocyte/granulosa interactions in vitro. Granulosa cells from abattoir ovaries were cultured in DMEM F12 Media supplemented with 10% FBS for 4 days. The cells were recovered and cryopreserved in 17 cryovials ($1x10^6$ cells/vial) for further analysis. Recovery of cells after cryopreservation was >80% with normal cell morphology. We assessed their growth profile by CCK-8, a colorimetric assay. 20,000 cells/well were cultured in a 96 well plate up to 21 days. The absorbance was recorded at 450nM on alternate days. Mean ± SD calculated using Excell were plotted against time which show a lag, log, stationary and decline phases of a growth curve with varying durations. Mouse anti-FSHR-FITC antibodies stained all cells in immunofluorescence assay, confirming their granulosa nature. To evaluate puromycin cytotoxicity, 40,000 cells/well were cultured in a 24 well plate in triplicate for 7 days in media supplemented with 0, 0.2, 0.5, 1, 2, 3, 4, 5 µg/mL of the drug. We observed a progressive reduction of cells up to 1µg/mL where 99% of cells were killed. Immortalization of the cells to generate a permanent cell line is underway.

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Pregnancy rate following fixed time AI in beef cattle with or without vitamin E injection. V. P. Tanguturi*, N. C. Whitley, T. D. Odom, L. A. Wartley, R. I. Turner, D. E. Brown, A. M. Shahat, A. R. Moawad, Fort Valley State University, Fort Valley, GA, 31030.

Fixed-time artificial insemination (FTAI) protocols have been widely utilized by the beef industry to decrease time and labor for estrus detection by inseminating females at a predetermined time. Our aim for this study was to determine if Vitamin E+AD (n=52; n=61 untreated) 2 weeks prior to FTAI on three farms would impact pregnancy rates in beef cattle. Two synchronization protocols, 7&7 Synch (7&7; with pre-synchronization) and 7-day Co-Synch+CIDR® (7dCSC) were used. A total of 113 Angus type females from three farms in Georgia, (GLEN, n=25; COBB, n=37; FVSU, n=51) were included (GLEN and FVSU farms used 7&7, while COBB used 7dCSC. For both protocols, GnRH was administered at FTAI. Estrus detection patches were placed on all animals at CIDR removal and last prostaglandin injection. Along with body condition score (BCS), estrus indicators recorded at AI included estrus patch status, color of vulva, mucus membrane, hardness of the cervix, and ease of insemination. Pregnancy was determined by transrectal ultrasonography 58-62 days after FTAI and 45-65 days after bull removal. There was no effect of treatment on pregnancy rates in this study. However, although overall pregnancy rate (from FTAI and clean-up bull) was not different by farm, AI pregnancy rate was highest for the farm using the 7dCSC protocol and having a moderate body condition score (COBB) with the other two farms having AI pregnancy rates similar to each other but lower (GLEN) or higher (FVSU) body condition scores compared to COBB.

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Fermentation Characteristics of Calf Grower Feed Supplemented Postbiotic *Lactobacillus acidophilus* With or Without Essential Oil Blend. O. O. Adelusi*, A. O. Oderinwale, J. M. Enikuomehin, M. Wuaku, J. O. Alabi, A. E. Kholif, U. Y. Anele, Department of Animal Sciences, North Carolina Agricultural and Technical State University, Greensboro, NC, 27411.

Grower calves often experience suboptimal rumen development and dysregulated fermentation due to abrupt dietary transitions from liquid to solid feed, leading to reduced nutrient digestibility and impaired growth performance. Natural additives can modulate rumen microbiota, stabilize fermentation patterns, and improve feed efficiency and overall calf performance, thereby limiting antibiotic usage. We hypothesized that supplementation with postbiotic *Lactobacillus acidophilus* (PLA) and essential oil blend (EOB) can synergistically enhance rumen degradation, optimize fermentation, and mitigate enteric methane output in grower calves. The study investigated the effects of EOB, PLA and their combination on the *in vitro* gas production, dry matter digestibility (DMD), and volatile fatty acid (VFA) profile of grain-Alfalfa hay (60:40) calf grower feed. Eight treatments were set up in a 2 x 4 factorial arrangement with EOB (0 or 20 µL/g of feed) and PLA at four levels (0, 5.0, 7.5 and 10.0 µL/g of feed) to conduct a 24-hour *in vitro* fermentation procedure with 8 replicates each. Data obtained were statistically analyzed using two-way analysis of variance. Gas production increased with PLA, whereas EOB reduced both total gas and methane output. Dry matter digestibility remained unaffected by either additive. Although total VFA and acetate concentrations decreased with PLA and EOB inclusion, the proportion of propionate increased, reducing the acetate-to-propionate ratio with PLA. Overall, PLA and EOB shifted rumen fermentation toward improved efficiency by enhancing gas production with a similar level of dry matter digestibility, lowering methane emissions, and promoting propionate production without compromising nutrient digestibility.

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Virtual Fencing: Smart Technology to Enhance Grazing Efficiency for Efficient Livestock Production in the US. P. Rimal*, and N. Gurung. College of Agriculture, Environment, and Nutrition Sciences, Tuskegee University, Tuskegee, AL, 36088.

Beef and dairy production is one of the largest agribusinesses in the United States. Although the US government is extending its support to many beef and dairy farmers, producers still face numerous challenges, including labor-intensive fencing and its maintenance and operations, and inefficient conventional grazing management. In this study, we conducted a systematic literature review to address the issue of grazing management in beef cattle and ruminants in the US using the keywords “virtual fencing,” “rotational grazing,” “precision livestock management,” etc. Study confirmed that GPS-enabled smart collars specifying digital boundaries are the critical component of virtual fencing for monitoring and controlling the animals' movement and performance in the pasture. Cattle and ruminants adjust their behavior quickly and adapt their movement in the specified GPS-enabled digital boundary guided by smart collars, confirming their potential use in cattle and ruminants for smart grazing. It optimizes production and higher returns through cost reduction in labor, maintenance, and operation, accompanied by improved pasture health, environmental conservation, and sustainable livestock production. Though the virtual fencing technology is a smart

and efficient option, but this technology is not fully harnessed by the small producers. Collectively, virtual fencing is an economically viable and environmentally sustainable technology in livestock production and pasture management, requiring capacity enhancement of smallholders and incentivizing them in the long run.

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Kentucky Beef Producer Extension Survey: Producer Demographics and Programming Needs. R. O. Ewetade*, S. N. Carr, and A. R. Hines. Department of Agriculture, Health, and Natural Resources, Kentucky State University, Franklin, KY, 40601.

To guide the development of more targeted Extension programming, a survey assessed the demographics, production characteristics, and educational preferences of cattle producers in Kentucky. A 12-question survey administered during the October 2025 Franklin County Cattlemen's Association meeting captured producer demographics (county of residence, age, hectares managed, operation type, herd size) and program preferences related to management topics, equipment needs, and preferred delivery formats. Out of the total attendees (n = 38), 16 survey responses (42%) were submitted. Data was summarized as follows. All respondents resided in Franklin County, with most producers aged 60+ years (56.3%), followed by those aged 40 – 60 (31.3%). Most producers (93.3%) managed ≥20.2 ha of pastureland, with half managing >40.5 ha. All producers managed cow-calf operations, with 18.8% having mixed species systems. An equal proportion (n = 7; 41.2%) reported herd sizes of 26–50 or 50–100 hd. Main management styles practiced were moderate rotational grazing (rotations 7-21 d interval), continuous grazing and slow rotational grazing (≥ 28 d interval; 40, 26.7, and 26.7%, respectively). For delivery format, field tours (36.8%) and weekday evening programs (31.6%) were preferred over Saturday, weekday, virtual, or 2-3 d hands-on workshops (10.5, 10.5, 5.3, and 5.3%, respectively). Programing interests included breeding management (87.5%), grazing management and fencing (43.8%), herd health (37.5%), forage selection and hay/baleage/silage (31.3% each). Results of this survey provide direction for future Extension efforts, demonstrating a clear demand for targeted education in breeding and pasture management while guiding the selection of delivery methods to maximize engagement.

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Evaluation and adaptability of cool-season legumes on yield and nutritive value in Kentucky forage systems. I. S. Salako*, R. O. Ewetade, E. Workman, S. N. Carr, V. Niyigena, and A. R. Hines.Department of Agriculture, Health, and Natural Resources, Kentucky State University, Franklin, KY, 40601

Rising anthelmintic resistance of gastrointestinal parasites, such as *Haemonchus contorts,* is a continued concern for small ruminant production in the Southeastern US. Overuse of anthelminthic drugs have reduced treatment effectiveness, leading to interest in plant-based alternatives, such as plant secondary metabolites (PSM) produced by known legumes. However, there is limited comparative data on these legumes and their adaptability to Kentucky systems. Therefore, the objective of this research is to determine the yield, height, and nutritive quality of cool-season PSM-producing legumes in Kentucky. Native and introduced species to be included in this screening experiment Legumes (n = 11) were arranged in a small plot screening trial utilizing a complete randomized design, with a 11x3x2 factorial treatment structure to encompass legumes species, replication within plot, and planting year. Plots [1.5 x 1.5m] were seeded at the Harold R. Benson Research Farm (Frankfort, KY) according to USDA and Extension recommendations of each species. Post establishment, forages were measured every 7 d for height. Legumes were harvested once the average canopy height was 30cm. Total harvested biomass was recorded for yield. A subsample was assayed for DM, OM, NDF, ADF, ADL, and CP. Data were analyzed using SAS v. 9.4.

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Dynamics of Progesterone in Beef Cattle. E. Bridges Jr.*, Department of Agriculture, Alcorn State University, Lorman, MS 39096; A. Jones, Department of Agriculture, Alcorn State University, Lorman, MS 39096; and M. Mason-Montgomery, Department of Agriculture, Alcorn State University, Lorman, MS 39096.

This study explored the role of progesterone in regulating cytokines by testing the working hypothesis that concentrations of progesterone alter the expression and production of cytokines that aid in the survival of recently transferred embryos such as TNF-α, and IFN-tau. Fifty (N=50) cows of similar body condition scores, but varying ages and breeds were evaluated in the study and were randomly assigned to either a control or a treatment group. Fifty

cows were synchronizedfor estrus and randomly placed into one of three experimental groups; the control group (n=22) received an embryo on day 7 after exhibiting estrus; group 2 (n=12) received a CIDR two days prior to transfer; and group 3 (n=16) had a CIDR inserted immediately after the transfer of the embryo. All CIDR's were removed on day 21. Pregnancy was determined by rectal palpation at 30 and 55 days. Embryos were non-surgically transferred to cows following palpation of a viablecorpus luteum. Blood samples were collected caudally in all cows on days 5, 7, 14, and 21 for recipients and ELISA tests were conducted for progesterone, TNF-α, and IFN-tau. Cows were rectally palpated on D44 and D69 to determine pregnancy. Results presented a negative correlationbetween progesterone and TNF-α in Groups 1 and 3 and a positive correlation between the concentrations of INFT and the concentrations of progesterone between these same groups. Cowsin Group 2 had a correlation was between the upregulation of the concentrations of TNF-α and thedownregulation of the concentrations of INFT.

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FECRT Efficacy and Telemetry Integration. J. Shoalmire*, J. Snowden, C.P. Bagley, M. K. Tate, Southern University Agricultural Research and Extension Center, Baton Rouge, LA, 70813.

A 42-day controlled field evaluation was conducted to assess the efficacy of Ivomec Plus and Synanthic against gastrointestinal nematodes in freshly weaned beef calves, while simultaneously monitoring physiological responses using Smaxtec eBolus telemetry with intra-ruminal devoces. Forty-nine calves were distributed into three treatment groups (Ivomec Plus, Synanthic, and Control; ~16 per group). Baseline fecal egg counts (FEC) averaged were relatively low measured in eggs per gram (EPG). Post-treatment analysis showed substantial FEC reductions, with Ivomec Plus and Synanthic decreasing 94.3% and 92.1% reductions, respectively ($p < 0.01$). These results confirm both compounds as highly effective anthelmintics under field conditions. Telemetry data revealed transient physiological responses characterized by mild temperature elevations as measured by the intra-ruminal bolus (peak 103.1 °F) and brief rumination declines (~15%) within 12 hours of dosing, followed by normalization and compensatory rumination rebound above baseline by 48 hours. No sustained deviations in pH or metabolic stability were observed, and control animals maintained consistent physiological parameters but exhibited persistent moderate parasite loads. Integrating FECRT and eBolus datasets produced a multi-dimensional validation framework linking pharmacological action, metabolic recovery, and host response kinetics. This approach demonstrates the potential of IoT-based telemetry to complement parasitological endpoints, enhancing field accuracy and reproducibility. The findings support development of automated alert systems for treatment verification, drug tolerance, and emerging resistance detection in beef cattle. This integrated precision-livestock model exemplifies how digital tools can advance sustainable parasite control and reinforce data-driven decision-making in modern beef production systems.

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Ensuring Data Integrity: Linking Biological Samples to Telemetry and Animal Identification. A. Lastie*, Department of Agricultural Sciences and Technology, College of Agricultural, Human and Environmental Sciences, Southern University and A&M College, Baton Rouge, LA 70813;, M. K. Tate Sr., J. Snowden, C.P. Bagley, F. Chappelle, T. Collins, Southern University Agricultural Research and Extension Center, Baton Rouge, LA, 70813.

Accurate data integrity is the foundation of reproducible animal research particularly as diverse as beef cattle production systems using different breeds, weaning dates, and further production techniques. At a teaching and research university, it is also important to integrate students into research techniques to better train them for jobs out in the beef cattle industry in the emerging area of improving and tracking technologies in agricultural enterprises. During this 42-d precision-livestock trial at Southern University Agricultural Research and Extension Center, a student developed and managed a comprehensive data-linking system connecting biological samples to telemetry and animal-identification records. Each calf was assigned a unique identifier integrating ear tag, RFID, and eBolus sensor numbers within a master spreadsheet to maintain traceability throughout the entire trail period. A triple-verification process—sample labeling, digital entry, and serial confirmation—resulted in reliable correspondence between field, laboratory, and telemetry data for over 250 records that were captured in this study. This system ensured that fecal egg count results, body-weight changes, and physiological telemetry (rumination, body temperature, and rumen pH) remained precisely aligned. The method now serves as the model standard operating procedure for subsequent SUN Beef projects. The system not only ensured accuracy but also provided hands-on student training in bioinformatics, data management, and research accountability under IACUC oversight. This work exemplifies student-led innovations can strengthen scientific quality and workforce readiness within precision-livestock programs. Her contribution supports

Southern University's mission to combine rigorous research practices with experiential education that prepares 1890 students for careers in data-driven agriculture.

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Visualizing Precision-Livestock Research: Field Documentation and Communication. A. Lastie*, Department of Agricultural Sciences and Technology, College of Agricultural, Human and Environmental Sciences, Southern University and A&M College, Baton Rouge, LA 70813;, M. K. Tate, Sr., J. Snowden, C.P. Bagley, T. Collins, F. Chappelle, Southern University Agricultural Research and Extension Center, Baton Rouge, LA, 70813.

The science and technology adapted for beef cattle production and management is a rapidly ever evolving area and is critical for maintaining consumer confidence in beef products in the marketplace. Effective science communication is vital for translating research into producer adoption and maintaining consumer confidence. During the precision-livestock dewormer study at Southern University, a student researcher created a visual field documentation framework linking photographic records, eBolus placement, and sampling events to each animal's identification and telemetry data in actual field studies. This field-to-database linkage produced an accurate visual audit trail, later transformed into infographics, QR-linked summaries, and bilingual outreach materials for SUN Beef workshops. These visual tools simplified understanding of rumination recovery, growth trends, and stress response, making research findings accessible to producers, students, and stakeholders. Feedback from workshop participants confirmed that visual materials increased comprehension of precision-livestock technology and encouraged producer confidence in adopting monitoring systems. The approach also provided valuable experience in digital content development and agricultural communication for student researchers. By merging scientific documentation with creative visual design, this project demonstrates how transparency, communication, and engagement strengthen technology transfer from research to practice. It aligns with Southern University Ag Center's outreach mission to promote education, technology literacy, and producer participation within 1890 agricultural programs. This effort could become critical in convincing the consuming public of the care and technology involved in producing fresh, wholesome beef for the consuming public and increase their confidence in beef management practices.

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Management of Fusarium Wilt with Novel Isolate Endophytes in Soybean and Tomato. M. Ọláwuni*, C. Ondzighi-Assoume, and M. Mmbaga, Biotechnology Research Laboratory, Department of Agricultural Sciences and Engineering, College of Agriculture, Tennessee State University, Nashville, TN 37209.

Fusarium wilt, caused by the soil-borne pathogen *Fusarium oxysporum*, affects major food crops, including vegetables, cucurbits, cereals, and legumes. Due to the pathogen's ability to infect a wide host range (over 100 crop species), its management is challenging for farmers using conventional agronomic practices. Our study examined an approach to managing the pathogen in soybean and tomato that had not been previously evaluated in these plants: novel isolate endophytes, Biological Control Agents (BCA) that have been shown to be effective alternatives to chemical pesticides for disease management and growth promotion in some plants. In laboratory studies, we screened and evaluated four BCAs (IMC8, PRT, PS, and PSL) *in vitro* on plates and in liquid co-cultivations. Each BCA and the pathogen were co-cultivated in media at room temperature, and we recorded the growth of the pathogen over 15 days. We found BCA to be highly effective in managing the pathogen. Specifically, IMC8 and PS showed the highest inhibition rate against the pathogen growth at 90.4% and 86.7%, while PRT and PSL inhibited the pathogen by 62.1% and 63.8%, respectively. Based on our results, we have developed an efficient liquid-induced system for pathogen infestation to investigate the efficacy of BCA in the management of Fusarium wilt in the greenhouse and the field.

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Sustainable Production Systems Integrating Mulch and Propagation Strategies for Improved Floral Hemp Performance. R. Kabenomuhangi*, A. Kumar, C.U. Nnadi, and E. Omondi, Department of Agricultural Sciences and Engineering, College of Agriculture, Tennessee State University, Nashville, TN 37209.

The legalization of industrial hemp under the 2018 Farm Bill marked a pivotal shift in U.S. agriculture, enabling its reintroduction as a high-value specialty crop. Despite its potential, floral hemp cultivation remains challenging due to stringent THC-compliance regulatory requirements, pests, diseases, and weed pressure. This study at Tennessee State

University's agricultural research farm is evaluating how different mulch treatments (plastic, straw, and roll-crimped winter rye) combined with tillage practices and propagation materials (clone and seedling) affect weed and disease management, cannabinoid production, THC compliance, and economic performance in floral hemp cultivation. The study employs a split-split plot design replicated four times. Preliminary results indicate that straw mulch significantly reduced soil temperatures, weed density, and disease severity compared to black plastic mulch and the no-mulch control, positioning it as an eco-friendly and cost-effective alternative. Seedling-propagated plants demonstrated greater plant-growth parameters, while clones tended to lower southern blight disease. Additionally, cover crop-mulched organic farming systems reduced grass and broad leaf weed densities compared to conventional systems, highlighting the potential of sustainable practices to address regulatory and environmental challenges in hemp cultivation. These findings emphasize the potential of integrating sustainable practices to enhance hemp production efficiency while meeting regulatory standards. They provide actionable insights for farmers navigating the complexities of hemp cultivation and contribute to promoting the broader goals of economic sustainability, environmental stewardship, and agricultural resilience.

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Influence of Transplanting Depth on the Incidence of Southern Blight in Floral Hemp (*Cannabis sativa* L.). C.U. Nnadi*, E.C. Omondi, R. Kabenomuhangi, A. Kumar, and M. Olawuni, Department of Agricultural Sciences and Engineering, College of Agriculture, Tennessee State University, Nashville, TN 37209.

Southern blight, caused by *Sclerotium rolfsii*, is a destructive soilborne disease that poses a growing challenge to floral hemp production in the southeastern U.S. Preliminary greenhouse studies suggested that transplanting depth may influence disease incidence, with shallower planting – where the stem base remains above the soil surface – reducing infection. This field study was conducted to validate those findings and to examine interactions among transplant depth, mulch type, and pathogen inoculation under natural conditions. A split-plot randomized complete block design with four replicates was established in 2025. The main plot factor was plant type (seedling or clone), while subplot factors included transplant depth (deep or shallow), mulch type (none, black plastic, white plastic, or straw), and pathogen treatment (inoculated or non-inoculated with 10 g *S. rolfsii* per plant). Due to limited inoculum availability, individual plants served as experimental units, resulting in a slightly unbalanced design (64 plants in Block 1; 32 plants in Blocks 2 and 3). Preliminary results showed no significant difference between shallow and deep transplanting or between inoculated and non-inoculated treatments, suggesting that the inoculum concentration or viability may have been insufficient for consistent infection. However, straw mulch improved plant height and biomass while reducing southern blight incidence, consistent with previous findings (Maddela, 2025). White plastic, expected to reduce soil temperature similar to straw mulch, did not differ from black plastic, likely due to unusually high summer temperatures. The study will be repeated with verified inoculum efficacy to confirm treatment effects and strengthen disease-management recommendations.

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Corn Earworm (*Helicoverpa zea*) Herbivory Induces Cannabinoid Biosynthesis and Defense Gene Expression in Boax and Berry Hemp (*Cannabis sativa* L.) Varieties. F. Abrha*, T. Tolosa, and S. Zebelo, Department of Agriculture, Food and Resource Science, University of Maryland Eastern Shore, Princess Anne, MD 21853.

Following the 2018 Farm Bill, hemp (*Cannabis sativa* L.) with delta-9-tetrahydrocannabinol (Δ^9-THC) concentrations below 0.3% (dry weight) is classified as an agricultural commodity. Hemp cultivation has expanded due to its various applications and therapeutic value, but this growth has been challenged by rising insect pressure. Corn earworms (CEW) have emerged as a major pest of cannabidiol (CBD) hemp. A recent report from our lab showed CEW feeding raised Δ^9-THC above the legal threshold, yet its effects on genes driving cannabinoid biosynthesis remain unclear. This study examined CEW infestation impacts on CBD, Δ^9-THC, and expression of genes responsible for cannabinoid and jasmonic acid biosynthesis genes, in two hemp varieties, Boax and Berry. Plants were grown under controlled conditions, and CEW larvae were applied at the flowering stage. After 24 hours, samples were analyzed using gas chromatography–mass spectrometry (GC-MS) and real-time QPCR. In Boax, CEW herbivory significantly increased cannabinoid levels and caused upregulation of cannabinoid and jasmonic acid biosynthetic genes. RNA sequencing identified 266 differentially expressed genes (DEGs), with 116 upregulated and 150 downregulated. Upregulated DEGs were enriched in stress and jasmonic acid signaling. Similarly, Berry plants showed elevated CBD, THC, and upregulation of the same genes under CEW damage. These

findings reveal molecular and biochemical responses of hemp to insect stress and provide a foundation for breeding pest-resilient hemp varieties with stable cannabinoid profiles.

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The Economics of Precision Nitrogen in Agriculture: The Case of Optimizing Nitrogen Use to Sustain High Yields of Soybeans in North Carolina. M. Miniya*, K. Jefferson-Moore, and A. Abouzeid, Department of Agribusiness, Applied Economics and Agriscience Education, North Carolina Agricultural and Technical State University, Greensboro, NC 27411.

Soybeans are valued as one of the top agricultural commodities in North Carolina (NC), and they make a significant contribution to the state's economy. Precision nutrient management is important for increasing farm profitability and sustainability because inefficient nitrogen use can increase production costs and environmental damage. This study looks at the economic and agricultural benefits of precision nitrogen methods in NC soybean production systems. The main objective is to determine the best nitrogen application rates, timing, and innovative solutions for increasing yield, improving profitability, and reducing environmental damage. Secondary data from USDA-NASS, the NC Department of Agriculture and Consumer Services, and NC State University Cooperative Extension will be used in a quantitative analysis to determine profitability and nitrogen use efficiency across multiple production areas. The results of the study are intended to provide useful information for farmers, policymakers, and agricultural Extension agents. This study intends to reduce input waste, promote sustainability, and maximize soybean farmers' profitability by identifying the best nitrogen strategies.

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Canker Diseases of Woody Ornamentals in Tennessee: Identification and Pathogenicity of Botryosphaeriaceae and Diaporthaceae Species. P. Subedi* and F. Baysal-Gurel, Department of Agricultural Sciences and Engineering, Tennessee State University, Otis L. Floyd Nursery Research Center, McMinnville, TN 37110.

Canker diseases caused by fungal pathogens pose a significant threat to the production of woody ornamentals in Tennessee. However, there is limited taxonomic information on the causal agents associated with these diseases. This study aimed to identify and characterize the major fungal pathogens responsible for canker diseases in woody ornamentals. Symptomatic samples of redbuds (*Cercis* spp.), maples (*Acer* spp.), and dogwoods (*Cornus* spp.) were collected from various nurseries and processed for pathogen identification. Typical symptoms included sunken necrotic lesions, V-shaped discoloration in woody tissues, shoot blight, and branch dieback. Isolates were characterized based on colony morphology, pycnidial and conidial features, and molecular analysis using a phylogenetic reconstruction of concatenated *ITS*, *TUB*, and *EF1-α* gene sequences. Pathogens belonged to two major fungal families: Botryosphaeriaceae and Diaporthaceae. Botryosphaeriaceae accounted for approximately 40% of isolates and included *Botryosphaeria dothidea*, *Diplodia seriata*, *Lasiodiplodia theobromae*, and *Neofusicoccum parvum*. *B. dothidea* was the most requently isolated species. About 30% of isolates belonged to the *Diaporthe eres* species complex. Pathogenicity tests were conducted under greenhouse conditions using a completely randomized design with six replicates per isolate. All tested isolates were pathogenic, although aggressiveness varied among species. *L. theobromae* was the most aggressive, producing the largest mean lesion length and highest pathogen recovery percentage, followed by *N. parvum*. These findings highlight the diversity and virulence of fungi causing canker disease in woody ornamentals and provide valuable information for developing effective management strategies in Tennessee nurseries.

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Evaluation of Soil Biodegradable Mulch Used in Plasticulture System Under Different Climatic Regions of North Carolina with Tomato as a Model Crop. E. Atley*, T. McGee, and G. Yang, Department of Natural Resources and Environmental Design, North Carolina A&T State University, Greensboro, NC 27411.

Plastic mulch is widely used in commercial and high-tunnel vegetable production to improve crop yield, soil temperature, and moisture conservation. However, conventional polyethylene (PE) mulches do not fully degrade in soil, creating long-term environmental concerns. To address this issue, this study was initiated to evaluate biodegradable mulch materials as sustainable alternatives to PE mulch, with a focus on potential use in certified

organic systems where microplastic residues are prohibited. A randomized complete block split-plot design was used to assess four biodegradable mulches and a standard plastic mulch across two tomato cultivars. Parameters analyzed included marketable and cull fruit yield, plant height, canopy width, fruit quality, soil temperature, percentage of weed cover, and mulch degradation. After one month, no significant differences in mulch degradation were observed. However, after three months, one biodegradable material exhibited significantly greater degradation than the control. Mulch type did not significantly affect weed pressure, and no nutsedge penetration was observed through the paper-based mulch treatments. Similarly, no significant differences were found in yield or fruit quality parameters among treatments. These findings suggest that biodegradable mulch products can provide comparable weed suppression and tomato yield performance compared to standard PE mulch, while offering potential environmental benefits over a typical five-month growing cycle.

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Integrating Soil Moisture and Sap Flux Sensing to Optimize Irrigation, Physiology, and Yield in Dual-Purpose Industrial Hemp (*Cannabis sativa L.*). E. Kwekutsu*, H. Sidhu, A. Bhowmik, and H. Sharma, Department of Natural Resources and Environmental Design, North Carolina Agricultural and Technical State University, Greensboro, NC 27411.

Optimizing water use is essential for sustainable production of high-value specialty crops such as hemp (*Cannabis sativa L.*), which is increasingly cultivated for its applications in fiber, food, biofuel, and therapeutic products. As a dual-purpose crop, hemp's economic value depends on maximizing both biomass and seed yield. However, its physiological and hydrological responses to varying soil moisture regimes remain underexplored. Addressing this knowledge gap is critical given water scarcity, rising irrigation costs, and the demand for sustainable production systems. This study evaluated the effects of three sensor-controlled irrigation regimens (low, medium, and high) on physiological responses, sap flux, and yield performance of dual-purpose hemp (cv. 'Canda') grown under greenhouse conditions in Greensboro, NC. A randomized complete block design was used with 10 replicates per treatment. Plant physiological traits, including photosynthetic rate (P_n), transpiration rate (E), and stomatal conductance (g_s), were measured weekly using a LI-6800 photosynthesis system. Whole-plant water transport was assessed via heat-balance method sap flux sensors. Biomass and seed yield components were recorded at harvest. High irrigation significantly increased P_n compared to medium and low levels; high irrigation also resulted in higher E and g_s. Sap flux was greater under high irrigation compared to low irrigation. High irrigation produced significantly greater fresh biomass and doubled seed yield compared to low and medium irrigation. These findings demonstrate that precision irrigation, informed by integrated sap flux and soil moisture monitoring, can improve water-use efficiency, optimize physiological performance, and sustain hemp productivity in water-limited environments.

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Differential Gene Expression in Salt-Tolerant Cotton Species in Response to Salt Stress. *S.G. Kommireddypally*, S.K. Sanathanam, S. Mentreddy, L. Nyochembeng, E. Moss, and V.R. Sripathi,* Department of Natural Resources and Environmental Sciences, Alabama A&M University, Normal, AL 35762.

Salt stress is a significant issue in agriculture, especially for *Gossypium hirsutum* (Upland cotton), which is essential for global fiber production. As soil salinity rises due to weather impacts and agricultural practices, studying molecular responses to salt stress is vital for breeding resilient cotton cultivars. Identifying key genes for salt tolerance is essential for developing stress-tolerant varieties, which is a priority for food security. This study aims to identify key salt-tolerant and differentially expressed genes (DEGs) using RNA-Seq by analyzing the transcriptomes of salt-tolerant cotton species under stressed and unstressed conditions. This study will examine the responses of salt-tolerant cotton species exposed to NaCl concentrations of 0 mM (control) and 300 mM, with leaf samples collected at 0, 24, 48, 72, 96, and 120 hours after treatment with three replicates (1 species x 2 treatments x 6 collection time points x 3 replicates = 36). DNA/RNA was extracted from the leaves of treated and untreated 30-day-old seedlings. RNA-seq analysis will include quality control, trimming, alignment, counting, normalization, differential gene expression (DGE) analysis, and functional enrichment analyses using GO, COG, and KEGG pathways. This study will identify important genes that regulate osmotic pressure, ion balance, and protection against oxidative damage. It will also identify key gene families linked to plant stress resistance, such as protein kinases, glutathione S-transferases, the CAZy family, and expansion proteins. The findings from this study on salt-tolerant materials will provide a crucial basis for identifying potential breeding parents for salt tolerance in cotton.

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Strategies for Successful *Chenopodium quinoa* cultivation in Low-Altitude and Heat-Stressed Areas of Maryland's Eastern Shore. J.M. Ithiru,* P. Natarajan, and S.A. Dhekney, Department of Agriculture, Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853; and E.N. Jellen, Plant and Wildlife Sciences, Brigham Young University, Provo, UT 84602.

Chenopodium quinoa is traditionally cultivated in temperate regions of South America but has now expanded to over 120 countries worldwide. High temperatures above 32°C limit its cultivation by negatively impacting flowering and seed development. This study aimed to assess the effect of heat stress on the performance of quinoa genotypes across different planting seasons and to identify key genes regulated by heat stress for quinoa genetic improvement. Nine genotypes were tested over two years in multiple planting seasons under greenhouse and field conditions to evaluate vegetative, flowering, and yield traits. Total RNA was isolated from quinoa genotypes exposed to heat stress during flowering, and RNA sequencing was performed to identify differentially expressed genes in response to abiotic stress. Significant differences among genotypes, seasons, and environments were observed, with heat stress severely affecting vegetative and flowering traits, leading to notable variation in yield across seasons. RNA sequencing revealed a total of 3,340 upregulated genes and 2,752 downregulated genes in response to heat stress. Key upregulated proteins included heat shock proteins, jasmonate-induced proteins, and the transcription factor bHLH, which are important for the plant's heat tolerance mechanisms. Downregulated genes included PHD finger MALE STERILITY 1, agamous-like MADS-box, and Aspartic-Protease proteins, all essential for flower and seed development. This research highlights the involvement of key transcription factors and regulatory genes in quinoa heat-stress response, and their potential as targets for breeding heat-tolerant quinoa varieties while identifying suitable planting seasons and promising lines for commercial production.

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Growth-Promoting Effects of Endophytic *Trichoderma* on *Corchorus olitorius* Cultivated in a Passive Hydroponic System. S.K. Bonik*, C.P. Cotton, B. Khatabi, and A.B. Matthews, Department of Agriculture, Food and Resource Sciences, and M. Sepehri, Department of Natural Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853.

Hydroponic cultivation offers a sustainable and resource-efficient alternative to conventional soil-based agriculture. However, optimizing crop yields in hydroponic systems remains challenging due to the absence of soil microbiomes. Introducing endophytic microorganisms presents a biologically driven strategy to enhance plant growth, as these microbes naturally colonize root tissues and improve nutrient uptake, root development, and overall system productivity. Among endophytes, the genus *Trichoderma* is widely recognized for its dual role as a biofertilizer and biocontrol agent, promoting crop growth and quality through antagonistic and growth-stimulating traits. This study evaluated the growth-promoting potential of *Trichoderma* on *Corchorus olitorius* (jute plant) using the Kratky Method, a passive hydroponic system. A preliminary greenhouse study, evaluating eleven *Trichoderma* strains, isolated from distinct soil sources, showed treatments PGPF20 and PGPF29 to be the most pronounced growth enhancement. These treatments were used in a high tunnel hydroponic study evaluating the growth, yield, and resilience of *Trichoderma*-treated jute plants grown in nutrient solutions at two concentrations (50% & 100%). Chlorophyll content, yield, phytonutrient content, and plant biomass were evaluated. The *Trichoderma*-treated plants grown in 100% nutrient solution exhibited significant increases in plant growth and development compared to the control. Moreover, total phenolic and flavonoid contents were significantly higher in treated and control plants grown in the 50% nutrient solution. These findings indicate that *Trichoderma* strains PGPF 20 and PGPF 29 effectively promote vegetative growth and biochemical performance without compromising product quality, highlighting their potential as sustainable bio-inoculants for hydroponic jute production under semi-controlled environments.

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Synthetic Data-Augmented Neural Network Regression for Crop Yield Prediction. C. Ngo* and Y.N. Chi, Department of Agriculture, Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853.

To overcome limitations in crop data availability and variability, synthetic datasets were generated using Generative Adversarial Networks (GANs) to enhance model robustness and support data-driven analysis for training machine learning models in precision agriculture. This study primarily investigates the effectiveness of Multiple Linear Regression (MLR) and Neural Network Regression (NNR) models in forecasting crop yield using synthetically generated data. Following outlier removal, the final dataset includes 1,465 samples and key agronomic variables such as soil quality index, fertilizer application rate (kg/ha), number of sunny days, and total seasonal rainfall (mm). Both models were trained using a 70/30 train-test split, and their performance was evaluated using Mean Squared Error (MSE). The NNR model, configured with a two-layer architecture (two neurons in the first layer and one in the second), achieved an MSE of 35,853.37, outperforming the MLR model, which yielded an MSE of 36,148.27. These results demonstrate the superior ability of neural networks to capture nonlinear relationships in crop yield prediction. The study underscores the value of synthetic data augmentation and neural network design in enhancing model accuracy under data-scarce conditions, offering practical implications for precision agriculture and sustainable resource management.

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Cultural Management Research and Applications of Holy Basil (*Ocimum tenuiflorium*) Grown in Maryland. **E.E. Cable* and V.V. Volkis,** Department of Natural Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853; and **A.G. Ristvey,** University of Maryland Extension, Wye Research & Education Center, Queenstown, MD 21658.

Ocimum tenuiflorium, commonly known as holy basil or tulsi, is a crop with a rich history in Ayurvedic medicine and has been recognized with a wide range of health and product applications. Tulsi, which is predominantly found in India, is rich in phenolic compounds and essential oils, enabling it to address various ailments, such as headaches and bronchitis. Research indicates that the growing location and cultural management practices can influence the phytochemical composition of holy basil, affecting its overall effectiveness as a medicine. This study investigates the phytochemical profile variations in Tulsi by comparing four different varieties across four distinct soil types. Additionally, the research also assesses the impact of precision irrigation techniques on the growth and yield of *Ocimum tenuiflorium.* The irrigation treatments include deficient, medium, and high levels of water supply to evaluate how varying moisture levels affect the profile of key phytochemicals and essential oils. Newly published methods in automatic distillation and high-pressure speed extraction will be employed for the sample preparation, and the results of the phytochemical analysis and essential oil yields will be presented.

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CRISPR/Cas9 Functional Validation of Candidate Genes for Gummy Stem Blight Resistance in Watermelon. V. Patel*, S. Chinreddy, and U.K. Reddy, Gus R. Douglass Institute, West Virginia State University, Institute, WV 25312.

Gummy Stem Blight (GSB), caused by *Stagonosporopsis* species, is a major fungal disease limiting watermelon (*Citrullus lanatus*) productivity worldwide. Although quantitative trait loci (QTL) analyses have identified genomic regions associated with resistance, functional validation of candidate genes remains limited. This study employs CRISPR/Cas9-mediated genome editing to investigate the roles of three promising resistance-associated genes: *Avr9/Cf-9 rapidly elicited protein*, *LysM domain receptor-like kinase*, and *Sentrin/SUMO-specific protease*. Gene-specific gRNAs were designed and cloned into CRISPR vectors for transformation into *Agrobacterium tumefaciens* (LBA4404). Watermelon cultivars ‘Charleston Grey’ and ‘Sugar Baby’ are used for both tissue culture–based and in planta transformations. Preliminary regeneration studies identified thidiazuron (2 mg/L) as the most effective cytokinin for callus induction, with cotyledonary node explants showing the highest regeneration efficiency. Edited lines are being validated through PCR, sequencing, and pathogen assays. The integration of QTL-seq with functional genomics will accelerate the development of GSB-resistant cultivars, reducing reliance on fungicides and enhancing sustainable cucurbit production.

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Examining the Roles of CRK38 and RUB Genes in Enhancing Multi-Metal Stress Tolerance in Arabidopsis thaliana. S.K. Cook*, V. Thakral, S. Chinreddy, and U.K. Reddy, Department of Biology, Gus R. Douglass Institute, West Virginia State University, Institute, WV 25312.

Acidic soils, which comprise nearly half of the world's arable land, pose a major threat to global agriculture due to the increased solubility and toxicity of heavy metals such as aluminum, cadmium, and arsenic. Understanding the molecular basis of plant tolerance to heavy metals is essential for engineering resilient crops suited to contaminated or nutrient-deficient soils. This study investigates the functional roles of *CRK38* (Cysteine-Rich Receptor-Like Kinase 38) and *RUB* (Related to Ubiquitin) genes in mediating tolerance to multiple metal stresses and phosphate starvation in *Arabidopsis thaliana*. T-DNA insertion mutants, overexpression lines, and CRISPR/Cas9-generated knockout lines were systematically evaluated under varying pH and metal ion conditions. Preliminary data show that *RUB* knockout lines exhibit enhanced aluminum tolerance compared to wild-type and overexpression lines, suggesting a link between rubylation and stress signaling. Ongoing work focuses on creating *CRK38-RUB* double mutants and crosses with *MATE* and *ALMT1* mutants to dissect additive and epistatic interactions in organic acid-mediated detoxification pathways. These findings provide insights into plant stress physiology and contribute toward developing molecular strategies for breeding metal-tolerant and nutrient-efficient crop varieties.

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Functional Analysis of AP2 and PPR Genes in Tomato Reveals Their Regulatory Roles in Fruit Metabolism and Stress Adaptation. S. Ramireddy*, S. Chinreddy, C. Lopez-Ortiz, P. Nimmakayala, and U.K. Reddy, Gus R. Douglass Institute, West Virginia State University, Institute, WV 25312.

Understanding the molecular determinants of fruit quality and stress resistance is essential for improving tomato breeding and productivity. In this study, we functionally characterized two key regulatory gene families – APETALA2/Ethylene Response Factor (AP2/ERF) and Pentatricopeptide Repeat (PPR) – identified through genome-wide association studies (GWAS) and spatial transcriptomic analyses in *Solanum lycopersicum*. Using CRISPR/Cas9-mediated genome editing via *Agrobacterium tumefaciens* transformation, we generated multiple independent knockout lines of AP2/ERF and PPR in the MicroTom cultivar. Phenotypic evaluations revealed distinct and complementary roles of these genes in growth, ripening, and stress tolerance. AP2/ERF mutants exhibited reduced vegetative growth, delayed flowering, accelerated ripening, and enhanced anthracnose resistance, suggesting its function as a negative regulator of ripening and a susceptibility factor. Conversely, PPR mutants displayed increased plant vigor, early fruit maturation, and elevated carotenoid accumulation, consistent with their role in plastid development and pigment metabolism. Metabolomic profiling revealed broad alterations in primary and secondary metabolites, particularly in carotenoid and phenylpropanoid pathways. Both knockout lines demonstrated improved drought tolerance, maintaining higher leaf turgor and delayed wilting under water deficit. These findings highlight the multifunctional roles of AP2/ERF and PPR in coordinating tomato fruit development, metabolite composition, and abiotic stress resilience, providing a molecular foundation for precision breeding of Solanaceae crops with enhanced nutritional quality and environmental adaptability.

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Understanding the Pathogens Behind Sweet Potato Postharvest Losses in Missouri. U. Kamboj* and W. Kaluwasha, College of Agriculture, Environmental and Human Sciences, Lincoln University of Missouri, Jefferson City, MO 65101.

Sweet potato *(Ipomoea batatas)* is an important crop with significant nutritional value, but postharvest losses due to fungal infections that occur prior to and after harvest pose a major challenge. There is limited information on the pathogens responsible for sweet potato postharvest losses in Missouri. The objective of this research was therefore to isolate and identify fungal pathogens from diseased sweet potato storage roots. Sweet potato storage roots with symptoms of postharvest diseases were either obtained from local sweet potato farmers or collected from stored roots harvested from our research plot. Following disinfection, storage root pieces (5mm) were cultured on Potato Dextrose Agar (PDA) amended with antibiotic for 4-5 days. Developing colonies were then transferred to new PDA plates to obtain pure cultures. Several fungal isolates representing diverse genera were successfully isolated from diseased sweet potato storage roots. Whole-root and root-slice pathogenicity assays of pure isolates in addition to non-inoculated controls were conducted using storage roots of sweet potato cultivars with diverse characteristics. Results

will be discussed in the presentation. Pathogenic isolates are being identified based on morphology and/or amplification of the internal transcribed spacer (ITS) region. This research will provide information on the prevalent fungal pathogens causing diseases during sweet potato storage in Missouri and variations in susceptibility to these pathogens, allowing for further research evaluating sustainable disease management strategies to reduce losses.

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Chemical and Nutritional Profiling of Industrial Hemp (*Cannabis sativa* L.) Seeds for Advancing Sustainable Breeding. K.P. Thennakoon[1]*, K.C. Daundasekara[1], J.J. Jones[1], S. Woldesenbet[1], A. Weerasooriya[1], D. Wang[2,3] and G. Murillo Morales[2,3], [1]CAFNR Research, College of Agriculture, Food and Natural Resources, [2]Center for Energy and Environmental Sustainability, and [3]Department of Chemistry, Prairie View A&M University, Prairie View, TX 77446.

Industrial hemp (*Cannabis sativa* L.) has long been cultivated for food, fiber, and medicine. Centuries of domestication and selective breeding have made identification of hemp genotypes more complicated. The legalization of low-narcotic hemp in the U.S. has renewed opportunities to explore its agricultural and nutritional potential, emphasizing the importance of characterizing seed quality for sustainable breeding and crop improvement. This study used metabolomic approaches to characterize and screen diverse hemp genotypes, with the goal of identifying high-quality seeds with higher nutrition value. Seeds from 40 accessions were obtained from multiple sources, including the USDA seed bank. Finely ground seed samples were assessed to determine compositional and nutritional characteristics using an integrated analytical approach. Thermogravimetric Analysis (TGA) was used to quantify percentage moisture and volatile matter, thereby assessing seed quality and thermal stability. Macro- and micronutrient concentrations were determined through Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES 5100), ensuring precise elemental quantification. Protein content was measured using the Plant Total Protein Extraction Kit (Sigma-Aldrich) to assess the nutritional composition of the seeds. Additionally, dried seed samples will be extracted by sonication using hexane and methanol, followed by Gas Chromatography-Mass Spectrometry (GC-MS) and High-Performance Liquid Chromatography (HPLC) analyses to identify metabolite diversity. These analyses will generate seed chemical fingerprints across genotypes, enabling the identification of nutritionally superior seeds. Future studies will integrate metabolomics with advanced genetic diversity assessments and phenomics to enable the discovery of quality seeds with higher nutrition value, thereby supporting breeders with resilient, high-yielding hemp cultivars.

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Improving Detection Methods for Recovering Phorid Flies from Release Sites. S. Fann*, J.B. Oliver, N. Youssef, and K.M. Addesso, Department of Agricultural Sciences and Engineering, Tennessee State University, Otis L. Floyd Nursery Research Center, McMinnville, TN 37110.

Phorid flies *Pseudacteon* spp. (Diptera: Phoridae) are solitary parasitoids that are highly host specific. They parasitize worker ants in the *Solenopsis saevissima* (Smith) complex in their native range of South America and in the red, black, and hybrid species found in Tennessee. Phorids can locate their hosts from long distances, cued by pheromones emitted by the ants during nest disturbance or foraging. Laboratory studies have demonstrated that they are attracted to piles of dead worker ants, so odor is likely a mediator of attraction. Phorids hold promise as a means of biocontrol; for example, by disturbing foraging worker ants, they could help limit the colony's resource procurement without the need to kill the queen. Three species have been previously released by the Oliver lab and collaborators in Tennessee, including *Pseudacteon curvatus*, *Pseudacteon tricuspis*, and *Pseudacteon obtusus*. To date, only *P. curvatus* has been recaptured. In this study, we evaluated modifications of the pizza tri-stand trap to improve phorid capture. We found that the presence of live and dead ant baits in the trap improved capture at known sites of *P. curvatus,* while other baits were less successful. We also evaluated the use of tape on various pan traps, including plastic and cardboard, as a potentially easier way to recover trapped flies and reduce the steps required for subsequent molecular experiments. We found differing success rates. We will continue to work on trap modifications and will deploy the best trap design at the release sites of the other unrecovered species.

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Analysis of Methods to Facilitate Salinity Stress Tolerance in Common Bean (*Phaseolus vulgaris* L.) Using Smooth Cordgrass (*Sporobolus alterniflorus*) as a Model. K.D. Williams*, A. Todd, and G. Ozbay, Department of Agriculture and Natural Resources, Delaware State University, Dover, DE 19901.

Salinity stress, intensified by weather extremes, threatens global agriculture and severely impacts common bean (*Phaseolus vulgaris L.*), a key glycophyte crop. Salt stress reduces yield and increases mortality, though some genotypes exhibit tolerance partly due to endophytic microorganisms. In contrast, smooth cordgrass (*Sporobolus alterniflorus*), a salt-tolerant marsh grass stabilizing Delaware's coastline, thrives in high-salinity environments and likely harbors efficient salt-responsive alleles. This study compares two strategies for enhancing salinity tolerance in common bean: gene editing and endophyte inoculation. Common bean and marshgrass were exposed to 35 ppt (parts per thousand), 10 ppt, and 0 ppt salinity. RNA was extracted, cDNA synthesized, and qPCR performed to identify salt-responsive genes for CRISPR-Cas12a design. Edited components were agroinfiltrated into bean leaf tissue. Endophytes were extracted from common bean and marshgrass tissues, sub-cultured, and biochemically tested for plant growth-promotion abilities. Microbes that passed biochemical testing were co-cultured to determine mutual compatibility and were infiltrated into leaf tissue. Endophyte-infiltrated and agroinfiltrated plants were then salt stressed side-by-side at 35 ppt, 10 ppt, and 0 ppt to compare the efficacy of each treatment morphologically. Physiological testing measuring relative leaf area, chlorophyll content, and RNA-binding protein (RPB) expression was conducted on each treatment group. Results show significant differences between physiological measures of plant groups subjected to the two treatments, indicating a disproportion in efficacy between the treatments. This study paves the way for potential studies further analyzing the mediation of salt stress effects on crop plants.

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***Agrobacterium*-Mediated Transformation of Sweetpotato for Dual Viral Resistance Against SPLCV and SPVC.** A. Jones*, C. Zhang, and Y. Meng, Department of Agriculture, Alcorn State University, Lorman, MS 39096.

Sweetpotato (*Ipomoea batatas* L.), a member of the Convolvulaceae family, ranks as the world's seventh most important food crop. Mississippi is the third-largest U.S. producer of sweetpotato after North Carolina and California. However, sweetpotato production faces a major constraint: the cumulative effect of viral infections, which leads to severe cultivar decline and yield losses. *Sweetpotato leaf curl virus* (SPLCV) and *Sweetpotato virus C* (SPVC) are two of the primary viruses responsible for devastating diseases and yield reductions in Mississippi. In this study, a novel biotechnological approach was developed to address the viral disease problem. To induce gene silencing in transgenic sweetpotato, a dual-resistance genetic construct targeting SPLCV and SPVC was introduced into a binary vector for expression. *Agrobacterium*-mediated transformation was used to achieve transgene expression in the sweetpotato line PI318846. Seven transgenic lines were confirmed by PCR. To evaluate the viral resistance of these transgenic lines to SPLCV and SPVC, grafting and biological infection protocols were optimized; the resulting data will be discussed further.

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Fire in the Orchard: Isolation, Characterization, and Antimicrobial Sensitivity of *Erwinia Amylovora* Causing Fire Blight on Pear in Mississippi. A.O. Popoola* and E. Ali, Department of Agriculture, Alcorn State University, Lorman, MS 39096.

Erwinia amylovora, the causal agent of fire blight, is a destructive pathogen of global economic importance to pome fruit production. Although the disease is acknowledged in Mississippi's agricultural extension, a critical gap exists in the scientific record, with no formal reports on the pathogen's isolation or characteristics from the state. This study provides the first scientific documentation of *E. amylovora* isolation and characterization in Mississippi and assesses the antimicrobial sensitivity of local isolates. Five bacterial isolates were recovered from symptomatic pear trees in a Mississippi orchard. Identification was confirmed using a polyphasic approach, including biochemical tests (catalase-positive, oxidase-negative, levan-positive) and species-specific molecular amplification. Pathogenicity for all isolates was unequivocally verified by fulfilling Koch's postulates on immature pear fruit. In vitro sensitivity assays against streptomycin, the primary bactericide for fire blight control, revealed a significant finding: four of the five isolates (80%) were resistant. This study not only constitutes the first report of the isolation and characterization of pathogenic *E. amylovora* in Mississippi but, more critically, provides the first evidence of streptomycin-resistant populations.

This discovery has urgent implications for disease management strategies in the region, indicating a possible future risk of control failure with streptomycin and necessitating an immediate re-evaluation of spray recommendations.

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Development of QPCR Markers for the Rapid Detection of Toxigenic *Aspergillus flavus* in Peanuts. M.M. Masud*, Department of Agriculture, S. Waliullah, Department of Biology, and A. Emran, Department of Agriculture, Alcorn State University, Lorman, MS 39096.

Aflatoxin contamination caused by *Aspergillus flavus* is directly and indirectly linked to human food chains, posing significant health hazards to humans and livestock. An early detection of toxin-producing *A. flavus* is crucial for managing this disease. In this study, we developed a molecular marker for the rapid and accurate detection of aflatoxigenic *A. flavus*. We collected 104 peanut samples from different locations across Mississippi and identified *A. flavus* through specific primers (FLA1/FLA2). Four genes (*aflD*, *aflR*, *aflP*, and *aflQ)* were selected from the aflatoxin biosynthesis gene cluster, and subsequent primers were designed based on the target region, followed by primer optimization and validation. Based on the developed markers, we employed RT-PCR and RT-qPCR assays to validate the markers, including gene expression and quantification. Our results indicated that all the isolates belong to *A. flavus*, showing a sharp band at 490 bp. We also found different gene expression and quantification patterns throughout the four genes among all isolates using our developed markers. Our developed marker system successfully distinguished toxigenic and atoxigenic *A. flavus* isolates with high specificity and sensitivity. Our correlation study between gene expression results and aflatoxin production indicated the ability to produce specific derivatives by a specific gene. This molecular diagnostic approach allows for rapid screening of contaminated peanut samples, enabling early intervention and improved management strategies. Overall, the findings of this study contribute to the establishment of a reliable, cost-effective, and high-throughput detection system for aflatoxin contamination, promoting food safety and sustainable peanut production.

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Pathogenicity of *Didymella americana* Isolated from Watermelon. P. Bista*, L. Brooks, E. Clark, F. Mrema, I. Atoloye, and B.P. Bhatta, Department of Agriculture, Alcorn State University, Lorman, MS 39096.

Didymella americana is a fungal pathogen that causes leaf spot and leaf blight diseases. It has been reported to infect lima bean, table beet, corn, wheat, lilies, and tea crops. Leaf spots were observed on symptomatic watermelon leaves during a recent field research trial. After isolation, phenotyping, and sequencing, the causative fungus was identified as *D. americana* (GenBank: PV754059). Further greenhouse studies were conducted in a completely randomized design using predetermined fungal spore concentration to assess the pathogenicity of *D. americana* on five watermelon genotypes (PI 560013, WUCH Hybrid, Charleston Diploid, PI 189225, and Jubilee) and host crops (table beet, soybean, tomato, sweet corn, and lima bean). Disease severity and incidence were recorded two weeks after inoculation. Results indicated that the popular watermelon cultivar 'Jubilee' was the most susceptible, whereas the wild (PI 189225) showed high resistance. Likewise, tomato and beet root were also severely affected by this pathogen. However, soybean, sweet corn, and lima bean showed tolerance. Koch's postulates were confirmed by isolating fungus from the symptomatic leaves of the inoculated plants and sequencing the isolated daughter strains of the fungus. This study revealed that *D. americana* is pathogenic on watermelon, table beet, and tomato. This is the first study to report pathogenicity of *D. americana* on watermelon and tomato. Further studies include fungal inhibition tests using conventional and organic fungicides. These findings are important in developing resistant cultivars and determining effective disease management strategies against emerging fungal pathogens such as *D. americana*.

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***Scutellaria montana* Chapman: Floral Biology and *in vitro* Conservation of a Federally Threatened Plant.** S.A. Armstead* and N. Joshee, Agricultural Research Station, Fort Valley State University, Fort Valley, GA 31030.

Scutellaria montana Chapman, commonly known as large-flowered/mountain skullcap, is a perennial species from Lamiaceae that faces an existential risk. Habitat fragmentation and limited natural regeneration are the two major contributing factors to the poor natural population of *S. montana*. Limited data is available on the pollen viability,

germination, output, and pollination success that are critical for natural regeneration. This study analyzed the key reproductive parameters during flower development, providing insights into the reproductive challenges of *S. montana*. Floral morphometric data were collected in 25 post-anthesis (POA) flower samples. Substantial esterase activity at the stigmatic surface revealed an active environment for pollen germination. To assist ex situ conservation, efficient micropropagation protocol development is in progress. An explant sterilization protocol was optimized for the plant samples collected from the greenhouse-raised plants, which contained the steps of washing explants in running water for 30 minutes, a quick wash in 70% ethanol followed by 15% bleach solution treatment for 20 minutes, multiple washes in autoclaved water and inoculation of juvenile shoot tips and nodes. This method exhibited a 60% survival of clean decontaminated cultures. By using Driver and Kuniyuki Walnut (DKW) basal medium and two cytokinins, BAP (benzyl amino purine) and TDZ (thidiazuron) at various concentrations (0.5 µM, 2.5 µM, 5.0 µM, 10.0 µM, and 50.0 µM), an optimized protocol was developed.

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Phytoalexin/Aflatoxin Synthesis during *in vitro* Peanut-*Aspergillus flavus* Interaction. P. Lakkarsu*, S.G. Saroja, and N. Joshee, Agricultural Research Station, Fort Valley State University, Fort Valley, GA 31030.

Aspergillus flavus infection of peanut causes huge annual economic losses due to aflatoxin contamination, with infected crops unfit for human consumption. While peanuts naturally produce phytoalexins as antimicrobial defense compounds against fungal invasion, the temporal relationship between phytoalexin and aflatoxin accumulation remains poorly understood, limiting our ability to predict contamination risk and develop effective resistance strategies. This study investigated the interplay between phytoalexin production and aflatoxin accumulation across different peanut cultivars during the early stages of *A. flavus* infection. Peanut seeds were surface-sterilized and artificially inoculated with *A. flavus* NRRL 3357 spore suspension (5×10^5 spores/mL) through precision-drilled cavities, then incubated in the dark on 1.5% agar medium at 30°C to simulate field infection conditions. Samples were harvested at 48, 72, and 96 h post-inoculation alongside sterile controls, mechanically pulverized, and extracted using methanol-water (90:10 v/v) for dual analysis of phytoalexin and aflatoxin content profiles using High Performance Liquid Chromatography and Nuclear Magnetic Resonance spectroscopy. We anticipate distinct temporal signatures where resistant peanut cultivars rapidly mobilize diverse phytoalexins (arachidin, medicarpin, and resveratrol derivatives) within 48-72 h of infection, creating a chemical barrier that suppresses aflatoxin biosynthesis, while susceptible varieties show delayed or insufficient phytoalexin responses, allowing progressive aflatoxin accumulation over a 96-h period. It is expected to uncover cultivar-specific phytoalexin fingerprints that correlate inversely with aflatoxin levels, potentially identifying early biochemical markers for predicting contamination risk. This research may establish the foundation for developing rapid diagnostic tools to assess peanut lots for aflatoxin susceptibility and optimize post-harvest economic losses.

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Species-Specific Susceptibility of Stored-Product Insect Pests to Entomopathogenic Nematodes. E.E. Enobong*, J.K. Danso, and G.N. Mbata, Entomology Research Laboratory, Agricultural Research Station, Fort Valley State University, Fort Valley, GA 31030; and D.L. Shapiro-Ilan, USDA-Agricultural Research Service, Byron, GA, 31008.

Stored-product insects such as *Tribolium castaneum* (Herbst), *T. confusum* (Jacquelin du Val), *Rhyzopertha dominica* (Fabricius), and *Oryzaephilus surinamensis* (Linnaeus) cause major postharvest losses in stored grains. Dependence on synthetic pesticides as a management tactic raises issues of residues, resistance, and environmental contamination, highlighting the need for eco-friendly alternatives. Entomopathogenic nematodes (EPNs) are promising candidates for postharvest pest management. This study tested the virulence of four EPN strains –*Steinernema carpocapsae* (All), *S. feltiae*, *Heterorhabditis indica*, and *H. floridensis* (K22) – against the four insects under laboratory conditions. Bioassays were conducted with three infective juvenile (IJ) concentrations (1,000, 2,000, and 4,000 IJs/mL) and evaluated at 1, 3, 5, 7, 14, and 21 days post-inoculation under 30 °C and 75% relative humidity. Mortality was significantly affected by insect species, EPN strain, concentration, and exposure time ($p<0.05$). *S. carpocapsae* and *H. indica* induced rapid mortality in *Tribolium* spp. within 3-7 days, while *R. dominica* and *O. surinamensis* showed delayed responses, peaking at 14-21 days. Overall mortality ranged from 8.3% to 91.6%, increasing with dose and time, whereas controls remained below 8%. Susceptibility ranked as *O. surinamensis* (61.3%) > *T. confusum* (55.8%) > *T. castaneum* (51.1%) > *R. dominica* (5.6%). Among EPNs, *H. floridensis* and *S. carpocapsae* consistently achieved the highest mortality (>35%), whereas *S. feltiae* and *H. indica* were less effective (<12.2%). These results confirm

species-specific susceptibility and identify *H. floridensis* and *S. carpocapsae* as potential biocontrol agents. Field evaluations are needed to validate their use in integrated pest management programs.

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Machine Learning Approaches for Automated Classification of Sericea Lespedeza Species. R. Kota*, A. Cockrell, A. Siddique, N. Whitley, A.K. Mahapatra, and T.H. Terrill, Department of Agricultural Sciences, Fort Valley State University, Fort Valley, GA 31030; S.S. Panda, Institute for Environmental Spatial Analysis, University of North Georgia, Oakwood, GA 30566; E.R. Morgan, Institute for Global Food Security, Queen's University, Belfast, UK; and J.A. van Wyk, Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

Sericea lespedeza (*Lespedeza cuneata*), a perennial leguminous plant, plays an important role in sustainable agriculture due to its drought resistance, soil conservation benefits, and value as a bioactive forage for livestock. Accurate classification of *Lespedeza* species is critical for their effective use in agroecosystems, where misidentification can limit productivity and ecological benefits. Traditional classification approaches rely on manual expertise, which is time-consuming and prone to error. Advances in machine learning provide opportunities for automated, scalable species recognition. This study investigated the use of Support Vector Machine (SVM), Backpropagation Neural Network (BPNN), and Convolutional Neural Network (CNN) models for classifying six sericea species. High-resolution leaf and stem images were captured using a Samsung A54 smartphone under control conditions. Preprocessing steps, including scaling, normalization, and data augmentation, were applied to reduce noise and improve model generalization. Both SVM and BPNN achieved an accuracy of 82% and a weighted F1-score of 0.82, while CNN yielded comparable performance. A Cohen's Kappa value of 1.0 across models confirmed near-perfect classification agreement. The balanced dataset and distinct visual traits of lespedeza leaves and stems contributed to consistent model performance. While SVM and BPNN delivered strong results, CNN demonstrated potential advantages due to its ability to learn hierarchical features, particularly relevant for larger datasets and more complex plant structures. Future research should explore hyperspectral imaging, transfer learning, and integration into mobile applications for real-time, field-ready species identification. These findings underscore the growing role of AI in precision agriculture, providing practical tools for researchers, farmers, and environmental managers.

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Optimization of Root Induction in Peanut (*Arachis hypogaea*) Cuttings: A Sustainable Alternative to Conventional Seed-Based Propagation. M. Keys*, D. Jones, and K. Matand, Center for Biotechnology Research and Education, School of Agriculture and Applied Sciences, Langston University, Langston, OK 73050.

Micropropagation has been widely applied for rapid multiplication, genetic transformation, embryo rescue, and pathogen elimination in many crops, including peanut (Arachis hypogaea). Despite its scientific value, micropropagation requires specialized laboratories, technical expertise, and costly reagents, which limit its accessibility for small-scale farmers and researchers with limited resources. Therefore, exploring potentially simpler and cost-effective alternative cloning methods is encouraged. This study aimed to evaluate a "macro-propagation" method for its potential to cost-effectively clone peanut plants through stem cuttings using locally available organic materials. We hypothesized that during the wound healing process of the cuttings, some of the cellular perceptions resulting from the signals of organic substance treatments could lead to root induction. Branches from four peanut market types; Virginia, Valencia, Spanish, and Runner, were collected and treated with tomato, potato, banana, jalapeno, lemon, and zucchini for potentially containing natural rooting stimulants alongside water as a control. A randomized block design with three replicates per treatment was applied. Individual cuttings represented experimental units. Cuttings were rooted under greenhouse conditions and later transferred to the field plots to assess survival, growth, flowering, and pod formation. The results revealed variable rooting responses among the tested types. Virginia exhibited the highest rooting and field adaptation rates (>60%), followed by Valencia, while Spanish and Runner showed the lowest success. These findings demonstrate the feasibility of vegetative propagation in peanuts using simple, organic substance treatments, providing a sustainable and cost-effective alternative to seed-based production for small and resource-limited farmers in Oklahoma and similar peanut-growing regions.

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Evaluating Parent-of-Origin Effect in Vintage Tomato Marker-Assisted Backcross Breeding. B. Maharjan*, K. Bhattarai, and **B.E. Liedl,** Department of Biology, West Virginia State University, Institute, WV 25112.

Interest in local food has increased demand for vine-ripened and uniquely colored tomatoes. Vintage tomato varieties meet this demand with superior flavor and high market value but are vulnerable to pests and diseases, limiting profitable production. Our focus is to incorporate multi-pest resistance from a donor parent to two vintage varieties, Radiator Charlie and Mr. Stripey, using marker-assisted backcross breeding. Earlier vintage improvement efforts used F1 hybrids made in one direction and faced challenges in cross success, fruit set, and seed germination, prompting the creation of reciprocal F1 crosses to test for parent-of-origin effects. In both the BC_1 and BC_2 populations, the expected inheritance for three pest-resistance genes using molecular markers did not fit the expected 1 heterozygous:1 homozygous recessive ratio for at least one or more of the markers for each population. Principal component analysis of SNP markers revealed clustering among four populations for each vintage variety; however, both BC_1 and BC_2 had admixtures of the populations with no consistent evidence supporting a parent-of-origin effect. SNP loading patterns, primarily from chromosome 8, indicated distinct genomic contributions among crosses. The fixation index identified statistically significant differences between the BC populations and their donor parents. Only the Radiator Charlie BC1 populations exhibited a parent-of-origin effect for the fixation index. Parent-of-origin effect was detected in cross success, seed germination, and the fixation index. However, the best cross direction for cross success was using the vintage variety as the female, but seed germination required it to be the male parent.

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Physiological and Molecular Characterization of Carbon Storage Efficiency in Industrial Hemp (*Cannabis sativa* L.). S. Sharma*, S.H. Mahadi, P. Koirala, C. Christian, and B. Valliyodan, College of Agriculture, Environmental and Human Sciences, Lincoln University of Missouri, Jefferson City, MO 65101.

Industrial hemp (*Cannabis sativa* L.) is an emerging multipurpose crop with high potential for atmospheric carbon capture due to its extensive root system and high biomass productivity. However, variation in carbon storage capacity among genotypes remains explored insufficiently. This study aims to evaluate the carbon sink potential of two hemp varieties: dual-purpose type (Futura), a fiber type (Jinma) and a landrace (LHV). The root system and seeds, the primary carbon sink tissues, were examined to assess genotypic differences in carbon allocation and storage efficiency. Physiological parameters, including photosynthetic rate, stomatal conductance, transpiration rate, and intercellular CO_2 concentration, were recorded using LI-COR 6800 and LI-COR 600 systems. Total organic carbon in root and seed tissues was quantified using a Total Organic Carbon (TOC) analyzer to evaluate carbon storage potential. We conducted the gene expression profiling of selected genes associated with carbon allocation and storage, including transporter gene: sugar transport (SUT), suberin biosynthesis gene: Glycerol-3-Phosphate Acyltransferase 5 (GPAT5), and Cytochrome P450 86A1 (CYP86A1) in roots and starch biosynthesis genes - ADP-Glucose Pyrophosphorylase (AGPase) and Starch Branching Enzyme (SBE) - in seeds. Varieties exhibiting higher photosynthetic efficiency and carbon assimilation capacity showed enhanced carbon accumulation in sink organs. These findings help identify hemp varieties/genotypes with superior carbon storage potential, contributing to molecular breeding strategies for improved carbon storage.

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Maximizing Quinoa Production Through a Dual-Purpose Harvesting Method. G. Ndunguru*, S. Pathan, and A.G. Addissu, College of Agriculture, Environmental and Human Sciences, Lincoln University of Missouri, Jefferson City, MO 65101.

Quinoa is typically grown either for grain or leafy greens, but not from the same crop. This study introduces a novel dual-purpose production method that enables the harvest of leafy greens first, followed by grain from the same plant, thereby enhancing both overall productivity and economic returns. Four quinoa lines were evaluated under two treatments: (1) cut, where leafy greens were harvested four weeks after germination and plants were subsequently allowed to grow and mature, and (2) control, where plants were grown to full maturity without harvesting the greens. The experiment was conducted using a randomized complete block design with three replications across three planting dates, spaced one week apart. Field management practices remained consistent across all treatments and dates. Grain yield was consistently higher in the cut treatment compared to the control across all three planting dates. This dual-purpose system offers multiple benefits, including harvesting both leafy greens and increasing grain yields, reducing

water and fertilizer requirements, minimizing field preparation to a single operation, and shortening the production cycle to approximately 100 days. These findings highlight the potential of quinoa as a dual-purpose crop that can strengthen food and nutritional security while promoting sustainable agricultural practices, particularly for smallholder farmers.

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Natural Genetic Variation of Selected Agronomic Traits in Cowpea Germplasm. K.K. Ntsunyo*, J.Y. Asiamah, P. Koirala, S.H. Mahdi, C. Carson, and B. Valliyodan, College of Agriculture, Environmental and Human Sciences, Lincoln University of Missouri, Jefferson City, MO 65101.

Cowpea (*Vigna unguiculata* L. Walp.) is a nutritionally and agronomically important legume widely cultivated in sub-Saharan Africa and other tropical regions. However, the current production rate is far below global demand. A better understanding of the physiological and genetic basis of plant performance is required for the development of crop-breeding strategies. In this study, a diverse panel of 200 cowpea accessions were evaluated under field conditions at the G.W. Carver Farm, Lincoln University. A comprehensive phenotypic screening was conducted for selected traits, including flowering time, maturity, plant height, and canopy. A genome-wide association study (GWAS) was conducted to identify genomic regions associated with these major traits. The same subset was grown under controlled conditions for three weeks to screen for variations in the root system architecture (RSA) and GWAS was conducted to identify genes and mutations associated with major RSA traits. The GWAS revealed several significant marker-trait associations (MTAs), including loci on multiple chromosomes linked to the traits analyzed. Notably, strong associations were detected for striga resistance, overlapping with previously reported QTL regions, validating the utility of this panel. Candidate genes linked to RSA were also identified, providing targets for gene expression studies and further functional validations. This study demonstrates the value of integrating African landraces and wild relatives for dissecting the genetic architecture of plant performance and crop improvement in cowpea. The identified markers and candidate genes offer valuable resources for marker-assisted selection and molecular breeding aimed at improving cowpea resilience and productivity in both U.S. and African environments.

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Assessment of Thrips Populations, Diversity, and Distribution in Missouri Onions. R. Dhariwal*, A. Chitturi, and S. Veeramasu, College of Agriculture, Environmental and Human Sciences, Lincoln University of Missouri, Jefferson City, MO 65101.

Onions (*Allium cepa*) are an important crop and an emerging specialty crop in Missouri's diversified vegetable production systems. Thrips, particularly onion thrips (*Thrips tabaci*), are among the most damaging pests of onion worldwide. They directly damage leaves by feeding on them, causing leaf scarring and reducing bulb size, yield and quality – resulting in up to 45% economic losses. Onion thrips also transmit *Iris Yellow Spot Virus* (IYSV), which further reduces the photosynthetic area of plants as well as the storage quality of onion bulbs. However, information on thrips species diversity and their population dynamics in Missouri onion systems remains scarce. To fill this gap, a pilot study was initiated to identify the thrips species associated with onions and to document their distribution and seasonal fluctuations under local field conditions in the southeastern region of Missouri. Thrips were monitored weekly throughout the growing season using yellow sticky traps. Captured specimens were collected for identification to determine the predominant species present in the cropping system. Preliminary results indicate that *T. tabaci* was the most frequently occurring species, with population peaks corresponding to warmer periods of the season. Additional thrips species were occasionally observed and are currently being identified to establish a more comprehensive species profile. The results will serve as a foundation for developing integrated pest management strategies and regional monitoring tools to support sustainable onion production and protect the economic viability of this emerging crop.

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Pathogenicity Assessment of *Fusarium* Isolates Associated with Fruit Rot in Heirloom Tomato. M. Pokharel* and W. Kaluwasha, College of Agriculture, Environmental and Human Sciences, Lincoln University of Missouri, Jefferson City, MO 65101.

Fungal pathogens pose a significant threat to heirloom tomato (*Solanum lycopersicum* L.), which is highly valued for its unique flavor, taste, and appearance. This experiment was conducted to test the pathogenicity of fungal isolates obtained from diseased heirloom tomato fruits. Symptomatic heirloom tomato fruits were collected from field research plots throughout the growing season. Tomato fruit pieces were surface sterilized in 10% sodium hypochlorite and 70% ethanol prior to plating on Potato Dextrose Agar (PDA) amended with antibiotic and incubated at 25°C. Emerging fungal colonies were subcultured onto fresh PDA plates to obtain pure cultures. Agar plugs from pure cultures of eleven fungal isolates (seven *Fusarium longifundum*, three *F. aethiopicum* and one *F. fujikuroi*), were used to inoculate artificially wounded, surface-sterilized tomato fruits purchased from a grocery store; in addition, a control group was inoculated with agar plugs from plain PDA. Inoculated tomato fruits were incubated at 25°C for seven days to observe symptom development, and disease incidence was recorded. All isolates induced rot symptoms, with variations observed in the severity of rot and amount of sporulation. These isolates will be subjected to further molecular identification and used to compare heirloom cultivar responses in fruit and whole-plant pathogenicity assays. Pathogenic isolates will be used in future research to evaluate management strategies.

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Fine-Mapping of *Get03* – One of the Loci Controlling Type-IV Trichome Development in *Solanum lycopersicum*. D. Ledesma*, Department of Biology, C. Parlapiano, Agricultural & Environmental Research Station, and E. Vendemiatti, Department of Biology, West Virginia State University, Institute, WV 25177.

Trichomes are specialized epidermal structures that provide multiple protective functions in plants, including defense against insect herbivory, pathogens, and abiotic stresses. Among the diverse trichome types found in tomatoes (*Solanum spp*.), type-IV glandular trichomes are particularly important due to their production of acylsugars, natural insecticides that confer broad-spectrum pest resistance. However, cultivated tomatoes (*S. lycopersicum*) typically lose these trichomes after the seedling stage, limiting their defensive potential. Previous genetic analyses identified several loci controlling the development of type-IV trichomes in tomato, introgressed from the wild species *S. galapagense*. The present project aims to fine-map the *Get03* locus on chromosome 3 to identify candidate genes responsible for sustaining type-IV trichomes during plant maturity. This region currently spans 11.13 Mb and contains 879 genes. Using a recombinant population derived from a cross between the cultivated variety Micro-Tom (MT) and the introgressed line MT-*Get03*, plants are being phenotyped for trichome density and structure, while genotyped with CAPS markers designed for the *S. galapagense* genomic region. The integration of morphometric and molecular data will narrow the chromosomal interval underlying the trait, paving the way for gene identification. The results will advance the understanding of epidermal differentiation mechanisms and facilitate the breeding of pest-resilient crops in the Solanaceae family.

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Enhancing Early Field Establishment of *Moringa oleifera* through Mycorrhizal Inoculation and Indigenous Soil Management Practices. E. Harris*, J.A. Yisau, F. Mrema, I. Atoloye, and A. Ayegbaroju, Department of Agriculture, Alcorn State University, Lorman, MS 39096.

Moringa oleifera is a fast-growing multipurpose tree valued for its nutritional, medicinal, and ecological importance; however, its field establishment in the subtropical southern U.S. is still poorly documented. This study evaluated the effects of mycorrhizal inoculation and indigenous soil management on early field growth of *M. oleifera* at the Model Farm Experimental Station, Alcorn State University, Mississippi. A randomized complete block design with four soil treatments – Control (CO), Mycorrhizal inoculation (MYCO), Native soil (NAT), and Promy compost (PROMY) – was replicated eight times. Growth parameters assessed 10 weeks after transplanting included plant height (HT), collar diameter (CD), internode length (INTD), leaf count (LC), and chlorophyll content (CCH). Analysis of variance revealed significant treatment effects for height and collar diameter ($F_{3,21} = 4.002$, $p = 0.021$; $F_{3,21} = 4.138$, $p = 0.019$), with MYCO producing the highest means (HT = 154.27 ± 9.19 cm; CD = 20.45 ± 1.07 mm) and NAT the lowest (115.81 ± 9.19 cm; 15.95 ± 1.07 mm). Differences in LC, INTD, and CCH were not significant ($p > 0.05$). Correlation analysis showed strong positive associations among HT, CD, and INTD ($r = 0.69–0.86$, $p < 0.001$) and between LC and CD ($r = 0.654$, $p < 0.001$), suggesting coordinated vegetative development and resource allocation. Weak relationships between CCH and morphological traits ($r = –0.065$ to 0.198, $p>0.27$) indicated that structural vigor rather than chlorophyll content drove early growth. Mycorrhizal inoculation significantly improved early establishment and

vigor of *M. oleifera* under Mississippi's humid subtropical conditions, underscoring its value as a sustainable, low-input soil enhancement strategy for regional agroforestry and specialty crop systems.

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Analyzing the Impact of Outliers on Crop Yield Prediction Using Regression Models. D. Leysath*, J. Sahoo, and Y. Kim, Department of Computer Science & Mathematics, South Carolina State University, Orangeburg, SC 29117.

Outliers are data points that significantly deviate from the majority of other observations within a dataset. In the context of machine learning (ML), the presence of outliers can severely degrade model performance by distorting statistical measures and biasing the model training process. We investigated the impact of outliers on regression models used for predicting corn yield. The dataset included features such as dew point, bare soil temp, and rainfall. We injected 130 artificial outliers into the dataset. We detected the outliers using the Interquartile Range (IQR) method, the Z-Score method, and the Modified Z-Score method. The detected outliers were treated by replacing them with the median of the respective feature. This process resulted in three datasets: the original dataset with outliers, the IQR-treated dataset, and the Z-Score-treated dataset. Each dataset was split into an 80% training set and a 20% testing set. We evaluated the performance of three regression models: Linear Regression, Random Forest Regression (RFR), and Support Vector Regression (SVR). We considered three error metrics: Root Mean Squared Error (RMSE), R-squared (R^2), and Mean Absolute Error (MAE). Our results showed that the RFR model achieved the best overall performance for each outlier detection method, showing improvements ranging from 5-10%. The model with the most significant improvement was found to be SVR, which improved RMSE by a factor of 11.43. SVR also improved R^2 and MAE by 100% and 82%, respectively. This study confirms that robust outlier detection and treatment are critical preprocessing steps in machine learning.

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Identification of Natural Semiochemicals from Essential Oils Using Behavioral Screening in *Drosophila melanogaster.* R. Logue* and E. Suber-Bey, Division of Physics, Engineering, Mathematics, and Computer Science, and C. Stratton, Department of Biological Sciences and DNA and Data Science Core (dsDNA Core), Delaware State University, Dover, DE 19901.

Insects detect plant volatiles through chemoreceptors that guide feeding and oviposition. Harnessing these interactions offers opportunities to identify safer, plant-derived pest control compounds. This study uses *Drosophila melanogaster* as a model to build a foundational behavioral dataset for essential oils (EOs) and to identify common semiochemical motifs within these complex mixtures. Flies were exposed in controlled arenas to single-drop EO presentations representing citrus, floral, spicy, and herbal classes, and their responses were recorded under standardized video. Behavioral endpoints included orientation, approach or avoidance, contact latency, grooming, and immobilization, with exposure conditions held constant across trials. Early observations indicated that certain EO classes, particularly citrus chemotypes, often elicited strong behavioral activity in this model without presuming dose-specific outcomes. To move beyond empirical labels, we decomposed EO compositions into constituent volatile profiles and cross-referenced those profiles with public chemical records to extract structural and physicochemical metadata (e.g., functional groups, vapor pressure). These features informed a ranked list of candidate semiochemicals prioritized for antennal detection and follow-up bioassay. The resulting dataset will (i) calibrate explainable behavioral AI classifiers within aiNsect, (ii) seed GC-EAD verification of antennal responses to flagged volatiles, and (iii) guide fractionation and recombination of botanical blends toward field-ready, rotation-compatible formulations. By anchoring discovery in a well-characterized model species and emphasizing general behavioral endpoints, this work establishes a reproducible path from EO screening to practical, plant-derived tools for agricultural pest management.

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Identification of a *Solanum pennellii* Chromosomal Region Conferring Type-IV Glandular Trichome Development Without Negative Effects on Tomato Growth and Yield. P. Hart*, S. Ellingson, and E. Vendemiatti, Department of Biology, West Virginia State University, Institute, WV 25177.

Glandular trichomes are epidermal structures for which study is gaining momentum as they are sources of several secondary metabolites of economic and ecological importance. Related wild *Solanum* species are important genetic

resources for cultivated tomato (*S. lycopersicum*), offering natural genetic variations that provide resistance to herbivory. Among these traits, the presence of type-IV glandular trichomes confers insect resistance, since they are sources of natural insecticide acyl sugars (AS). The absence of type-IV glandular trichomes in the cultivated tomato is regarded as one of the causes of its susceptibility to insects. In this work, we created a near-isogenic line (NIL) in the Micro-Tom (MT) cultivar that harbors type-IV trichomes on adult leaves. The NIL was named *Pennellii enhanced trichomes* (MT-*Pet*), and despite the presence of type-IV trichomes, which is considered to be a juvenile character, MT-*Pet* did not present pleiotropic phenotypes and showed the same fruit yield of MT. LC-MS and the Rhodamine-B assay demonstrated that the presence of type-IV trichomes was not sufficient to increase AS accumulation in MT-*Pet*. The only locus introgressed was mapped in the pericentromeric region of chromosome 3, and its eventual cloning will contribute to gaining insights into trichome development and breeding for insect resistance.

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Simulated Tractography of Insect Neural Circuits for Applied Behavioral Control in Agriculture. B. Jacob*[1], R. Hayford[2], J. Lee[2], H. Lawal[1], and C. Stratton[2]; [1]Department of Biology, Delaware State University, Dover, DE 19901; [2]DNA and Data Science Core (dsDNA Core), Delaware State University, Dover, DE 19901.

Insects detect and act on plant volatiles through compact neural circuits that convert olfactory input into rapid behavioral decisions. We leverage the fruit fly model, *Drosophila melanogaster*, to build *simulated* diffusion-tractography maps registered to published connectomic atlases, generating spatial connectivity priors across the antennal lobe, lateral horn, mushroom bodies, and central complex. These neural priors feed the **aiNsect** platform, where explainable behavioral AI links video-derived ethograms to stimulus windows, and gas chromatography–electroantennographic detection (GC–EAD) confirms antennal responses to specific volatiles. The combined framework enables biologically grounded prediction and testing of semiochemical blends that can push pests from crops or pull them into traps, forming the basis of rotation-ready, botanical strategies that conserve beneficial insects. Our applied focus targets *Drosophila suzukii* (spotted-wing drosophila) as the primary pest in berry systems, with thrips as a validated secondary target. By uniting simulated tractography, connectome-guided modeling, and GC–EAD validation, we reduce trial-and-error in volatile selection, improve interpretability of behavioral outcomes, and accelerate field deployment of practical, low-barrier tactics. The result is a reproducible, open framework that strengthens sustainable pest management and facilitates rapid translation from laboratory insight to on-farm guidance.

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The Influence of Natural Genetic Variation in Sorghum Seed Size on the Response to Manure Phytotoxicity. C. Lars*, D. Bradford, S. Woldesenbet, Q. Li, and T. Kebrom, Cooperative Agricultural Research Center, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Poultry farms generate a substantial amount of manure that is rich in plant nutrients. Recycling chicken manure as soil organic amendment is the most environmentally friendly approach to waste management and provides farmers with an additional source of income through manure sales. As a result, commercial chicken manure is widely available in the U.S. However, manure can contain plant nutrients at levels that are toxic to plants. Therefore, evaluating the potential toxicity of manure to crops using the seed germination bioassay is a common practice. However, the lack of a universally accepted seed for the assay has hindered progress in understanding manure phytotoxicity and interpreting results from different laboratories. Recently, we examined the germination of mustard, sorghum, and sweetcorn seeds, which differ significantly in size, in chicken manure extracts and found that larger seeds were more tolerant than smaller ones. To further support these findings, we investigated the impact of natural genetic variation in sorghum seed size. Our results showed that sorghum varieties with smaller seeds were more sensitive to the phytotoxic effects of chicken manure than those with larger seeds. The efforts to identify a universally accepted seed have focused on finding the most sensitive seed to manure phytotoxicity to serve as a model. However, using a highly sensitive seed may label manure with very mild phytotoxicity as toxic. Our research demonstrates that using multiple seed types with varying sizes may provide more informative and reliable results when testing for manure phytotoxicity.

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Infected Leaf Identification Using InceptionNeXt Model. M. Pelzer*, M. Sistla, J. Sahoo, and Y. Kim, Department of Computer Science & Mathematics, South Carolina State University, Orangeburg, SC 29117.

Convolution Neural Networks (CNNs) are used in modern computer vision tasks, where a computer is used to classify, identify, and/or segment an image without the assistance of a human. InceptionNeXt is a CNN architecture that combines ConvNeXt with Inception Modules. It dissects large kernel depth wise into multiple parallel branches to maintain large receptive fields. This model has the added benefit of reducing computational complexity and memory usage while maintaining accuracy. InceptionNeXt has been used in the medical field to aid in the diagnosis of cancers and tumors. However, it is still underexplored in the agricultural sector. In this work, we will investigate the ability of the InceptionNeXt model to accurately detect infected leaves. Our dataset contains images of infected and healthy plant leaves of three crops: tomato, apple, and pepper. We utilized a pre-trained InceptionNeXt model and fine-tuned it using the FastAI framework. We measured accuracy, F1-score, precision, and recall for all three crops. Our results showed that our model achieved an accuracy of greater than 99% for all crops. The model achieved an F1-score of greater than 99% for all crops. Precision was found to be greater than 98% for all crops. The model achieved 100% recall for tomato and apple, and 99.6% for pepper. Our future work will include examining the efficiency of the InceptionNeXt model for multi-class leaf disease classification tasks using RGB and multispectral images.

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Optimization of Stack Ensemble Learning Using Genetic Algorithm for Crop Yield Prediction. N. Omer*, J. Sahoo, and Y. Kim, Department of Computer Science & Mathematics, South Carolina State University, Orangeburg, SC 29117.

In the agricultural sector, Machine Learning (ML) has emerged as a powerful technology for crop yield prediction. While traditional regression models have the capability of producing satisfactory results, studies show that Ensemble Learning, a process that combines multiple ML models, is more powerful for regression tasks. Stacking Ensemble has the unique capability of combining heterogeneous models, enhancing overall prediction accuracy. Although stacking ensembles have been explored for yield prediction, there have been limited efforts to optimally combine the ML models. In this work, we designed a Genetic Algorithm-based approach to determine the optimal ensemble. A Genetic Algorithm works by continuously evolving a population of chromosomes over generations through selection, crossover, and mutation. Each chromosome is a 10-bit binary representation of candidate models, where 0 denotes exclusion and 1 denotes inclusion. We considered a dataset that contains weather parameters, including temperature, humidity, rainfall, and wind speed, as input features and yield as the target feature. A population of 30 chromosomes evolved over 20 generations using tournament selection, with a 50% crossover rate and a 30% mutation rate applied. Chromosomes were evaluated using Root Mean Square Error (RMSE) as the fitness metric, with lower RMSE values indicating stronger ensemble performance. Our results show that the Genetic Algorithm-based approach efficiently found the best combination of candidates and produced an ensemble model that significantly improved prediction accuracy compared to individual ML models. We also observed that a higher crossover caused the Genetic Algorithm to converge early.

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Chickpea Weed Identification Using Hyperspectral Imagery, a Comparison between Supervised vs. Self-Supervised Learning Models. E. Moore*, H. Dakshinamurthy, and N. Kusi, Public Service and Agriculture/1890 Research and Extension, South Carolina State University, Orangeburg, SC 29117.

Weed identification and management in commercial row crops is a labor-intensive yet critical practice for maximizing yield and preventing competition with crops. Chickpea (*Cicer arietinum)*, being a relatively new crop in South Carolina, exhibited heavy weed infestation at the SC State Research and Demonstration Farm in Olar, SC. The challenge of *green-on-green* classification is distinguishing chickpea plants from morphologically and spectrally similar weeds making automated detection complex. Although hyperspectral imagery acquired using a Resonon Pika-L camera provided a high spatial resolution of 2 cm, the spectral distinction between chickpea and weeds remained limited. To address this, we compared supervised and self-supervised learning approaches for weed identification. For the supervised models, manually created chickpea and weed masks were used to train Random Forest and Support Vector Machine classifiers. In contrast, a self-supervised model was trained to learn spectral and spatial representations directly from the unlabeled hyperspectral cubes. Model performance was evaluated using a confusion matrix, allowing a direct comparison between the two learning paradigms. The results provide insight into the potential of self-supervised learning to reduce manual labeling efforts while maintaining or improving classification accuracy for hyperspectral crop-weed discrimination.

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College Students' Perceptions of Organic Foods in Nigeria and the United States. O. Akinbode*, Department of Community and Regional Planning, Alabama A&M University, Normal, AL 35762.

Organic food consumption is rising in the United States and the world. This rise may be attributed to its perceived nutritional, health, and environmental benefits. Understanding the organic food perceptions of young adults in college is significant in promoting organic food products' health and nutritional benefits. This study aimed to investigate the associations between economic factors, consumption, and perception of college students from two cultures. A survey of 434 participants from Alabama A&M University and the University of Ibadan, Nigeria, was conducted. Data were analyzed using descriptive statistics and bivariate correlations ($P \leq 0.05$). Results indicated that most U.S college students know about organic foods, while Nigerian students have little knowledge of what organic foods are. The most effective source of awareness was word of mouth/social media, with a positive perception of organic foods. Also, organic consumers in U.S colleges are more likely to consume organic foods as they age, and the higher the individual family income, the higher the consumption. Married individuals and those with higher education are more likely to consume organic foods. However, the results for the organic consumers in Nigerian colleges showed that married couples were less likely to consume organic foods, with no significant association with other economic factors. With this growing awareness, organic food market producers must strategically address this growing demand, as college students are potential future consumers of organic foods.

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Inactivation of *Salmonella* on Pecan Kernels Using Lactic Acid. P. Tamang*, H.L. Degala, R. Gyawali, A.K. Mahapatra, Food Engineering Laboratory, College of Agriculture, Family Sciences, and Technology, Fort Valley State University, Fort Valley, GA 31030.

Foodborne pathogens such as *Salmonella* spp., *Listeria monocytogenes*, and *Escherichia coli* present persistent safety risks in low-moisture foods, including tree nuts. Pecan kernels are particularly vulnerable due to high fat content and low water activity that allow pathogens to survive conventional processing, storage, and handling. Traditional decontamination methods, such as propylene oxide fumigation or thermal processing can compromise nut quality. Growing demand for clean label foods has therefore increased interest in natural antimicrobial interventions, including organic acids, such as lactic acid. The objective of this study was to evaluate the inactivation of these foodborne pathogens on pecan kernels using lactic acid. Pecan kernels were spot inoculated with mixed cultures of the *Salmonella* spp., (~6 $\log 10$ CFU/g), air-dried, and spot treated by 1% (v/v) lactic acid solution for 1, 5, 10, and 20 min. Surviving populations were counted on selective media and expressed as log reductions relative to untreated. Mean reductions were 1.36 ± 0.15, 2.23 ± 0.19, 2.74 ± 0.19, and 2.69 ± 0.20 $\log 10$ CFU/g, respectively. These findings showed that lactic acid provides an effective, food-grade intervention for controlling pathogenic bacteria on pecan kernels, offering a simple, low- cost strategy to enhance microbial safety and could meet preventive-control requirements in a commercial pecan processing facility. However, the effect of lactic acid treatment on pecan kernel quality needs to be assessed.

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Effects of Pulsed Light on Some Physical Properties of Shelled Pecans. J.C. Awaogu*, H.L. Degala, R. Gyawali, A.K. Mahapatra, Food Engineering Laboratory, College of Agriculture, Family Sciences, and Technology, Fort Valley State University, Fort Valley, GA 31030.

Pulsed Light (PL) offers an alternative method for enhancing the shelf life of shelled pecans, however, the effects of PL on nuts are required to be evaluated to ensure the quality of the nuts. This study assessed the effects of PL on some physical properties of shelled pecans. Shelled pecans were treated with PL at varying distances (4.5-9.5 cm) and treatment times (0-20 s), and analyses, such as mass, dimensions, temperature rise, cooling rate, color, and texture were assessed. The average length, width, thickness, and mass of shelled pecans were 30.83, 18.35, 8.13 mm, and 2.47 g, respectively. The temperature rise and cooling rate increased with a shorter distance from the light source and longer treatment time, with the temperature of the ventral side of the pecan being higher than the dorsal, and the temperature at 4.5 cm higher than other distances at all the treatment times. The L*, a*, and b* values of

control and treated samples were not statistically significant, at 4.5 cm whereas, they were significant at 7 and 9.5 cm. There were no significant effects on the texture of shelled pecans. Therefore, this study demonstrated that the PL could be applied to shelled pecans, causing only minimal effect on the physical properties, but the treatment time and distances should be considered. Further studies on the effects of PL on farther distances and longer treatment times will be carried out to assess the effects of these treatment conditions on other quality parameters.

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The Effects of Pulsed UV Light on the Qualities of Strawberries. E.I. Lynda*, H.L. Degala, R. Gyawali, A.K. Mahapatra, Food Engineering Laboratory, College of Agriculture, Family Sciences, and Technology, Fort Valley State University, Fort Valley, GA 31030.

Strawberries are highly perishable fruits that are vulnerable to postharvest changes, which shorten their shelf life and lead to substantial economic losses. This led to a demand for sustainable technologies capable of preserving strawberry quality without causing physical or sensory damage. Pulsed light, a nonthermal decontamination method, has been explored as an innovative approach for extending the shelf life of fresh products. In this study, fresh strawberries were subjected to pulsed UV light (PUVL) treatment at different distances (13.36 and 14.76 cm) for 10, 20, and 30 s, and their physicochemical and sensory qualities were evaluated after 14 d of refrigerated storage. The parameters assessed included color, texture, firmness, pH, temperature, weight, moisture content, and water activity. The results showed that PUVL did not significantly affect visual attributes, such as color and texture. Mean color values of control and treated strawberries were insignificant, indicating stability in visual quality during storage. Texture analysis revealed no significant change in the firmness of strawberries. Similarly, no significant change in moisture content and water activity of control and treated samples across all storage days were observed. These findings indicate that pulsed light does not accelerate dehydration, softening, or discoloration. By maintaining stable physiochemical and sensory parameters during refrigerated storage, pulsed light treatment effectively supports the prolongation of strawberry shelf life without compromising quality.

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Reduction of Aflatoxin in Peanuts Using Pulsed Light. M.N. Adam*, H.L. Degala, R. Gyawali, and A.K. Mahapatra, Food Engineering Laboratory, College of Agriculture, Family Sciences, and Technology, Fort Valley State University, Fort Valley, GA 31030.

Peanuts (*Arachis hypogaea)* are cultivated globally and are valued for their high nutritional benefits. Despite their economic and nutritional importance, their subterranean growth habit makes them susceptible to *Aspergillus* species contamination, eventually producing aflatoxins. Available conventional thermal methods have limited success because aflatoxins are heat stable and resistant to thermal degradation, necessitating the need for novel methods of nonthermal decontamination. Pulsed light (PL) is an eco- friendly nonthermal technology that uses short high intensity broad-spectrum light ranging from 200-1100 nm to inactivate aflatoxin without compromising the quality of the peanuts. Therefore, this study evaluated the effectiveness of PL in reducing aflatoxins in peanuts. *Aspergillus flavus* NRRL 3357 strain were inoculated onto in-shell peanuts and peanut kernels at 20% moisture content, followed by incubation at 28 °C for 14 d to induce aflatoxin production. The peanuts were then treated at distances of 5, 7, and 10 cm for 30, 60, 90,120, 180, 210, 240, and 300 s in the sterilizing chamber of the Z-1000 PL generator. Pulsed light reduced aflatoxin levels in peanuts by breaking down the toxins. The study also seeks to assess the effect of PL treatment on peanut quality by measuring changes in physical and chemical parameters such as color, texture, peroxide value, free fatty acids, moisture content and water activity.

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Inactivation of *Salmonella* in Goat Milk Powder by Blue Light. S.M. Awad*, H.L. Degala, R. Gyawali, A.K. Mahapatra, Food Engineering Laboratory, College of Agriculture, Family Sciences, and Technology, Fort Valley State University, Fort Valley, GA 31030.

Pathogenic bacteria, such as *Salmonella* spp. can survive longer periods in dried foods such as powder milk. While heat is an effective germicidal agent, thermal processing of foods can result in unpleasant organoleptic qualities and nutrient losses. Thus, there is a need for nonthermal sanitization technologies. Light-based technology, such as light-

emitting diodes (LEDs), can be used to provide a low-cost and long- lasting nonthermal sanitization solution. This study examined the ability of blue light to inactivate *Salmonella* on non-fat goat milk powder. Four *Salmonella enterica* strains (Enteritidis PT 9c, Montevideo, Saintpaul, and Newport) were inoculated (~8 $\log_{10}$ CFU/mL) on non-fat milk powder and exposed to blue light from 16.5 cm at a wavelength of 403.5 nm for 8, 16, 24, and 48 h. The treatment reduced *Salmonella* by 0.83, 0.89, 0.92, and 1.17 $\log_{10}$ CFU/ g, respectively, in non-fat goat milk powder. The results showed that blue light successfully inactivated *Salmonella* in non-fat goat milk powder. Further research, including the effect of blue light on the quality characteristics of non-fat goat milk powder, needs to be assessed.

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Zinc(II) Complexes with N, O-donor Ligands: Synthesis, Characterization, and Antimicrobial Applications against Foodborne Pathogens. M. Genamo*, A. Geremew, E. Peace, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446; S. Abdelwahed, Department of Chemistry, College of Arts and Sciences, Prairie View A&M University, Prairie View, TX 77446; L. Carson, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Foodborne illnesses continue to pose significant global health and economic challenges, with millions affected annually, including children. The crisis is exacerbated by the rise of antimicrobial resistance (AMR) in the food chain, primarily due to excessive antibiotic use in agriculture and transmission through contaminated food. As one of the top 10 global health threats, AMR necessitates innovative antimicrobial strategies. Conventional antibiotics are increasingly ineffective as bacteria outpace drug development, misuse in agriculture escalates resistance, and biofilms shield pathogens from treatment. Thus, new antimicrobial agents are urgently needed to address foodborne pathogens and improve food shelf life. This study focuses on synthesizing and characterizing zinc (II) complexes as alternative antimicrobial agents targeting AMR in foodborne pathogens. Novel zinc (II) complexes derived from thiamine and curcumin were synthesized via a conventional reflux method and analyzed using UV–Vis, FTIR, NMR, SEM, EDX, XRD, and DSC. Their antimicrobial efficacy was tested against *Escherichia coli, Staphylococcus aureus, Listeria monocytogenes*, and *Salmonella typhimurium* through agar diffusion and minimum inhibitory concentration (MIC) assays, while antioxidant activity was assessed by DPPH assay. The complexes demonstrated enhanced antibacterial activity, achieving MIC values of 25 μg/mL, outperforming streptomycin, and an IC_{50} of 75.54 μg/mL in DPPH assays. The synergistic effect between the zinc center and organic ligands contributed to increased bioactivity and stability. These results suggest that zinc (II) complexes are promising for food safety, with further studies needed to explore their stability and molecular mechanisms.

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Conservation Practices' Adoption and Financial Support as an Alternative to Transform Farm Sustainability in South Carolina. M.A. Wardlaw*, A. Jean-Louis, S. Frederick, H. Dakshinamurthy, A. Williams, Public Service and Agriculture 1890 Research & Extension, South Carolina State University, Orangeburg, SC 29117.

South Carolina's agricultural sector faces converging crises: severe soil degradation, soaring input costs, and increasing weather variability. Compounding these challenges, prime farmland is being lost to development, reducing available space for both production and conservation. The sector also confronts an aging farmer population: with most over the age of 65 and fewer young people entering agriculture. Consequently, farms struggle to adapt to new systems or technologies that could improve long-term viability and environmental stewardship. While many farmers express a desire to implement sustainable practices, they are often hindered by high upfront costs, perceived economic risk, and a significant knowledge gap regarding best management practices. This study investigates how integrating targeted training programs with strategic economic incentives can facilitate a practical and lasting transition toward sustainable agriculture in South Carolina. Through in-depth interviews with farmers, program coordinators, and policymakers, we identify the key components of successful interventions. Our findings reveal that hands-on workshops, coupled with financial assistance that offsets initial investment costs, effectively promote the adoption of soil health and water conservation techniques and resource-efficient management systems. The research demonstrates that this dual approach makes sustainability not just an environmental imperative, but an economically viable strategy. By reducing risk and enhancing profitability, these programs foster both ecological resilience and farm business health, creating for long-term agricultural sustainability across the region.

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Metabolomic Insights into the Uptake and Biochemical Responses of Mung Bean Sprouts Exposed to PFAS.
A. Dhakal*, N. Thomas, S. Mahdi, X. Jones, N. Tu, A. Adeyeye, Q.Yang, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101.

Per- and polyfluoroalkyl substances (PFAS) are emerging and persistent environmental contaminants with strong bioaccumulative potential. While human exposure has been extensively studied, their uptake and metabolic impacts in plants remain unclear. This study examined the absorption, accumulation, and metabolic alterations of perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) in mung bean sprouts (Vigna radiata L.) under controlled hydroponic exposure. Metabolomic profiling using UHPLC-MS/MS revealed that PFAS primarily accumulated in roots, with limited translocation through xylem and phloem. PFOS showed higher bioaccumulation and stronger metabolic inhibition than PFOA. At elevated PFOS levels (200 ppb), significant disruptions occurred in flavonoid, isoflavone, and lipid-related pathways, accompanied by increased kaempferol, isoliquiritigenin, and jasmonate-associated metabolites. Meanwhile, decreased leucine–leucine and leucine–valine indicated perturbed energy metabolism and growth suppression. Multivariate analyses (PCA, volcano plots, heatmaps) showed distinct clustering among PFOS, PFOA, and controls, highlighting compound-specific stress responses and reprogrammed metabolism that favors stress tolerance over biomass accumulation. These results demonstrate that PFAS effectively penetrate plant tissues and induce substantial metabolomic disturbances, emphasizing their potential risks to food safety and crop resilience. More results and details will be reported during the conference.

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PFAS-Induced Disruption of Root Metabolism and Nitrogen Fixation in Mung Bean Sprouts.
N. Thomas*, A. Dhakal, S. Mahdi, X. Jones, N. Tu, A. Adeyeye, Q.Yang, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101.

Per- and polyfluoroalkyl substances (PFAS) are persistent organic pollutants with strong bioaccumulative potential and ecological toxicity. While previous hydroponic studies showed that perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) accumulate in mung bean sprouts (Vigna radiata L.) and alter major metabolic pathways, their effects under soil conditions remain unclear. In this study, we examined the biochemical and physiological responses of mung bean grown in PFAS-contaminated soils, focusing on root metabolism and nitrogen fixation. As a representative C3 legume, mung bean forms symbioses with rhizobia to enhance biological nitrogen fixation. UHPLC-MS/MS-based untargeted metabolomics revealed that even at environmentally relevant PFAS levels, significant alterations occurred in amino acid and redoxrelated pathways essential for nitrogen assimilation. PFOS caused stronger metabolic disruption than PFOA, leading to oxidative stress and disturbed signaling between roots and rhizobial partners. Although soil organic matter modulated PFAS uptake, it did not eliminate toxicity. This work provides new insight into PFAS-induced disturbances in soil–plant–microbe interactions and highlights the need for evaluating these persistent contaminants in terrestrial agroecosystems. Detailed findings will be presented at the ARD conference.

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Metabolomic Profiling of Soil Biochemical Dynamics for Sustainable Agriculture: UHPLCMS/MS Analysis Across Forest and Cultivated Land Systems. E. Owusu*, P. Salifu, A. Adeyeye, S. Mahdi, Q. Yang, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101.

Sustainable agricultural production is contingent on soil biochemical integrity preservation, which underpins nutrient cycling, microbial activity, and overall ecosystem resilience. However, land use changes from forested ecological systems to managed farmland systems engender complex and often undetected modifications in soil biochemical pathways that compromise long-term productivity and environmental stability. Conventional soil analytical approaches primary focused on bulk physicochemical properties lack the resolution to identify these early molecular disturbances that precede visible degradation. This study employed untargeted metabolomic profiling deploying ultra-high-performance liquid chromatography coupled with tandem mass spectrometry (UHPLC-MS/MS) to clarify fine-

scale biochemical shifts linked with the transition from bottomland forest soils to farmlands. The study targets key metabolome including organic acids, amino acids, phenolic compounds, and redox-sensitive metabolites, which in tandem mediate soil nutrient transformations and microbial metabolic activity. By coupling high resolution metabolomic signatures with traditional soil parameters such as organic carbon, total nitrogen, and enzyme activity, this work aims inter alia to identify metabolite signatures indicative of soil health across contrasting land-use systems. The study further seeks to illustrate metabolic pathways most responsive to agricultural conversion, deciphering mechanistic relationships relative to soil biochemical adaptation and resilience under cultivation. The outcomes from the study are among others expected to establish a metabolite-based diagnostic framework for soil assessment of soil health, facilitate timely detection of land degradation and provide insight for sustainable land management systems that promote resilient agriculture and ecosystem functioning. Overall, this study contributes to embedding metabolomics techniques into agroecosystem monitoring, providing a molecular-level comprehension impact of land-use conversion on soil function and sustainability. More results and detailed will be reported during the ARD conference.

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Food Safety in Digital Platforms: Evaluating Practices and Recommendations in Produce Fermentation Videos. M. Koirala* and S. Acharya, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101.

For the public, social media platforms are prominent sources for culinary information, including food preservation techniques like vegetable fermentation; however, the adherence to established food safety protocols in this content is not well understood. This study quantitatively evaluated and compared the demonstration of critical food safety practices in videos presented by social media influencers and non-official entities across YouTube and Facebook, while excluding educational content from government, extension, or other official organizations. A content analysis was conducted using a standardized questionnaire to record the adherence of each social media platform's videos to food safety and procedural criteria. The results of each were then compared using R Studio. The analysis revealed statistically significant disparities among the platforms regarding the demonstration of key food safety steps. Significant differences were observed in practices, such as the use of appropriate weights to keep vegetables submerged, the addition of salt, and recommendations for handwashing. On the other hand, no significant difference was found for other fundamental practices, such as the initial rinsing of vegetables. The findings indicate that the quality of food safety information for vegetable fermentation is inconsistent across these popular platforms. This variability poses a potential risk to consumers who may replicate unsafe practices, highlighting the need for consumers to be discerning and for food safety procedures to be strictly followed while disseminating accurate information.

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Dietary Peanut skins influence rumen fermentation, microbiome, and meat quality in lambs. T. A. Wilson*, Division of Animal and Nutritional Science, West Virginia University, Morgantown, WV 26505; M. Hitit, College of Agriculture, Food and Natural Resources, CAFRN Research, Prairie View A&M University, Prairie View, TX 77446; M.D. Idowu, Z.M. Estrada-Reyes, I.M. Ogunade, Division of Animal and Nutritional Science, West Virginia University, Morgantown, WV 26505; A.A. Pech-Cervantes, College of Agriculture, Food and Natural Resources, CAFRN Research, Prairie View A&M University, Prairie View, TX 77446.

Peanut skins (PS) are an abundant and economical source of antioxidants for ruminants. Thus, this study evaluated the effects of dietary incorporation of peanut skins (PS) on rumen fermentation, microbial communities, and meat quality of lambs. Thirty-three intact lambs (11 per treatment) were fed one of three diets: a) Control (no PS), b) Control + 20% intact PS, c) Control + 20% treated PS for 6 weeks. Then, lambs were slaughtered to collect meat and rumen fluid samples for fermentation, microbiome (16S sequencing), and meat quality traits. Treated PS reduced ($P < 0.05$) total VFA compared to the control. However, intact PS decreased NH_3-N in the rumen compared to the control (0.77 vs. 1.91 mM/L). Carcass weight was not affected by treatment, but dietary PS increased ($P < 0.05$) PUFA in meat compared to the control (33.4, 35.3 vs. 30.3 g/100 g FAME). Consequently, Intact PS tended ($P = 0.08$) to reduce meat yellowness in intact PS compared to the control ($b^* = 9.9$ vs. 11.4) and increased ($P < 0.01$) alpha-tocopherol concentrations (3.7 vs. 1.3 mg/g). Rumen microbiome data revealed a shift in bacterial communities between PS diets and the control ($P < 0.05$). The relative abundance was different between PS ($P < 0.05$) and the control. These results suggest that dietary PS improved meat quality by altering rumen bacterial communities in lambs.

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From Farm to Table: Ensuring Food Safety in Leafy Green Productions. J.A. Dias*, A. Jean-Louis, S. Frederick, H. Dakshinamurthy, A. Williams, Public Service and Agriculture 1890 Research & Extension, South Carolina State University, Orangeburg, SC 29117.

Leafy greens such as lettuce, spinach, and kale are particularly vulnerable to microbial contamination due to their consumption in raw form and large surface areas that retain bacteria, soil particles, and water residues. This study examines contamination risks throughout the leafy green production continuum, from pre-harvest practices to post-harvest handling and distribution. Through analysis of agricultural production data from South Carolina farms and review of recent food safety literature, we identify critical control points where contamination most frequently occurs. Primary risk factors include irrigation water quality, organic amendment management, inadequate sanitation during harvest operations, and temperature control failures during processing and transport. Our findings demonstrate that implementation of Good Agricultural Practices (GAPs), including routine microbial testing of irrigation water, worker hygiene training, and enhanced sanitation protocols, significantly reduces contamination risks. The research emphasizes preventive strategies that are economically feasible for both small-scale and commercial operations. We present a risk assessment framework that prioritizes high-impact interventions, including water source monitoring, harvest equipment sanitation, and cold chain maintenance. These evidence-based approaches not only enhance food safety outcomes but also reduce product loss and strengthen consumer confidence in locally produced fresh greens. This work provides practical guidance for growers, extension professionals, and food safety regulators seeking to minimize foodborne illness risks associated with leafy green production.

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Analysis of PAHs in South Carolina Agricultural Soil – a 20-year study. W. Webb*, T. Reed, C. Thomas, 1890 Research and Extension, South Carolina State University, Orangeburg, SC 29117.

Polycyclic aromatic hydrocarbons (PAHs) are toxic environmental pollutants known for their persistence, bioaccumulation, and health risks, including carcinogenic and mutagenic effects. Although many PAHs exist, the U.S. Environmental Protection Agency (EPA) has identified 16 priority compounds due to their high toxicity and prevalence in the environment. These pollutants are widely distributed across soil, water, air, and sediments, originating from both natural sources, such as forest fires, and anthropogenic activities, including vehicle emissions and industrial processes. Agriculture is South Carolina's leading industry, making the assessment of soil contamination essential to maintaining both environmental and economic sustainability. This study evaluates PAH concentrations in agricultural soils collected over a 20-year period from multiple regions of South Carolina to assess changes in contamination, degradation, and potential risk across different crop systems. Soil samples underwent Soxhlet extraction, concentration via rotary evaporation, and cleanup using silica gel and C18 chromatography prior to analysis. Fluorescence microscopy was used to detect and compare overall PAH contamination among soil samples, while Gas Chromatography–Mass Spectrometry (GC–MS) is being employed to quantify individual PAH compounds. Our results revealed significant variation in PAH contamination by region and crop type, yet an overall average change of only 7.67% over two decades, indicating strong persistence and resistance to degradation. These findings highlight the long-term stability of PAHs in agricultural soils and emphasize the need for continued monitoring and the development of targeted soil remediation strategies **to** reduce potential exposure and environmental risk.

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Evaluation and Correlation between TOC content, soil type and PAH contamination. T. Reed*, W. Webb, C. Thomas, 1890 Research and Extension, South Carolina State University, Orangeburg, SC 29117.

Polycyclic aromatic hydrocarbons (PAHs) are toxic, persistent organic pollutants originating from both natural sources, such as wildfires, and human activities, including vehicle emissions and industrial processes. Due to their stability and hydrophobicity, PAHs readily bind to soil organic matter, resulting in long-term accumulation in the environment. Research indicates that approximately 90% of priority PAHs reside in soil, making it a major reservoir and potential pathway for contamination of crops and the food chain. Agriculture is the top industry in South Carolina, with over 25,000 farms covering 4.8 million acres of farmland. This widespread agricultural activity increases the potential for soil PAH contamination and subsequent human exposure. In this study, we evaluated **total organic**

carbon (TOC) content and its relationship to PAH behavior in agricultural soils across the state. Soil samples representing different **crop types and textures** were analyzed to determine how these properties influence PAH accumulation and retention. Results revealed that **soil texture strongly affects organic carbon levels and PAH dynamics.** Corn, grown in sandy soil, exhibited lower TOC (4.8%) and smaller PAH change (6%), suggesting reduced organic matter retention and contaminant interaction. Conversely, okra, cultivated in silty soil, showed higher TOC (17.3%) and greater PAH change (8%), indicating increased carbon accumulation and pollutant binding. These findings demonstrate that **silty soils promote greater carbon storage and more active contaminant retention** than sandy soils, emphasizing the importance of soil composition in managing PAH contamination and guiding sustainable agricultural practices.

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The Blooming Threat: Tracking Bradford Pear Trees Using Satellite Imagery and Artificial Intelligence. H. Semlali*, South Carolina State University, 1890 Research & Extension, Orangeburg, SC 29117; P. Gregory, South Carolina State University, 1890 Research & Extension, Orangeburg, SC 29117; H. N. Dakshinamurthy, Public Service and Agriculture (PSA), South Carolina State University, 1890 Research & Extension, Orangeburg, SC 29117.
The *Pyrus calleryana* (known as the Bradford Pear) is a visually striking tree native to eastern Asia and widely planted across the United States for its showy white spring blossoms. However, this fast-spreading species has become a significant ecological concern, particularly in the southeastern United States, where it aggressively invades native ecosystems and disrupts biodiversity. Recognizing its environmental impact, South Carolina banned the sale and planting of Bradford Pear trees in October 2024. The species establishes itself rapidly, outcompetes native floras, and possess risks to infrastructure due to its brittle branches, threatening both ecological balance and public safety. Our objective is to detect and monitor Bradford Pear Trees in Orangeburg County using satellite imagery and artificial intelligence. A Python based workflow was developed using the Geo AI package in Google Colab, alongside tools like Google Earth Engine. High-resolution imagery from Sentinel-2, National Agriculture Imagery Program (NAIP), and Planet satellites was used to generate image tiles for model training and testing. Ground truth information was collected through field surveys visits, Google Earth Pro, Google Maps Street View, and iNaturalist. A deep learning model was trained to identify Blooming Bradford Pear trees at their peak bloom period, from early February to mid-March. The project produced interactive maps that pinpoint the trees' locations and bloom times These spatial tools offer valuable insights for landowners, environmental agencies, and policymakers to plan and implement effective control and removal strategies, supporting ongoing efforts to protect native ecosystems in South Carolina.

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Comparative Analysis of Ecological Structure and Functions of Selected 1890 Land-Grant University Campuses in the USA. J. Johnson*, Y. Qi, N. Williams, Department of Urban Forestry, Environment, and Natural Resources, Southern University and A&M College, Baton Rouge, LA 70813.

A university campus is an ecosystem that provides structure and function to support academic, administrative, and research needs for students, faculty, and staff. Green space is an integral part of the infrastructure that provides ecological, environmental, and economic benefits for campus population. There are 19 historically black colleges and universities (HBCUs) designated with land-grant status under the Morrill Act of 1890 in the USA. The study investigates the ecological structure and functions of selected HBCU campuses using a GIS based i-Tree Canopy program, which facilitates land use assessment using random sampling of aerial imagery and quantifies ecological and environmental benefits. For each selected campus geographic boundaries are drawn onto Google maps based on an ESRI shapefile. Five hundred to1000 random survey points are used and assigned based on predefined land use categories to achieve error margins. The study reports the results of the comparative analyses among the selected campuses in the following areas: (1) land use in five categories - tree/shrub canopy cover, grass/herbaceous cover, impervious areas (building, road, and other), soil/bare ground, and water body; (2) total carbon stored in trees/shrubs and annual carbon sequestration; (3) air pollution impacts by tree/shrub, including annual removals of CO, NO_2, O_3, SO_2, $PM_{2.5}$, and PM_{10}; and (4) hydrological benefits by trees/shrubs, including avoided runoff, evaporation, transpiration, interception, and potential evapotranspiration. The results will have implications in strategic planning and greenspace management to maximize the ecological and environmental benefits for the well-being of the HBCU campus communities.

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The Canopy and the Community: Quantifying the Disparity of Urban Forest Benefits and Vulnerability in Maryland. I. Kalama * and S. Stotts, Department of Agriculture, Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853.

Urban forests deliver essential ecosystem services, such as carbon storage, air-pollution removal, and stormwater regulation, that support environmental quality and public health. Yet these benefits are unevenly distributed, disproportionately favoring high-resource areas while economically distressed zones remain exposed to environmental stressors. This study mapped tree canopy cover, carbon storage and sequestration, air-pollution removal, transpiration, rainfall interception, and avoided runoff (volume and value) across 1,355 census tracts within Maryland's 34 urban areas using i-Tree Landscape estimates and 2020 U.S. Census tract boundaries. Community resilience status was classified using the U.S. Census Bureau's Community Resilience Estimates. Kruskal–Wallis tests showed significant disparities in ecosystem service distribution across vulnerability classes ($p < .001$), with Tukey's post-hoc tests confirming decreased ecosystem service provision associated with increased vulnerability. High-vulnerability tracts averaged 26% canopy cover and $9,876/yr in avoided runoff value, compared to 42% and $24,397/yr in low-vulnerability tracts. GIS-based spatial analysis further highlighted "high priority" tracts with both high vulnerability and less than 20% canopy cover, which were concentrated in Baltimore City and Prince George's County. These findings demonstrate persistent gaps in ecosystem service provision with the least resilient communities receiving the fewest benefits. The resulting tract-level framework offers a replicable tool for identifying ecosystem benefit gaps and prioritizing greening interventions for policymakers and land managers. It can be used to prioritize urban greening investments and advance strategies that enhance resilience and restore ecosystem benefits.

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Metabolic Shift Toward Glycolysis and RPS6/RPS7 Upregulation Mediate PFOS-Induced Inflammatory Stress in A549 Cells. G. Dupre*, R. Kondati, M. Thakur, D. Mutyala, S. Salukuti, S. Batra, Laboratory of Pulmonary Immunotoxicology, Department of Environmental Toxicology, College of Agricultural, Human and Environmental Sciences, Southern University and A&M College, Baton Rouge, LA, 70813.
Perfluorooctane sulfonate (PFOS), a persistent perfluoroalkyl substance extensively utilized in agricultural formulations, including pesticides, surfactants, and soil wetting agents, has emerged as an environmental contaminant of growing toxicological concern. To determine the cellular consequences of PFOS exposure on pulmonary epithelial cells (A549), we used the Seahorse XF Real-Time ATP Rate Assay and also evaluated the transcriptional regulation of molecular markers associated with inflammatory stress. PFOS exposure led to a significant increase in total cellular ATP production, primarily driven by an elevation in glycolytic ATP generation, while mitochondrial ATP production showed a modest rise. This bioenergetic profile indicates metabolic reprogramming toward glycolysis, representing a compensatory adaptation to PFOS-induced mitochondrial stress. Correspondingly, increased transcription of ribosomal proteins RPS6 and RPS7 was observed which suggests the involvement of mTOR–S6K signaling axis. Our findings may serve as an adaptive mechanism to sustain cellular viability but can inadvertently amplify oxidative stress and pro-inflammatory signaling, promoting cytokine release and epithelial injury. Collectively, these findings highlight that PFOS, through agricultural routes of exposure, can disrupt cellular energy homeostasis and stimulate ribosomal and inflammatory pathways in lung epithelial cells. This study provides mechanistic insight into how agricultural pollutants like PFOS may contribute to chronic inflammation and metabolic dysregulation in exposed human populations.

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Using GIS and Remote Sensing to assess the cooling effect of tree canopy on Urban Heat Islands in Scotlandville, Louisiana. R.N.D Armah*, Z.H. Ning, Y.A. Twumasi, D. Aniewu, J.D. Osei, P.M. Loh. The ANSWERS Institute - Air, Nutrients, Soil, Water, Ecosystem and Remote Sensing, Southern University and A&M College, Baton Rouge, LA 70813, USA.

Urban heat islands (UHIs) occur when built-up areas experience higher temperatures than surrounding regions due to the concentration of concrete, asphalt, and other heat-retaining surfaces. In a neighborhood like Scotlandville, where vegetation may be unevenly distributed, surface temperatures are likely to vary across different land cover types. This project uses Geographic Information Systems (GIS) and remote sensing to examine how tree canopy helps lower

surface temperatures and reduce urban heat in the area. Landsat 8 imagery was used to calculate Land Surface Temperature (LST), while the Normalized Difference Vegetation Index (NDVI) identified zones with dense tree cover. Areas with NDVI values above 0.6 were classified as tree-covered, while lower values represented grass, bare soil, or impervious surfaces like roads and buildings. Geoprocessing tools in ArcGIS Pro were used to calculate average temperatures and compared across these different land cover classes. The Zonal Statistics tool was used to extract mean LST values from each classified zone. The cooling effect was calculated by measuring the temperature difference between tree-covered areas and areas with little or no vegetation. This difference helps quantify how much tree canopy contributes to cooling the surface in Scotlandville. Maps and charts were created to visualize temperature distribution and vegetation patterns in the study area. The results reveal a correlation between higher tree canopy and lower surface temperatures. This research provides a valuable view of how trees help reduce urban heat in local communities using accessible geospatial tools and helps the city in urban forest management.

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Remote Sensing Assessment of Crop Health and Productivity in the Mississippi State Delta. K. K. Annan*, Z. Ning, R. Armah, D. Aniewu, Y.A. Twumasi, D. T. Gyan, E. Dadzie, J.D. Osei, Department of Urban Forestry, Environment, and Natural Resources, Southern University and A&M College, Baton Rouge, LA 70813.
The study aimed to assess crop health and productivity in the Mississippi State Delta using remote sensing data derived from the NASA MODIS platform. The research focused on evaluating how vegetation growth and temperature variations influenced crop performance between 2004 and 2024. Multi-temporal 16-day Normalized Difference Vegetation Index (NDVI) data from MOD13Q1 (250 m) and 8-day Land Surface Temperature (LST) data from MOD11A2 (1 km) were integrated to analyze patterns of vegetation vigor and heat stress. Croplands were extracted using the National Land Cover Database (NLCD) and the USDA Cropland Data Layer (CDL), ensuring that only agricultural areas were included in the analysis. To understand long-term vegetation changes, Mann–Kendall trend tests and Theil–Sen slope estimators were used to identify areas with significant decline or improvement in crop vigor. A Vegetation–Thermal Stress Index (VTSI) was developed by combining NDVI and LST anomalies to detect years of extreme stress. County-level yield data from the USDA National Agricultural Statistics Service (NASS) were used to validate remote sensing indicators. The results revealed distinct spatial patterns of declining vegetation health and rising thermal stress in several Delta counties. The findings demonstrated that satellite data could effectively monitor crop health, identify vulnerable areas, and support data-driven agricultural planning across the Mississippi State Delta.

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Urban Tree Canopy Dynamics in Baton Rouge, Louisiana: Historical Trends, Current Status, and Implications for Sustainable Urban Development. D. Aniewu *, Z. Ning, R. Armah, K. Annan, R.A. Antwi, D. T. Gyan, E. Dadzie, J.D. Osei, Department of Urban Forestry, Environment, and Natural Resources, Southern University and A&M College, Baton Rouge, LA 70813.

Urban tree canopies are vital for mitigating urban heat islands, improving air quality, managing stormwater, and enhancing residents' well-being. The objective of this study is to assess tree canopy covers and estimate their ecosystem services. Utilizing high resolution geospatial data from TreeCanopy.us and auxiliary sources. This study examines the historical and current tree canopy cover across census blocks in Baton Rouge. Our study revealed that Baton Rouge, historically boasted one of the highest tree canopy cover in the U.S., reaching up to 55%. However, recent decades have witnessed significant canopy loss due to urban expansion and land-use changes resulting in a current canopy cover of 33%. Further analysis revealed significant variations in canopy cover, with certain areas experiencing notable declines. For example, Central - a highly urbanized zone suffered the greatest canopy reductions, while certain peripheral areas exhibited modest gains due to reforestation and conservation programs. Additionally, tree intervention measures led to modest gains in some areas. Our research results showed that urban trees across Baton Rouge are estimated to sequester over 15,856 metric tons of carbon and remove over 400 metric tons of air pollutants annually, contributing millions of dollars in health-related economic benefits. With over 80% of the U.S population residing in urban areas and urban land expanding, the need for proactive canopy management has never been more urgent. Recommended actions include community engagement in tree stewardship, and the promotion of native species regeneration, policy reforms, and green infrastructure integration. These findings underscore the necessity of integrating tree preservation and expansion strategies into urban planning to maintain and enhance the ecosystem services provided by urban forests.

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Effect of Warming and Nitrogen Fertilization on Soil Organic Matter Composition in Perennial Bioenergy Croplands. M. Gaire*, L. Gamage, M. Manu, and J. Li, Department of Environmental Sciences, College of Agriculture, Tennessee State University, Nashville, TN 37209.

A key measure of soil health in global agroecosystems is the level of soil organic matter (SOM). Increasing SOM in global cropland can play a significant role in improving soil health, productivity, and carbon sequestration. However, achieving increased SOM stocks requires mechanistic understanding of soil microbial communities, which are key drivers of SOM transformations (e.g., turnover, retention, and stabilization) in the plant-soil ecosystems. Under rapid environmental change, rising temperatures and nitrogen fertilization are two important drivers that may reduce or significantly influence SOM storage, but specific fractions or compounds of SOM and their changes remain inadequately studied. This study aims to characterize the diversity of carbon compounds in SOM and plant dissolved organic matter (DOM) across switchgrass and gamagrass croplands, evaluate their compositional changes under warming and nitrogen fertilization treatments, and compare responses between two systems. Soil and plant samples (e.g., root and shoot) will be obtained under control, heated, and fertilized plots in both croplands. The abundance and components of carbon compounds in SOM, shoot, and root, and the DOM leached from shoot and root samples will be analyzed using Fourier-transform infrared spectroscopy (FTIR; Anton Paar Lyza 7000) and compared between different treatments. The expected results will improve our understanding of how warming and nitrogen inputs alter the stability of soil carbon and provide insights needed to develop effective strategies to sustain soil health and carbon sequestration in bioenergy cropping systems.

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Characterizing Depth Patterns for Algal Toxins, Chlorophyll, and Dissolved Oxygen in J. Percy Priest Reservoir, Nashville, Tennessee. A. Joyner[1], J.A. Cotton[1], M. Campbell[2], R. Archer[1], and T. Byl[1,3]; [1]Department of Environmental Sciences, College of Agriculture, Tennessee State University, Nashville, TN 37209; [2]U.S. Army Corps of Engineers, Water Management, Nashville District; and [3]U.S. Geological Survey, Nashville, TN.

The J. Percy Priest Reservoir in southeast Davidson County, Tennessee, is an important source of drinking water and a recreation ecosystem for Nashville and Middle Tennessee. However, there is concern that it is vulnerable to harmful algal blooms that could diminish its water quality. To better understand the occurrence and distribution of cyanotoxin and other indicators of water quality in the reservoir's water column – information that is important to making good risk-management decisions – Tennessee State University partnered with the U.S. Army Corps of Engineers, the U.S. Geological Survey, and the Tennessee Department of Environment and Conservation. The objective of this five-month study (June-November 2025) was to characterize the vertical distribution of oxygen, chlorophyll, microcystin toxin, and other parameters near the dam every two weeks. Microcystin was monitored using a series of 13 passive samplers at 0-90 feet and swapped out every two weeks. A multiprobe sonde was used to characterize water-profile chemistry. By June, lake stratification had developed at 20-30 feet below the surface. Temperatures and dissolved oxygen dropped significantly below the thermocline, specific conductance increased approximately 100 microSiemens at 20-30 feet, and chlorophyll fluorescence peaked at 15-20 feet. Microcystin was the main cyanotoxin, peaking at a depth of 30-75 feet in June, 0-30 feet in July, 50-80 feet in August, and 70-80 feet in September. These findings indicate that microcystin distribution in the water column changes with the growing season and should be monitored at multiple depths to help determine the safest depth from which to pull drinking water.

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Phosphate Activity-Based Profiles of Tennessee Johnsongrass Populations and Associated SNP Validations. G.M. Shaik*, S. Lymanska, and A.N. Aziz, Department of Agricultural Sciences and Engineering, College of Agriculture, Tennessee State University, Nashville, TN 37209.

Herbicide resistance in Sorghum halepense (Johnsongrass) poses a growing challenge to sustainable crop production in Tennessee. This study investigated the biochemical diversity among regional Johnsongrass populations by quantifying phosphate activity for profiling ecotypes. Leaf samples collected from 69 Tennessee counties across three geographical regions were first confirmed by PCR-based molecular markers specific to S. halepense. Later, enzymatic assay was used to determine and quantify the activity of 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS)

through phosphate release measurements. Phosphate activity varied significantly among the Tennessee-based weed populations, with the highest mean activity in the Central region (76.9%), followed by the Eastern (69.2%) and Western (64.1%) regions. These variations suggest that EPSPS-related resistance levels are not uniform but are influenced by local selection pressures and herbicide exposure patterns. Kompetitive Allele-Specific PCR genotyping of 129 representative Johnsongrass accessions using 20 SNP markers associated with agronomic and resistance traits is in progress. The primers were selected based on an over 90% amplification success rate to reveal high heterozygosity levels (60-80%) for demonstrating substantial genetic diversity within Tennessee populations. This study shows that integrating herbicide resistance-related enzymatic and KASP profiling can effectively identify biotypes per regional genetic variations. Such insights are valuable for improving weed management strategies for S. halepense and for providing genetic resources towards cultivated sorghum, thus contributing to more sustainable crop production in Tennessee.

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Mapping Environmental Impacts on Displaced Communities Along the I-40 Corridor in Tennessee. M. Payne*, C. Fearman, and R.S. Archer, Department of Environmental Sciences, Tennessee State University, Nashville, TN 37209.

Gentrification and displacement have had a disproportionate impact on certain communities due to factors involved in historical practices such as the redlining of neighborhoods and its related effects on the greening of cities. Such practices have led to disruption and environmental concerns. This project will investigate the impacts of displacement and gentrification due to past and ongoing projects affecting low-resource communities along the I-40 corridor in Tennessee, focusing in particular on communities in Memphis, Nashville, and Knoxville. By using spatial and quantitative analyses, case studies, and historical data, this research will explore whether communities that have faced displacement are “better off” in terms of having enhanced living conditions and fewer environmental concerns about issues such as urban heat islands, flooding, and pollution. This study aims to develop gentrification indicators, a “better off” index, and an overall reproducible model to offer insights on the role that gentrification and displacement have on communities in smaller cities in the U.S.

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Integrating GIS to Predict Soil Respiration Responses to Biophysical Factors Across Middle Tennessee. C. Apraku* and R.S. Archer, Department of Environmental Sciences, Tennessee State University, Nashville, TN 37209.

The Urban Heat Island (UHI) effect, characterized by significantly elevated air temperatures, presents a major challenge for urban management. This study aimed to quantify the geospatial and mechanistic link between soil respiration and its associated biophysical factors. Field studies were conducted at sites with established canopy and no canopy across 10 Middle Tennessee counties. Air temperature, representing UHI intensity at 124cm, and soil temperature were measured in-situ. Soil samples were collected at a 10cm depth, and moisture was quantified in a laboratory using the gravimetric method. Initial results confirmed that canopy cover is the primary determinant of soil water retention, resulting in higher soil moisture levels at shaded sites. Visual correlation established a robust inverse relationship between soil moisture and both soil and air temperature, with this negative correlation being more pronounced for air temperature. This finding provides empirical evidence that higher water retention, facilitated by canopy cover, enables efficient evaporative cooling, actively buffering and mitigating local UHI effects. This suggests that variations in soil moisture capacity may be linked to differences in soil bulk density across the rural-urban interface. Regression analysis and geospatial statistics will be used to predict the relationship with soil respiration using soil moisture, bulk density, air temperature, soil temperature, and land cover type as predictors. This research underscores that promoting soil moisture retention through strategic canopy placement is key for effective UHI mitigation. It also offers site-specific data valuable for improving the design and management of green infrastructure in humid subtropical areas like Middle Tennessee.

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Comparative Assessment of Microbial Community Structure in Lake Hood and University Lake, Anchorage, Alaska. L. Saunders*, and O. Idehen. College of Agriculture, Environment and Nutrition Sciences, Tuskegee University, Tuskegee Institute, AL 36088.

Petroleum-derived fuels continue to impact ecosystem health, as oil-based pollutants can persist in the environment for years, disrupting soil, water, and biological communities. This study investigates the effects of petroleum-related contaminants on the ecological and microbial health of Lake Hood—a passenger seaplane lake exposed to chemical pollutants—and compares them to University Lake, a recreational site in Anchorage, Alaska. Sampling was conducted in July 2025, with soil, water, and vegetation collected from three sites per lake. At each site, samples were taken along a gradient from submerged to shoreline soils, yielding 38 soil, 6 water, and 6 vegetation samples. Chemical analyses will assess soil and water properties, while microbial community structure and health will be evaluated through DNA-based methods. We hypothesize variation in the microbial community structure between the two lakes and higher total petroleum hydrocarbon (TPH) levels in Lake Hood resulting from aviation fuel exposure. A negative correlation is anticipated between microbial diversity and TPH concentration, though hydrocarbon-degrading bacteria are expected to be present. Additionally, hydrocarbon contamination is predicted to influence soil and water chemistry, potentially increasing alkalinity as hydrocarbon-derived hydrogen ions interact with lake water. This study provides comparative insight into the ecological consequences of hydrocarbon contamination in urban freshwater systems and contributes to understanding microbial responses to long-term petroleum exposure in cold environments.

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Assessing Extreme Weather Events and Ecological Simplification of Vernal Pools in Tuskegee, Alabama Forests using Bioindicators. K. Dames*, Integrative Biosciences Program, Tuskegee University, Tuskegee, AL 36088; R. Farid-Tilghman, S. Fall, Department of Agricultures and Environmental Science

Alabama wetlands are critical ecosystems increasingly impacted by extreme weather. Vernal pools—temporary forested wetlands—play disproportionate roles in maintaining biogeochemical, hydrological, and ecological functions despite their ephemeral nature. This study investigates how fluctuations in temperature and precipitation deviate from the long-term mean, drives ecological simplification, the reduction of niche diversity due to habitat loss and structural decline. By examining biodiversity across compositional, structural, and functional dimensions, this research assesses how weather extremes such as heat spikes, reduced precipitation, and prolonged droughts alter habitat complexity and species distributions. Field sites across Tuskegee University's forested lands, including Russell Plantation Big Swamp, Lake Tuskegee, and U.S. Highway 80, serve as focal points. Bioindicators such as salamanders and frogs—alongside environmental DNA (eDNA) from soil and water are used to monitor biodiversity loss and habitat quality. Comparative analyses of species' richness, abundance, and genetic diversity are coupled with hydrometeorological modeling and LiDAR remote sensing to reveal spatiotemporal trends in pool structure and climate response. Multivariate analyses integrate eDNA data, soil and hydrological metrics, and Community Earth System Model version 2 (CESM2) climate model outputs processed in R within a Linux environment. Findings reveal significant warming and declining precipitation patterns correlated with biotic and abiotic simplification. Ultimately, this work quantifies how climate-driven ecological simplification is reshaping Alabama's vernal pools from the molecular to landscape scale, informing restoration and resilience strategies for forested wetland ecosystems.

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Consumer Perception of Selected Attributes of Bioengineered (GMO) Crop Plants. S. l. Samuel*, IPPD, Ph.D. Program, Dept. of Ag. And Envi. Sciences, Tuskegee University College of Agriculture, Environment, and Nutrition Sciences and Tuskegee University Cooperative Extension Program, Tuskegee University, Tuskegee, AL 36088.
This study addresses the persistent discrepancy between the advancement of bioengineered crop technology and limited consumer acceptance, an issue highlighted by a current 30% approval rating despite the increased precision and prevalence of these food products since their commercial introduction in 1994. While previous research links attitudes, labeling information, and subjective and objective knowledge to consumer acceptance, the influence of economic determinants on knowledge acquisition and subsequent perception of risk, safety, and trust has not been thoroughly examined. The objective of this research is to investigate the potential impact of economic factors on consumer knowledge and acceptance of bioengineered crops. The null hypothesis tested is as follows: there is no statistically significant effect of economic determinants (including income, education, etc.) on consumers' levels of subjective or objective knowledge of bioengineered crops, the sources from which that knowledge is derived, or their perception of safety, risk, and trust. By testing this null hypothesis, the research aims to determine whether economic factors play a role in shaping consumer understanding and attitudes towards this food technology. The findings will provide valuable insight into the underlying dynamics of public opinion, which is critical for bridging the gap between scientific advancement and consumer behavior.

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Comparative Analysis of Vegetation Diversity and Community Structure in Restored and Natural Wetlands. M.A. Rahaman*, U. Deb, and M. Eggleton, Department of Aquaculture and Fisheries, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601.

The Natural Resources Conservation Service (NRCS), through the Agricultural Conservation Easement Program and the Wetland Reserve Enhancement (ACEP-WRE) initiative, has been conserving and restoring wetlands across the United States. This study evaluates vegetation development, species richness, and diversity across three types of wetlands: Easement (restored), Reference (Natural), and Control (agricultural). Vegetation data were collected from 31 sites in Arkansas, comprising 21 Easement, five Natural, and five Control sites. The recorded species include a diverse array of plant types: herbs, graminoids, shrubs, and trees, with graminoids and herbs dominating most sites. A total of 227 plant species were recorded, including 190 native (83.7%) and 37 invasive or non-native species (16.3%). Natural wetlands exhibited the highest ecological integrity with 93% native species, followed by Easements (86.7%) and Controls (71.0%). This gradient indicates that Easement wetlands are in an advanced recovery phase, transitioning from agricultural to natural conditions. The estimated Simpson Diversity Index was identical for Reference and Easement wetlands (0.78), reflecting a high and comparable level of species diversity and balanced community structure. In contrast, Control sites exhibited notably lower diversity (Simpson's Index = 0.70). Pielou's Evenness Index was highest in Reference wetlands (0.95), followed by Easements (0.92) and Controls (0.78), indicating a more even species distribution in restored sites compared to agricultural controls. Overall, ACEP-WRE restoration supports the development of diverse, native-dominated plant communities that increasingly resemble natural wetlands, thereby enhancing ecological resilience.

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Evaluation of Wetland Characteristics, Features and Stressors between Agricultural Conservation Easement Program and Natural Wetlands in the Mississippi Alluvial Valley Region of Arkansas. F. Abdal*, U. Deb, and M. Eggleton. University of Arkansas at Pine Bluff. Woodard Hall, University of Arkansas at Pine Bluff, 1200 N. University Drive, Mail Slot 4913, Pine Bluff, AR 71601.

The Natural Resources Conservation Service (NRCS), through the Agricultural Conservation Easement Program - Wetland Reserve Easement (ACEP-WRE), has been conserving and restoring wetlands across the United States. Assessing the ecological condition of these wetlands is crucial for evaluating program effectiveness, justifying public investments, and informing future conservation strategies. This study evaluated the condition of wetlands in the Mississippi Alluvial Valley (MAV) of Arkansas using a Rapid Assessment Method (RAM) adapted from the Ohio, Kentucky, and Texas Rapid Assessment Methods. The RAM included six metrics and 21 sub-metrics covering wetland size, buffer and surrounding land use, hydrology, substrate and habitat conditions, vegetation structure and interspersion, and overall ecological importance, with scores ranging from 0 to 100. Data from 26 sites, comprising 21 ACEP-WRE easements and five natural reference wetlands, were analyzed using GIS and field observations. Reference wetlands exhibited higher ecological buffer quality and lower surrounding land-use intensity than ACEP-WRE wetlands. They also showed greater probabilities of permanent inundation, woody debris, snags, and forested components. No significant differences were observed in seasonal inundation, open-water presence, or the presence of amphibian ponds. ACEP-WRE wetlands exhibited higher emergent vegetation cover, horizontal interspersion, and stressor indicators, including filamentous algae and vegetated mounds. Overall, ACEP-WRE wetlands appear to be in an early successional stage yet already provide critical ecosystem services, including wildlife habitat, floodwater retention, and water filtration.

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Understanding the Linkages between Water Quality and Fish Diversity: Insights from Arkansas Wetlands. S. Saha*, U. Deb, B.S. Johnson, M. Eggleton, and E. Thayer, Department of Aquaculture and Fisheries, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601.

Wetlands provide essential habitats for diverse fish species, with water quality parameters playing a crucial role in shaping the composition of fish assemblages. However, wetland fish communities and their associations with water

quality remain poorly studied in Arkansas. This study investigated fish assemblages and their relationships with water quality across 30 wetland sites in Arkansas, USA, during the summers of 2024 and 2025. The sites included five agricultural ditches, 20 Natural Resources Conservation Service (NRCS) Wetland Reserve Easements (WREs), and five natural or minimally disturbed wetlands in northeastern Arkansas. A total of 51 fish species and 41,909 individuals were recorded. Species diversity (Shannon–Wiener index), dominance (Simpson's index), richness (Margalef's index), and evenness (Pielou's index) varied among wetland types, though not significantly. Among water quality variables, temperature, oxidation–reduction potential, and pH exhibited significant differences across wetland types, whereas dissolved oxygen, conductivity, total dissolved solids, and salinity did not. Principal Component Analysis (PCA) revealed distinct water quality profiles for each wetland category, while Canonical Correspondence Analysis (CCA) highlighted the relationships between fish assemblages and environmental gradients. These results provide important baseline data on the relationships between fish diversity and water quality in Arkansas wetlands, enhancing our understanding of their ecological integrity and guiding wetland conservation and management efforts.

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Comparison of Pollinators in Different Locations with the Different Floral Plants on Pollinator Communities. I. Solomon*, Y. I. Park, Department of Agriculture, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601.

Pollinators are vital for sustaining agricultural productivity and ecological biodiversity, yet regional data on bee abundance and species diversity are limited. This study compared bee abundance and species richness associated with similar floral resources across multiple sites in Pine Bluff and Altheimer, Arkansas. Field sampling was conducted during the summers of 2024 and 2025 using soapy water traps, blue vane traps, and aerial nets. The collected bees were identified to the species level, and the data were analyzed to determine spatial and temporal patterns in species richness and abundance. A total of 32 bee species were documented, with Ptilothrix bombiformis being among the most frequently observed. Pollinator richness and abundance were generally higher in areas with greater floral diversity and open habitat structure compared to sites with limited floral resources. Seasonal variation was evident, with peak pollinator activity occurring in mid-summer. These findings highlight that pollinator communities in southeastern Arkansas are strongly influenced by the availability of floral resources and habitat conditions, underscoring the importance of effective habitat management practices in maintaining diverse and healthy bee populations.

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Environmental Contaminants and Vector Behavior: PFAS Effects on Mosquito Ecology. I. Beasley*, M. Okulate, M. Salvitti, J. Pitula, and E. Omagamre**,** Department of Natural Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853.

Per- and polyfluoroalkyl substances (PFAS) are persistent environmental pollutants that bioaccumulate across ecosystems, including wild mosquitoes. While prior studies have demonstrated PFAS-induced developmental and behavioral alterations in various insects, their effects on mosquitoes—a critical vector for numerous human diseases—remain largely unexplored. This study investigates whether environmentally relevant PFAS exposures influence mosquito development and feeding behavior, with implications for vector ecology and public health. Field-collected mosquitoes from riparian zones near wastewater treatment plants on Maryland's Eastern Shore were analyzed for PFAS accumulation using LC-MS, identifying a mixture of 14 PFAS compounds. Laboratory experiments exposed larval mosquitoes to graded concentrations of mixed PFAS (0, 10, 500, 1500, and 5000 ppt) and adult mosquitoes to blood meals spiked with 10 and 10,000 ppt. Developmental parameters, including pupation rate, adult emergence, exuviae count, and behavioral responses, were monitored daily. Statistically significant differences were observed in pupation delays at the 5000 ppt level, while 10 and 500 ppt exposures accelerated adult emergence compared to controls. Feeding aggression was unaffected by PFAS exposure. These findings suggest that environmentally relevant PFAS contamination may accelerate mosquito development, potentially altering vector population dynamics and disease transmission risks. Ongoing analyses are examining gene expression changes linked to PFAS exposure.

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Integrating Trees and Crops for Weather Resilience: Impact of Alley Cropping on Mitigating Anthropogenic Emissions. R. Limbu Sanwa*, and L. Karki. Department of Agriculture, Food and Resource Sciences, UMES Extension, University of Maryland Eastern Shore, Princess Anne, MD 21853.

Alley cropping is an agroforestry practice where rows of trees are interplanted, with annual crops grown in the alleys. This multidimensional system integrates the long-term benefits of trees with the annual productivity of crops and is recognized for its potential to reduce anthropogenic emissions and enhance soil carbon sequestration, offering a strategy for agricultural resilience. To showcase these benefits, the University of Maryland Eastern Shore has established research and demonstration sites in Westover and Eden, featuring pecan- and chestnut-based alley cropping systems. Baseline measurements of major atmospheric carbon fluxes were taken prior to system establishment to provide reference points for future assessments. Results showed that fluxes were consistently higher in the field designated to establish chestnut-based compared to the pecan-based alley cropping system. Normality tests (Shapiro-Wilk) indicated that CO_2 and N_2O fluxes were approximately normally distributed, while CH_4 deviated slightly. Welch's t-tests ($p < 0.05$) revealed significantly higher CO_2 ($t_{17.38} = 7.554$) and N_2O ($t_{14.65} = 2.397$) fluxes in the chestnut-based system. These results were further supported by Mann-Whitney U tests ($p < 0.05$), which revealed significant differences between the two systems for CO_2 ($U = 55$), CH_4 ($U = 55$), and N_2O ($U = 32$). Collecting baseline gas flux data is essential for addressing the future impacts of alley cropping on soil gas dynamics. The results demonstrated greater overall unpredictable weather patterns in land designated for the chestnut-based alley cropping system. These findings underscore the potential benefits of establishing alley cropping systems to optimize both environmental and economic benefits.

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Integrating Microbiome Characterization into Acid Mine Drainage Recovery Assessment. V.C. Urama*, S. Phuyal, F.M Guerrero-Toledo, A. Hass, F. Rojano, D.H. Huber**.** Department of Biology, Biotechnology Graduate Program, Gus R. Douglass Institute, West Virginia State University.

Acid mine drainage (AMD), generated through the oxidation of sulfur-rich minerals and catalyzed by microorganisms and iron, poses significant environmental hazards. When discharged into nearby streams, AMD lowers pH, increases metal loads and alters other physicochemical properties, resulting in biodiversity loss and substantial economic impacts. Effective remediation measures are therefore required to restore water quality. Cabin Creek, a stream in the Central Appalachian region, where coal mining is prevalent, is affected by AMD and currently undergoing passive remediation. Continuous assessment of such systems is essential to evaluate treatment performance, guide maintenance and inform future restoration efforts. While recovery in remediated streams involves both physicochemical and biological improvement, most evaluations emphasize water chemistry alone. Such evaluation overlooks the role of microbial communities in ecosystems and may not be sufficient to conclude the recovery of a once impacted stream. This study integrates microbial community characterization with physicochemical characterization across the treatment ponds, downstream receiving waters, and an unimpacted reference stream. Microbial DNA was extracted from sediment samples. Illumina sequencing of 16S rRNA, and QIIME analysis were used to characterize microbial diversity. Water chemistry was measured in situ using YSI multiparameter probe, while sediment chemistry was measured with ICP-OES and Dionex ion chromatography. Microbial diversity, alongside water and sediment chemistry varied across locations. We examined how microbial diversity and richness correlate with environmental conditions and identified key physicochemical factors shaping community structure. Findings from this work provide insight into the microbial ecology of remediation and support more holistic evaluation of AMD treatment success.

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Does The Use of Analogy Change Angler Attitudes More Than Scientific Evidence Alone? I. C. Atoe*, S. E. Lochmann, Aquaculture and Fisheries Department, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601.

Scientists are moving away from the deficit model of communication. Simply sharing science with the public has resulted in less than satisfactory outcomes. There is a movement toward strategic approaches to science communication. One such strategy is the use of analogy. Is the use of analogy really more effective than providing scientific evidence alone? We used a before-after-control-intervention study design to examine the change in attitude regarding the practice of catch and release before and after reading an article on the subject. A control article provided

evidence that catch and release is not always appropriate for a fishery. Treatment articles provided the same evidence but included one of two analogies to reinforce the evidence. Pre- and post-intervention surveys were analyzed to determine the change in survey respondents' attitudes toward harvest and toward catch and release as a conservation practice. Overall, angler's opinions regarding harvest and catch and release as a conservation practice did change, but there was no treatment effect, meaning a well-written article relying on science alone was as effective as science and an analogy. However, when parsed by respondent demographics, some demographic groups experienced a greater change in opinion regarding catch and release as a conservation practice. Trout anglers, anglers ages 21-40, anglers making more than $90,000 and anglers who fished 6-10 days per year demonstrated a treatment effect, with greater change in opinion when science was combined with an analogy. This work provides empirical evidence of the influence of analogies on effectively communicating messages with some anglers.

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Evaluating the Role of Native Grasses in Improving Water Quality and Soil Health in Agricultural Fields. J. Beasley*, T. White. UAPB Discovery Farm Educational Center, University of Arkansas at Pine Bluff, 1200 N. University Drive, Mail Slot 4912, Pine Bluff, Arkansas 71601.

Water quality and availability are becoming increasingly critical global concerns, particularly in the face of shifting temperature patterns, changing precipitation dynamics, and the growing frequency of extreme weather events. These environmental changes significantly affect runoff quality by altering nutrient loading and sediment transport. In Arkansas, agriculture plays a vital economic role, with approximately 13.8 million acres of farmland contributing nearly $16 billion to the state's economy. This study aims to assess nutrient, and sediment loads in edge-of-field runoff and utilize native grass as a cover crop and buffer strip to improve soil health and water quality. The experimental design includes adjacent demonstration plots separated by a levee, each equipped with a discrete runoff outlet and an ISCO 6712 edge-of-field monitoring station. Soil samples were collected from nine areas within the field using a 6-inch probe. The Mehlich III Nutrient soil test revealed an average pH of 5.6, which shows the soil being very acidic. At this level it would be difficult to hold nutrients. The recommendation of the Jefferson County extension office would be to apply lime at a rate of 3000 lbs./acre. Our hypothesis is that our use of conservation practices will reduce nutrient and sediment loss while enhancing soil health. Through the UAPB Discovery Farm Educational Center, our goal is to provide practical, data-driven recommendations to landowners and local policymakers. This work contributes to the broader understanding of how native vegetation and sustainable land management practices can improve water quality and promote long-term agricultural resilience.

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Economic Analysis of Cover Crops in Arkansas. C. Campbell*, T. White, R. Nedd**,** UAPB Discovery Farm Educational Center, University of Arkansas at Pine Bluff, 1200 N. University Drive, Mail Slot 4912, Pine Bluff, Arkansas 71601.

Nutrient runoff, particularly excess nitrogen and phosphorus, remains one of the most pressing water quality challenges in Arkansas. As agricultural production expands and long term weather variability intensifies, the need for robust monitoring and conservation strategies becomes increasingly urgent. Agriculture is the state's leading economic sector, contributing nearly $16 billion annually across 13.8 million acres. As the nation's top rice producer, Arkansas faces elevated risks of nutrient loss and sedimentation in waterways. This study, led by the UAPB Discovery Farm Educational Center in collaboration with Arkansas Discovery Farms, focuses on evaluating the impact of conservation practices—including nutrient management, native grass implementation, and cover cropping—on soil health and water quality. Demonstration plots were established side-by-side, separated by a levee, with each plot featuring discrete runoff outlets and ISCO 6712 edge-of-field monitoring stations. Soil samples taken from nine field locations at depths of 6-inches using soil probes revealed an average pH of 4.8, indicating highly acidic conditions which leads to limited nutrient retention. Based on local extension recommendations, correcting this may require lime applications of up to 2,500 lbs./acre—posing a significant cost to producers. In addition to environmental outcomes, the study aims to compare the economic benefit-cost of using cover crops versus leaving fields fallow. By integrating water quality monitoring, soil testing, and economic analysis, this research will provide actionable insights for farmers and policymakers. The goal is to support sustainable agriculture by reducing nutrient loss, improving soil function, lowering input costs, and enhancing long-term productivity.

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Understanding Farmers' Awareness and Adoption Readiness for Biochar in West Virginia. B. Hundley* and S. Bandara, Department of Business and Economics, West Virginia State University, Institute, WV 25112
Biochar is emerging as a sustainable soil amendment that can enhance soil fertility, improve water retention, and reduce reliance on chemical fertilizers. Despite its environmental and economic benefits, adoption among farmers remains limited, particularly in Appalachian regions dominated by small-scale farming. This study investigates farmers' awareness, knowledge, experience, and readiness to adopt biochar in West Virginia. Using survey data collected from local farmers, the research examines whether participants have heard of biochar, understand its uses, or have prior experience with it, as well as their willingness to purchase and factors influencing that decision. Preliminary findings indicate moderate awareness but limited hands-on experience, suggesting potential for market development through education and outreach. The study provides insights into the market potential for biochar and its role in advancing sustainable agricultural practices in the Appalachian region.
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Impact of Heirs' Property Educational Workshop on Knowledge, Participation, and Estate Planning Behaviors in Maryland. R. Khadka*, L. Karki , P. Bhandari, and N. Cook, Department of Agriculture, Food and Resource Sciences, UMES Extension, University of Maryland Eastern Shore, Princess Anne, MD 21853.

Heirs' property creates legal and financial vulnerabilities that often result in land loss, yet effective prevention strategies remain limited. This study evaluated the impact of Heirs' Property Education (HPE) workshops conducted across Maryland by the UMES Extension, focusing on how population characteristics shape participation, knowledge gains, and estate planning intentions. Post-event surveys (N = 123) assessed participants' understanding and behaviors related to heirs' property and estate planning. Ordinal Logistic Regression analyses indicated that community education significantly improved participants' ability to identify heirs' property (OR = 0.34), recognize its impacts (OR = 0.31), and understand the role of tax and partition sales in land loss (OR = 0.37). Education level, gender, race, and occupation influenced outcomes: participants with advanced degrees showed greater knowledge gains; women were more likely to create family trees; non-African American participants were more willing to identify co-heirs; and farmers were more inclined to compile local resource lists. The Multivariable Logistic regression (N = 69) further showed that individuals with graduate or professional degrees (OR = 0.26) and African American respondents (OR = 0.33) were less likely to participate in workshops. Women were nine times more likely than men to report heirs' property experience (OR = 9.25, $p < 0.05$). Participants aged 18-64 years, women, and those with higher levels of education were less likely to express a willingness to create wills. Overall, findings suggest that community-based education effectively enhances heirs' property awareness, while demographic factors—particularly age, education, gender, and race—strongly shape engagement and behavioral outcomes.

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Explaining Career Decision-Making Self-Efficacy (CDSE) of Agriculture Students. J. Ballard*, J.C. Ricketts, and T. Broyles, Department of Agricultural Business and Education; A. Clardy, Department of Agricultural Sciences and Engineering; and T. Webb, Department of Psychological Sciences and Counseling, Tennessee State University, Nashville, TN 37209.

This study examined the career decision-making self-efficacy (CDSE) of Tennessee State University (TSU) agriculture students and the factors that shape it, with the aim of informing advising and program design. Grounded in Social Cognitive Career Theory, the study used the CDSE-Short Form (25 items) tool. This descriptive survey of agricultural sciences undergraduates (n=94; census attempt) captured demographics, contextual and learning experiences (farm background, FFA/4-H, Summer Apprenticeship Program), interest in an agriculture career, and CDSE across five constructs: Accurate Self-Appraisal, Gathering Occupational Information, Goal Selection, Planning, and Problem Solving. Reliability was acceptable-to-excellent for all scales. Students reported "Much Confidence" overall (M=3.65, SD=0.67), with construct means ranging from 3.51 (Planning) to 3.73 (Accurate Self-Appraisal). However, scores trailed national normative CDSE values. Two race differences emerged: non-black students scored higher in Accurate Self-Appraisal and Problem Solving. In addition, Planning efficacy was higher among students with farm experience and those whose parents owned a farm; FFA participants also demonstrated higher Planning scores. Interest in an agriculture career (M=4.29, SD=1.00) was the only consistent predictor in regression models, significantly explaining Goal Selection, Planning, and Total CDSE; other predictors were nonsignificant. Findings suggest that targeted strategies – e.g., expanding experiential learning on TSU farms and with industry partners,

strengthening FFA/4-H pathways, and redesigning the Summer Apprenticeship Program with CDSE-focused activities – can elevate planning confidence and overall CDSE, helping more TSU students translate strong career interest into successful agricultural careers.

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Impact of Cooperative Extension in The Black Belt. K. St. John* and Department of Agriculture and Envi. Sciences, Tuskegee. University, 1200 W Montgomery Rd, Tuskegee, AL 36088, R. Shange, Cooperative Extension, Carver Integrative sustainability Center, Tuskegee University, Tuskegee, AL 36088,

This study reports on the impact of Cooperative Extension initiatives in the Black Belt region. Programs across agriculture, youth development, family and consumer sciences, and community development were evaluated to assess changes in participation, outcomes, and community benefit. Quantitative data were drawn from program records and evaluation surveys, while qualitative insights were captured through interviews with Extension staff and stakeholders. Findings indicate consistent impact and growth, including improved agricultural practices among small farmers, enhanced food security, and expanded opportunities for youth leadership and STEM engagement. Results also show that Extension programs contributed to greater family resource management and strengthened community capacity. By documenting both outcomes and long-term trends, this research demonstrates how Cooperative Extension reduces disparities and fosters sustainable development in the Black Belt.

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Bridging Insurance Disparities: Assessing Adequacy and Premium Burden Among Small Food and Nonfood Businesses in Coastal Economies. O.A. Odeyomi*, and G.C. Ejimakor; Department of Agribusiness, Applied Economics, and Agriscience Education, North Carolina Agricultural and Technical State University, Greensboro, NC, 27411.

This study examines disparities in cyclone insurance adequacy and premium burdens among small businesses operating within food and nonfood industries in U.S. coastal regions. Using data from the Coastal Small Business Insurance Survey, ordered logistic and generalized linear models were estimated to explore how firm size, ownership type, gender, revenue tier, industry category, and risk location affect insurance outcomes. Empirical results show that women-owned and food-based enterprises experience significantly lower adequacy levels and higher premium burdens. Specifically, small and women-owned firms exhibit 28–32% lower odds of obtaining adequate coverage and face premiums averaging 34% higher than their larger or male-owned counterparts. Firms located in high-risk coastal zones display a 0.42-point adequacy gap compared to those in low-risk areas, while differences across industries reveal that food-related enterprises—particularly in processing and retail—face higher cost-to-coverage ratios. These disparities persist even after controlling for years operation and ownership structure, suggesting structural inequities in market access and risk assessment practices. The study underscores the need for policy interventions that promote equity in disaster insurance, including risk-based subsidies, gender-responsive insurance design, and improved information sharing through cooperative networks. By integrating economic and business-level heterogeneity, the findings contribute to broader discussions on risk adaptation and resilience building for coastal small businesses that underpin regional food systems and local economies.

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Creating a Food Business Model: Case Study of Traditional Drinks made from Hibiscus, Millet, and Corn. J. Nyame*, E. Bonsi, R. Zabawa, D. Mortley, Y. Diabate, L. Asare-Baah, Department of Agricultural and Environmental Sciences, College of Agriculture, Environment and Nutrition Sciences, Tuskegee University, Tuskegee, Alabama 36088.

The food and beverage industry (F&B) is a crucial segment of every economy. Despite their importance, small and medium-sized businesses in the F&B sector face significant challenges, such as product variations, ineffective marketing, and inadequate business models, which lead to higher failure rates. Previous studies have focused on these issues, neglecting practical, sector-specific frameworks to support small businesses from idea generation to customer outreach. This study aimed to develop a comprehensive process flow for establishing a small food business, using traditional drinks made from millet, hibiscus, and corn as a case study. A standardized recipe for the three beverages

was created, and the drinks were prepared. The prepared drinks underwent sensory evaluation for visual appearance, taste, flavor, aroma, and overall acceptability, using a seven-point hedonic scale by a panel of 113 randomly selected participants. Analysis was conducted in Stata using descriptive statistics. A cost-based pricing strategy with a 25% markup was applied to determine the selling price, while a cost-benefit analysis assessed the economic viability of production and commercialization. Results from the sensory evaluation show that the millet drink achieved the highest overall acceptability score (5.75) and top ratings in taste (5.69), flavor (5.43), and aroma (5.63). However, it received the lowest score for visual appearance (4.64). The pricing analysis indicated a competitive price of $2.73 for a 350ml bottle, demonstrating financial sustainability with a 25% return on investment. This study presents a comprehensive business model that addresses common challenges small food businesses face, providing strategic solutions for product development and commercialization.

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Exploring the Potential Impacts of Square Foot Gardening for Sustainable Local Food Production in Kentucky. O. Ibiloro*, S. Dasgupta, and S. Sarr, Land-Grant Program, Kentucky State University, Frankfort, KY 40601.

Square Foot Gardening (SFG), a method developed to help people farm vegetables efficiently in small urban spaces using modest equipment, is proposed as a revolutionary, sustainable management strategy that enhances soil health, promote diversity and healthy diets, address urban food security, increase income by improving plant productivity / yield, and play a key role in sustaining the environment by emphasizing the use of recycled materials and compost as a component of the growing medium. However, its adoption rate is low among local producers in Kentucky. The essence of the project is a comparative research study evaluating the production, economics, and sustainability of SFG versus traditional row gardening for local food production in Kentucky, particularly in urban areas with limited space. This is achieved using a two-factor factorial design with three replications to determine if SFG, coupled with resource-efficient fertilization methods (preplant nutrients versus weekly water-soluble fertilizers), is the most productive, cost-effective, and sustainable approach for small-scale vegetable cultivation. The study expects to demonstrate that SFG will prove to be a more productive, cost-effective, and sustainable solution for small-scale vegetable plants, thereby encouraging wider local adoption and strengthening urban food systems.

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Farm Bill Pitch: Increasing Outreach for Environmental Quality Incentive Program in Jefferson County. M, White*, A. Noffsinger, and A. Lock. UAPB Small Farms Program, University of Arkansas at Pine Bluff, 1200 N. University Drive, Mail Slot 4912, Pine Bluff, Arkansas 71601. [2]United State Senate Agriculture, Nutrition & Forestry Committee, 328A Russell Senate Office Building Washington, DC, 20510.

The Environmental Quality Incentive Program (EQIP) provides agricultural producers and forest landowners with financial and technical help to solve issues related to natural resources, including enhancing water and air quality, promoting soil health, reducing soil erosion, and mitigating drought. The EQIP program has helped many farmers in the Jefferson County area. The problem in the Jefferson County area with the EQIP program is that most of the applicants applying are just about the same each year. How can we increase outreach opportunities through the UAPB Small Farm Program to get small farmers to apply? This research aims to develop alternative ways of informing small farmers about the EQIP program through alternative resources such as social media, mobile education and outreach within our communities, and field day participation to get new farmers to apply for the same opportunity. Through the UAPB Small Farms program, more farmers have learned about EQIP. We analyzed Natural Resource Conservation Services data in the Jefferson County database from 2020 to 2023. There was a slight increase in applicants, ranging from 9 to 17. According to Jefferson County District Conservationist Ma'Shayla Martin, they helped 17 farmers in 2023 and provided them with funding to implement conservation practices. With the increase in outreach in the 2024 application period, we expect to have even more applicants.

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Evaluating Electricity Demand in Alabama's Black Belt and the Impact of Demographic Factors on Energy Rebates Program. T. Curry*and T. Gautam Tuskegee University, Tuskegee, AL 36088

Alabama ranks third in the nation for per capita electricity consumption, primarily due to high residential demand for air conditioning and electric heating. Despite this, the state's Black Belt region experiences disproportionately high-

energy burdens, driven by lower household incomes, higher unemployment rates, and inefficient, aging housing stock. Although overall energy usage in the Black Belt is lower than in more urban areas and other counties, residents spend a significantly larger share of their income on energy costs. In this context, low-to-moderate-income households in Alabama stand to benefit substantially from home energy efficiency and electrification rebates established under the 2022 Inflation Reduction Act. These rebates, administered by the U.S. Department of Energy, are allocated based on household income relative to area median income, with full coverage for low-income and partial coverage for moderate-income households. This study examines how demographic factors influence rebate allocation and aims to inform policy decisions on targeted rebate distribution. Using county-level data from the Department of Energy, including household counts, energy burdens, costs, income, demographics, and educational attainment, we conduct regression analysis comparing Black Belt counties to other regions in the state. Preliminary results suggest that educational attainment, income levels, demographic composition, and energy costs significantly influence rebate accessibility, highlighting the need for regionally tailored implementation strategies.

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Who Values Carbon Reduction? Evidence from Consumer Segmentation in Greenhouse Cherry Tomato Markets. A. Varziri* and R. Chen Dept. of Ag. and Envi. Sciences, Tuskegee University, Tuskegee, AL 36088

Sustainability labels in U.S. food markets are proliferating, reflecting rising environmental concern but also increasing confusion over what different claims mean and which attributes genuinely indicate environmental impact. This study examines how consumers value carbon-reduction information relative to other production cues for a low-carbon cherry tomato produced in Controlled Environmental Agriculture (CEA). Using a latent class choice model, we identify four consumer segments. Tech-enthusiast value seekers respond positively to biotechnology and food-safety assurances, yet remain highly price sensitive and show limited interest in carbon-reduction claims. Seasonal and safety seekers—typically older and more educated—prioritize pathogen-free water, and seasonality as signals of naturalness and safety. Energy-practice greens are younger, lower-income consumers who favor energy-efficient and seasonal practices but are constrained by price. Carbon-first purists are more affluent households that place the highest weight on carbon reduction and energy efficiency while rejecting biotechnology, preferring low-carbon products achieved through "natural" methods. Across segments, carbon-footprint information resonates most with affluent, tech-averse consumers, whereas younger and price-constrained shoppers respond more to production-based sustainability cues—seasonality, safety, and energy efficiency—than to abstract carbon metrics. Percentage-style carbon labels are difficult for many consumers to interpret or connect to tangible product qualities, while production cues communicate visible actions and concrete benefits. These results suggest that effective carbon communication should translate technical reductions into clear, relatable messages (e.g., energy-efficient lighting or seasonal cultivation) to broaden appeal beyond a narrow, high-income niche.

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Bridging the Divide: Macon County Community Asset Map. H. Rockmore-Johnson*, Department of Agriculture and Environmental Sciences-Carver Integrative Sustainability Center, Tuskegee University, Tuskegee, AL 36088; G. Vaughn, L. MacDonald, University of Colorado Boulder, Boulder, Co 80309.

Many agricultural stakeholders work in isolation, with limited awareness of one another's resources or potential for collaboration. The project seeks to address this gap in awareness and coordination of farmers, producers, non-profits, and food distributors by developing the Macon County Community Asset Map (MCAM). The digital tool was designed to visualize, connect, and strengthen local networks that contribute to economic sustainability and technological innovation. Methods included qualitative data collected from 30 organizations through IRB approved interviews and surveys. The data was thematically analyzed to identify shared missions, collaboration goals, and resource needs. Findings revealed strong interest in cooperative marketing, shared outreach, and cross-sector partnerships, but a lack of centralized information. The MCAM compiles this data into a user-friendly website that highlights local assets and encourages community development. Therefore, the MCAM demonstrates how integrating participatory research and digital technology can bridge gaps between agricultural, business, and civic sectors. Cultivating a model of sustainable, community-driven development applicable in other rural and 1890 Land-Grant communities.

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The Effect of Access to Broadband on Rural Development Efforts in Alabama's Blackbelt A. Cornie*, and R. Shange. Dept. of Agricultural and Environmental Sciences, College of Agriculture, Environment and Nutrition Sciences, Tuskegee University, Tuskegee, Alabama 36088.

While broadband is widely perceived as an important instrument for accessing vital resources, such as jobs, education, health care, food, and information, this is not the case for every community in the United States. Alabama's Blackbelt is noticeably behind the rest of the states when it comes to internet access. This is a challenge for most people living in rural areas where there is limited or no internet access and connectivity. The purpose of this study is to assess the effect of broadband access on rural development in Alabama's Blackbelt and its potential to improve the life prospects and economic opportunities of the rural people. This study will use a mixed-method approach including surveys, focus group discussions, and secondary data analysis to evaluate broadband access and its effects. Additionally, Geographic Information Systems (GIS) mapping will be used to further reveal the spatial extent and patterns of broadband access in the region. This study will provide valuable insights to individuals and businesses in the broadband sector, helping them identify areas lacking broadband internet access for potential expansion and profit generation. It will also assist the government, scholars, the public, and other stakeholders in understanding the factors that affect broadband access, enabling them to address these challenges and promote development. Findings and implications will be presented.

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Consumer Demand and WTP for Intelligent Packaging in Beef Retail. H.J. McAllister*, Animal Science Industry, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32307; L. Nguyen, Agribusiness, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL, 32307.

This project aims to determine consumer demand and valuation of intelligent packaging for beef, emphasizing attributes that enhance shelf life, freshness, safety, environmental sustainability, and transparency. The primary research question is: What are the preferences and willingness-to-pay (WTP) for beef products with intelligent, environmentally friendly packaging compared to conventional packages, and which packaging attributes most influence consumer concerns about environmental impact. A discrete choice experiment embedded in a national survey of 400 U.S. beef consumers will be conducted, with participants recruited via in-store intercepts, community outreach, and online panels. Choice sets will vary by price, freshness indicators, origin transparency, certification, and environmental packaging. Mixed logit and latent class models will estimate WTP, account for preference heterogeneity, and identify distinct consumer segments. Expected outcomes include WTP estimates for each attribute, market segment profiles, and actionable recommendations for industry adoption. The intellectual merit lies in delivering an economic valuation of intelligent beef packaging that merges technological innovation with sustainability considerations. The anticipated impact includes guiding producers, retailers, and policymakers toward packaging strategies that build consumer trust, elevate perceived product quality, and promote a more sustainable, transparent beef supply chain.

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Building a Framework for Student Experiential Learning: Socio-Ecological Systems at Southern University. C.M. Joseph*, College of Agricultural, Human and Environmental Sciences, Southern University and A&M College, Baton Rouge, LA 70813.

This work will examine how experiential learning, and socio-ecological systems intersect through agricultural science, sociology, and the arts. The study builds a framework for applied learning in utilizing campus resources to create a thesis art showcase centering socio-ecological system. The framework combines David Kolb's experiential learning theory and an extended version of Talcott Parsons's AGIL+DE Paradigm. The research overall investigates individual and collective engagement within academic spaces and how that can impact well-being, social continuity, and the natural environment. Experimentation involves a final interdisciplinary student-led art showcase that emphasizes the Nature Connectedness Theory and Socio-Ecological systems at Southern University. The arts are used to platform scientific communication to underscore how experiential learning relates to real world application for college communities. A mixed-method approach combines qualitative analysis of student experiences through an open-ended survey as well as interpretative examination of academic literature. Quantitative analysis includes students' participation, ticket sales/funds raised, and likert scale of student and audience preferences post showcase. The thesis aims to develop a better understanding of culturally rooted learning environments that emphasize resilience and

innovation. Findings are anticipated to contribute to broader discussion on socio-ecological systems, scientific communication, and pathways towards experiential learning via utilization of campus resources.

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Green Classrooms: Linking Farms, Schools, and Student Success. E. Jackson*, T. White, D. White, I. Young. UAPB Discovery Farm Educational Center, University of Arkansas at Pine Bluff, 1200 N. University Drive, Mail Slot 4912, Pine Bluff, Arkansas 71601.

The Farm to School Initiative was launched to connect schools with local farms and provide students with access to fresh, healthy, locally grown food. Established in Arkansas under Act 506 by former Governor Asa Hutchinson in 2019, the program aims to embed farm-to-school practices in local education systems to improve health, strengthen community ties, boost local economies, and support environmental sustainability. A key component of this initiative is the integration of school gardens into wellness plans, promoting food security by ensuring consistent access to nutritious food and fostering physical, social, and economic inclusivity. This study explored the impact of a school gardening program involving the principal, 2 teachers, 4 volunteer parents, and 25 students, of varying learning abilities who participated in preparing and maintaining the garden. The objective was to provide hands-on opportunities for all children to learn how food is grown, encouraging healthier eating habits and a deeper appreciation for agriculture. The garden served as a platform for experiential learning across subjects such as science, nutrition, and environmental studies. It also fostered community engagement, bringing together educators, parents, and volunteers to support the garden's development. Findings indicated that gardening activities enhanced students' self-esteem, responsibility, and teamwork, while also promoting patience and cooperation. Notably, the experience had therapeutic benefits—reducing stress, anxiety, and symptoms of depression among participants. Students with learning disabilities or special needs worked collaboratively with their peers, reinforcing inclusivity and a sense of shared purpose.

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Economic Roots and Market Resilience: A Comparative Study of the Apple Industry in West Virginia and Virginia. E. H. Hodges*, S. Bandara, Dept. of Business & Social Sciences, West Virginia State University, Institute, WV 25112.

The apple industry is a key component of the agriculture sectors within West Virginia and Virginia. Virginia has been a leader in apple production since the nineteenth century, remaining among the top apple producers in the U.S. Historically, the industry has provided a steady source of income for farmers and supported local economies. However, both states experienced production declines and stagnation in the early 2010s, which reduced farm incomes, slowing economic activity and the access to fresh produce in surrounding rural communities. To address these challenges, West Virginia focused on government programs to absorb surplus apple supplies, helping farms remain viable. Virginia, in contrast, optimized its acreage by redirecting resources from less productive orchards to higher-yield areas. This study examines how these distinct approaches shaped the recovery and growth of the apple industry from 2007 to 2024 and highlights the economic and structural adjustments that supported renewed stability in both states.

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Development of resilience-related skills and their impact on agricultural and community participation. J Christmas*, N Swinson, Virginia State University, Virginia Cooperative Extension, Douglas L. Wilder Building, Carter G Woodson Ave, Petersburg, VA 23806.

Cultivating resilience-related skills in youth is essential for fostering positive cognitive, behavioral, and emotional development. This study explores the role of *Harvest Heroes*, an interactive 30 ft × 30 ft board game, in developing resilience-based skills and agricultural awareness among youth ages 7–18. Participants engage in the roles of grower, consumer, and USDA Farm Service Agency lender, completing activities and challenges that connect agricultural concepts to real-world decision-making. This research is to examines how game-based learning influences the development of resilience-related skills and how these skills affect adaptive capacity, community engagement, and

agricultural participation among youth. Data was collected using pre- and post-program surveys and semi-structured interviews with participants. Evaluations measured both skill development and changes in participants' understanding of agricultural systems. Results indicated that the *Harvest Heroes* experience enhanced participants' resilience-related competencies, particularly problem-solving and relationship-building. Youth also displayed increased adaptability and awareness of how agriculture supports community well-being. As well as an expressed stronger connection to agricultural systems and a desire to share their knowledge with peers. Overall, findings suggest that game-based agricultural education can effectively strengthen resilience skills while fostering community awareness and engagement among youth, offering a promising model for future educational outreach in agriculture and youth development.

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What Is Driving the Demand for Goat Meat in the Southern United States? R. Potter *, M. Ibrahim, B. Kouakou, N. Pattanaik, and B. Cornish, College of Agriculture, Family Sciences and Technology, Fort Valley State University, Fort Valley, GA 31030; B. Onyango, Darr School of Agriculture, Missouri State University, Springfield, MO 65897.

The growing demand for goat meat in the United States can be linked to changing demographics and increased interest in healthier diets. Goat inventory has remained steady in recent years, but consumption has continued to rise, causing demand to outpace domestic supply and driving a surge in imports. Since 2000, imports have increased substantially, making the U.S. one of the leading goat meat-importing countries worldwide. Most meat goat operations are located in southern states and understanding consumption trends and accessing management and marketing information are critical for producers. To explore factors influencing demand, a consumer survey was conducted in 2023 across 14 southern states with 1,203 respondents. Results indicated that demographic factors and eating habits strongly influenced goat meat demand. These findings provide insights into market dynamics and highlight opportunities to strengthen domestic production and marketing strategies.

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Farmland Ownership and Intergenerational Asset Accumulation in Oklahoma: Financial Outcomes for Farm Households. K. Reynolds-Latham*, N. De Silva, S. Giscombe, W. Whittaker. Department of Agriculture and Natural Resources, Sherman Lewis School of Agriculture and Applied Sciences, Langston University, Langston, OK 73050

Farmland ownership plays an important role in long-term asset accumulation and financial outcomes for farm households in rural America. In Oklahoma, where agriculture stimulates many local economies, increasing land values and shifting ownership patterns raise both opportunities and constraints for new and beginning producers. This study examined the relationship between farmland ownership, intergenerational asset transfer, and household financial outcomes, with a focus on Oklahoma as a representative agricultural state. Using secondary data from the USDA National Agricultural Statistics Service (NASS), the Federal Reserve Bank of Kansas City's Ag Finance Database, and the U.S. Census Bureau's American Community Survey (ACS), trends in farmland values, ownership demographics, and farm household incomes were analyzed from 2005 to 2025. Scenario-based modeling compares asset accumulation and debt repayment outcomes for landowners versus renters over a 20-year horizon, under varying appreciation and interest rate conditions. Preliminary results indicate that farmland appreciation—averaging 4–6 percent annually—supports long-term asset growth, while rising production costs and financial constraints affect entry for new producers. The analysis highlights the role of land transition mechanisms, cooperative ownership arrangements, and credit program participation in supporting successful intergenerational transfers and long-term farm viability. Findings provide evidence to inform agricultural finance, extension education, and investment planning related to farmland ownership in Oklahoma.

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Empowering Tuskegee's Farming Community: Living Toolkit to Supporting Tuskegee's Small Farmers and Entrepreneurs. S. Smith*, K. McClain, K. Powe, D. Hooks, L. Lunsford, Department of Agriculture and Environmental Sciences-Carver Integrative Sustainability Center, Tuskegee University, Tuskegee, AL 36088; J. Stuart, L. MacDonald, L. Hunter, University of Colorado Boulder, Boulder, Co 80309; and J. Leeker, Cornell University, Ithica, NY 14850.

Food insecurity in Macon County is significantly higher than the national average, revealing a disconnect between the region's agricultural potential and the community's nutritional well-being. The Empowering Tuskegee project seeks to address this disparity by integrating research, design, and community collaboration to develop a living toolkit for Community Supported Agriculture (CSA) systems. Between June and August 2025, the project applied the Theory of Change framework to narrow its approach and control for bias. Through iterative feedback and reflection three key objectives emerged: (1) promote economic growth through community-based agricultural practices that support small businesses and farmers, (2) strengthen producer to consumer relationships by encouraging engagement with local products, and (3) present and adopt the toolkit through the Carver Integrative Sustainability Center as an extension outreach tool. Methods included interviews with CSA services in Macon County, consultations with food systems experts, and analysis of existing USDA data. The interview transcripts underwent thematic coding to produce a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis, while the expert consultations and USDA data informed best practices and user-friendly designs. Results structured the development of a comprehensive toolkit featuring planning templates, region and income-specific business plans, and literature reviews; delivered as both an online guide and story map. The toolkit serves as a replicable model for strengthening understanding and engagement with local food systems.

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Cultivating Wellness and Cultural Heritage: Integrating *Zingiber Officinale* (Ginger) and *Hibiscus Sabdariffa* (Sorrel) Production into Agri-Tourism Experiences for Hospitality Education. K. Edmonds* and H. Hutchinson, College of Agriculture, Virginia State University, Petersburg, VA 23806.

Agri-tourism presents an innovative platform to connect hospitality education with sustainable agriculture, cultural heritage, and wellness. This study explores the integration of *Zingiber officinale* (ginger) and *Hibiscus sabdariffa* (sorrel) cultivation into Agri-tourism experiences as a means of enhancing hospitality management education and community engagement. Both crops hold deep cultural significance and possess remarkable health benefits—ginger for its anti-inflammatory and digestive properties, and sorrel for its antioxidant-rich, vitamin-packed qualities. Through immersive field visits to working farms, Hospitality students gain firsthand experience in sustainable production methods, value-added processing, and experiential guest programming. Students participate in hands-on activities such as harvesting, beverage formulation, and culinary workshops that emphasize the link between agriculture, nutrition, and guest satisfaction. The project fosters appreciation for farm-to-table operations and underscores the growing importance of health-conscious, culturally rooted tourism. This initiative demonstrates how Hospitality Management programs can leverage Agri-tourism as a tool for experiential learning, community development, and entrepreneurial growth. It promotes sustainability and wellness through the design of authentic guest experiences centered around locally grown crops. Ultimately, incorporating ginger and sorrel Agri-tourism into Hospitality curricula prepares students to innovate within the evolving tourism landscape, aligning education with environmental stewardship, cultural preservation, and economic empowerment.

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Enhancing Women's Health and Community Well-Being Through AI-Powered Business Intelligence. J. Mason*, C. Winstead, College of Agriculture, Science & Technology, Delaware State University, Dover, DE 19901; Z. Wang, L. Wei, L. Xue, Centers for Disease Control and Prevention, CDC Women's Health Division, Population Reference Bureau, Washington, DC 20036; L. Hill, A. Rao, S. Artiga, U. Ranji, McKinsey Institute for Economic Mobility, Maternal Health Equity, Kaiser Family Foundation, Washington, DC 20005.

Persistent inequities in healthcare and nutrition continue to undermine reproductive health and family well-being in rural and urban communities. Gaps in care—such as delayed diagnoses, nutrition deficiencies, and inconsistent service coordination—affect maternal health outcomes and the stability and resilience of families and local communities, while placing financial strain on public systems and hindering family support, youth development, and community growth. This research proposes AI-powered business intelligence (BI) to strengthen the efficiency, quality, and accessibility of reproductive and nutrition services for women. The BI system will integrate electronic health records with community-based nutrition and social service platforms to detect redundant testing, gaps in nutrition counseling, delays in maternal care, and misallocated resources affecting families. Machine learning algorithms will generate real-time insights for providers, improving coordination across programs such as WIC, SNAP-Ed, community health

centers, and local family service agencies. Early analyses will assess whether BI tools can reduce redundant testing by 15%, shorten treatment and nutrition-service delays by 20%, and improve referral and follow-up efficiency compared to current methods. By reducing costs, improving timeliness, and enhancing service integration, the project aims to strengthen family stability, support healthier pregnancies, and foster resilient communities. Ethical safeguards—including data privacy, model transparency, and ongoing bias monitoring—are embedded throughout. This research demonstrates how AI-enabled BI can improve women's health, support families, and contribute to community and economic development, aligning directly with the mission of the Office of Family, Youth, Community and Economic Development.

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Trade Policy and U.S. Farm Productivity: Evidence from Tariffs and Retaliatory Tariffs. K. A. Parker*, Agribusiness Program, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32307; L. Nguyen, Agribusiness Program, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL, 32307.

This research examines how recent trade policy shocks affect U.S. farm productivity using farm-level panel data and measures of exposure to tariffs and retaliatory tariffs. We construct a shift–share index of tariff exposure that captures both import tariffs on key inputs (e.g., machinery, fertilizer, and intermediate goods) and foreign retaliatory tariffs on U.S. agricultural exports. Using a difference-in-differences and event-study design, we compare farms that are more versus less exposed to these shocks before and after the escalation of trade tensions in the late 2010s. A one standard deviation increase in net tariff exposure is expected to reduce total factor productivity by 2.5–4.0 percent, with larger effects for export-oriented and labor-intensive farms. Retaliatory tariffs on U.S. agricultural exports operate primarily through lower output prices and capacity utilization, while input tariffs raise input costs and dampen investment in machinery and technology. Heterogeneity analysis will assess whether smaller farms and producers of trade-exposed commodities, such as specialty crops and soybeans, experience disproportionately large productivity losses. The findings will show how trade policy shocks can erode farm-level productivity in the short to medium run, even when macro indicators such as output or land values appear relatively stable. We will draw implications for the design of safety-net programs, the targeting of ad hoc trade aid, and the broader evaluation of tariff-based trade strategies in agriculture. The results will inform policymakers, producer organizations, lenders, and agribusiness stakeholders about the productivity costs of trade conflicts and support better risk management.

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Assessing food insecurity in Texas: factors and intervention strategies. J. Price*, K. Gosh. Sherman Lewis School of Agriculture and Applied Sciences, Langston University, Langston Oklahoma, 73050.

Food insecurity remains a critical public health and economic concern in Texas, varying across urban and rural areas. This study analyzed USDA food insecurity data across four sub-regions—East, North, South, and West Texas—using multiple linear regression to identify significant economic and food access predictors. Food insecurity rate (%) served as the dependent variable, while predictors included poverty rate, WIC participation, free and reduced-price lunch participation, SNAP redemption, farmers market access, local food access, and vegetable farm density. Results indicate that poverty consistently emerged as the most robust predictor across all regions, with the highest coefficients in South Texas ($\beta = 0.0039$, $p < 0.001$) and East Texas ($\beta = 0.0041$, $p < 0.001$). Other significant predictors varied by region: WIC participation among women was significant in East Texas ($\beta = 0.0045$, $p = 0.0037$), and reduced-price lunch participation contributed significantly to both East and South Texas. Farmers market access and vegetable farm density were not significant predictors in most regions, highlighting the limited mitigating effect of local food outlets alone. Model fit was strongest in North and East Texas ($R^2 \approx 0.76$) and lowest in West Texas ($R^2 \approx 0.30$), suggesting regional heterogeneity in underlying drivers of food insecurity. These findings underscore the critical role of economic vulnerability, particularly poverty, in driving food insecurity across Texas, while programmatic supports like WIC and school lunch programs exhibit region-specific associations. Policy interventions should prioritize alleviating poverty, with tailored strategies for rural versus urban sub-regions to effectively reduce food insecurity.

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A Geospatial Approach to Arboretum Education: Showcasing Native Tree Seasonal Interest at UMES. N. Jeanpiere* and S. Stotts, Department of Agriculture, Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853.

The University of Maryland Eastern Shore (UMES) is pursuing recognition as a public arboretum, leveraging its wide-ranging collection of trees, including 1,535 specimens from 80 species, to inspire and educate. This project supports that goal by developing an ArcGIS StoryMap focused on the seasonal ecological value of these species across the campus landscape. The foundation of this tool was a recent campus tree inventory, which was consolidated and analyzed to verify the native status of unique species. Trees demonstrating distinct seasonal interests, such as flowers, fruit, foliage color, and bark texture, were then selected and visually documented. The StoryMap guides users through the campus, featuring at least three notable native trees for each season. Undergraduate students in agriculture and natural sciences contributed to field data collection, photography, and content development, reinforcing experiential learning and a sense of stewardship for the campus landscape. Future phases will expand the StoryMap with interpretive signage, QR codes, and outreach modules tailored for campus visitors and local schools, broadening its impact as a place-based learning resource. This interactive, geospatial tool combines field observation and ecological research to transform the campus into an accessible educational resource, fostering environmental awareness and community engagement while supporting UMES's long-term arboretum vision.

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Hemp as an Economic Driver: Evaluating Market Potential and Growth Prospects. K.A. Raymond*, A.L. Parks, and W. Dewalt, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Industrial hemp (*Cannabis sativa L.*) has recently attracted significant attention for its wide-ranging applications in medicine, textiles, construction, and industrial manufacturing. In the state of Texas, since its legalization in 2019, the hemp industry has been a major contributor to the Texas economy. As global markets evolve and regulatory frameworks shift, hemp is increasingly recognized as a versatile agricultural commodity with the potential to influence economic development across multiple sectors. This study investigates the economic dimensions of hemp by evaluating its market potential through an analysis of production trends, policy environments, and demand drivers in industrial, medicinal, and consumer markets. A mixed-method approach is employed, integrating economic modeling with policy analysis to examine factors that shape profitability and sustainability within the hemp industry. Key areas of focus include cost structures, supply chain integration, and the role of technological innovation in creating value-added products. Additionally, the research considers the implications of international trade dynamics and evolving legal frameworks on market expansion and competitiveness. By addressing these interconnected elements, this study aims to provide a comprehensive understanding of hemp's position within the global economic landscape and its capacity to serve as a catalyst for growth in both domestic and international markets.

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Empowering Student Entrepreneurs Through the FAB Lab: The Fashion and Apparel Business Laboratory at Southern University. S. L. Kennedy Benson, A. Johnson*, K. Youngblood, Department of Human Sciences, College of Agricultural, Human and Environmental Sciences, Southern University and A&M College, Baton Rouge, LA 70813.

The Fashion and Apparel Business (FAB) Laboratory at Southern University was established to enhance entrepreneurship, leadership, and technical skills among students pursuing careers in fashion, apparel, and textiles. The FAB Lab provides experiential learning opportunities that connect students in the Apparel, Merchandising, and Textiles program with real world applications in design, production, and business development. Through the FAB Fellows Leadership Program, fifteen undergraduate students participated in structured mentorship, leadership development, and entrepreneurship training. As a result, two Fellows, Amaya Johnson and Kayla Youngblood, successfully launched and expanded their own fashion-based businesses, Meraki by Maya and Haus of Koyture, respectively. Their experiences as FAB Fellows included attending New York Fashion Week and participating in the McDonald's Change of Fashion Initiative, where they collaborated with industry professionals and gained exposure to national fashion and entrepreneurship practices. To date, the FAB Lab has engaged approximately 50 youth

participants, 40 community entrepreneurs, and reached more than 200 individuals through events such as FAB LAB Friday's, Southern University Fashion Week and the FAB LAB Gala. These experiences demonstrate the value of experiential education in building entrepreneurship, leadership, and innovation among students in the fashion and human sciences disciplines.

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An Empirical Study: Student Use of Generative Artificial Intelligence (GenAI) Tools in Higher Education. K. Harrison*, J. Seo, Department of Human Sciences, College of Agricultural, Human and Environmental Sciences, Southern University and A&M College, Baton Rouge, LA 70813.

Generative Artificial Intelligence (GenAI) is increasingly integrated into everyday life, and college students are among its most active adopters. This study investigated how higher education students utilize GenAI through a quantitative design employing convenience sampling in the Southeastern United States. Results indicate that over 90% of participants use free versions of GenAI tools, with ChatGPT (78.9%) being the most preferred platform, followed by Grammarly. Over half of the participates reported using GenAI technologies for less than 1 hour per day. The primary applications include academic writing or research and studying or tutoring support. Analysis of Variance (ANOVA) results suggest that traditional students are more likely to use ChatGPT than non-traditional students on a 7-point Likert scale. Multivariate Analysis of Variance (MANOVA) results reveal that while students value accessibility and ease of use, they also express concerns that GenAI may hinder interpersonal and transferable skills, such as leadership and teamwork. Many participants voiced apprehension about overreliance on GenAI technologies. Nevertheless, students demonstrated a strong willingness to continue using GenAI as an educational support tool in the future. Notably, traditional students demonstrated greater awareness of both benefits and drawbacks compared to non-traditional students. These findings suggest that higher education institutions should proactively integrate GenAI technologies into teaching and learning to enhance student outcomes and prepare graduates for an AI-driven workforce.

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An Approach to Stand Counts and Crop Health Using Robotics. S. K. Yerramsetti*, D. V. Singamsetti, Department of Agriculture Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853; L.Ward, and A. Nagchaudhuri, Department of Engineering, University of Maryland Eastern Shore, Princess Anne, MD 21853.

Manual methods for stand count and vigor assessments in agriculture are highly time-consuming and error-prone, particularly in large-scale cornfields. This presentation addresses the integration of robotics, computer vision, and artificial intelligence to develop an autonomous and scalable solution for accurate plant detection, counting, and health assessment. Utilizing an AgileX Scout Mini equipped with an Intel Real sense d435i camera, video segments were systematically collected at predefined intervals corresponding to 1/1000th of an acre. OpenCV and YOLOv8 algorithms were employed to ensure precise detection and tracking of individual plants across video frames, addressing challenges such as variable lighting, occlusions, and growth stage variations. Plant health was quantified using a vigor scoring system to assess morphology, stem strength, and color health. Stand count estimates achieved up to 96.67% accuracy when compared against the known seed application rate. The approach demonstrates great potential for practical agricultural applications including crop emergence assessment, early disease detection, growth rate tracking, and yield estimation. Future enhancements aim to integrate drone and satellite imagery for improved detection capabilities, multi-class identification, and expanded analytical functions such as weed and pest detection, disease classification, and cloud-based data processing.

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Advancing AI-Based Diagnostics for Plant Disease and Insect Identification Using Real-World Field Imagery. V. Hanzer-Diaz*, N. Ftwi, B. Goodwyn, P, Natarajan, S. Tubene, Department of Agriculture, Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853; and R.S. Ouedraogo, Department of Entomology, The Pennsylvania State University, University Park, PA 16802.

Artificial intelligence (AI)-driven plant disease and pest diagnostics depend on varied, authentic, and regionally relevant datasets. This study evaluates the performance of the PlantVillage AI model and uses Google's Vertex AI to train a region-specific agent tailored for the Eastern Shore. The goal is to refine diagnostic accuracy, adapt results to local conditions, and provide the contextual management information that is often missing from PlantVillage AI. A total of over 1,900 real-world field images representing 43 crop species, including grapes, corn, apples, pumpkins, strawberries, echinacea, and poplar, were analyzed for fungal infections, nutrient deficiencies, and insect damage. Diagnostic accuracy, contextual relevance, and management recommendations were validated by experts. The PlantVillage AI model achieved an overall accuracy of 69.04 percent, effectively recognizing common diseases but lacking regional adaptability. The Vertex AI-based agent demonstrated improved potential for localization, though it still faced challenges in differentiating visually similar symptoms and generating precise control guidance. The results highlight the importance of training AI models with regional datasets and integrating environmental and cropping data to enhance performance. Future directions include the development of Retrieval Augmented Generation (RAG) systems and open-access, cost-efficient AI platforms that strengthen decision-making support for farmers, students, and extension specialists on the Eastern Shore.

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A CNN-Based Imaging Framework for Fish Health Classification in Aquaculture Applications. J. Chi*, and C. Nindo, Department of Agriculture, Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, Maryland 21853.

Fish diseases pose a major challenge to aquaculture productivity, food safety, and overall ecosystem health by reducing yield quality and affecting water systems. Early and accurate disease detection is essential to minimize economic losses and prevent spread. This study applies a deep learning-based imaging framework for automated fish health assessment using *SalmonScan*, an open-source image dataset published on Mendeley Data. The dataset consists of 1,208 RGB images derived from an initial set of 115 samples and was used to train a Convolutional Neural Network (CNN) based on the ResNet-50 architecture. The model effectively distinguished healthy and infected salmon (*Salmo* spp.), achieving high classification accuracy and demonstrating potential for recognizing visual cues associated with infection. While primarily exploratory, the findings show how existing deep learning models can support disease detection and visual monitoring in aquaculture. The study also outlines opportunities for future work in multi-class disease classification, data augmentation, and cross-species model adaptation. Overall, this framework illustrates how adaptable, AI-driven imaging methods can enhance aquaculture management and advance broader goals in food quality and security.

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Sweet Sorghum Varietal Androgenic Profiles Investigated per Five Microspore Developmental Stages. M. Ọláwuni*, S. Lymanska, C. Kurapati, G. Shaik, and A. Aziz, College of Agriculture, Tennessee State University, Nashville, 37209.

Sweet sorghum is a multipurpose crop with the ability to survive on low-input land. *In vitro* cold stress can reprogram developing pollen towards the embryogenic pathway. This research investigated the androgenic response of sorghum microspores toward haploid tissue generation. Panicles were harvested for aseptic isolation of microspores from the anthers of five sorghum varieties (Achi Turi, Dale, Dasht Local, Sugar Drip, Topper 76-6). Surface sterilization of cold-pretreated spikelets was achieved by complete dipping in 70% ethanol for 30 seconds, followed by a 15-minute dip in 1% $NaOCl_3$ and then rinsing twice with sterile water. To retrieve microspores, 10-20-anthers were crushed in 300ul liquid-media using a sterile mini-pestle on a rotary machine, and gametophytes were dispersed onto semi-solid media. Five progressive microspore developmental stages were tested for comparative androgenic response per genotypes on two MS 5519 media (pH of 5.8); one contained 2,4-dichlorophenoxyacetic acid, kinetin, B5 vitamin, maltose, $CaCl_2$ and $FeSO_4.7H_2O$, while the other had indole-3-butyric acid, kinetin, B5 vitamin, 6-benzylaminopurine, naphthaleneacetic acid, and sucrose. After 17 days of culture, the first media could elicit responses from all five varieties, while both media induced calli from four varieties: Achi Turi, Dale, Dasht Local, and Sugar Drip. Microspores from the panicles' distal portion of all varieties were found more responsive on the above androgenic media. These outcomes could facilitate a haploid breeding approach to genetically enrich sweet sorghum in desirable traits.

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Multiomics Approaches to Explore Reniform Nematode Resistance in Cotton. S. K. Sanathanam*, A. Bibi, S. G. Kommireddypally, Department of Natural Resources and Environmental Sciences, Alabama A&M University, Normal, AL 35762; S. M. Punnuri, College of Agriculture, Family Sciences and Technology, Fort Valley State University, Fort Valley, GA 31030; K. Lawrence, Department of Entomology and Plant Pathology, Auburn University, Auburn, AL 36849; and L. T. Walker, V. R. Sripathi, Department of Natural Resources and Environmental Sciences, Alabama A&M University, Normal, AL 35762.

Cotton (*Gossypium spp.*) is an important crop in tropical and subtropical regions, primarily grown for its natural textile fiber, which makes up 35% of global fiber production. All parts of the cotton plant, including seeds and lint, have economic importance. Cotton is cultivated in over 80 countries, with the U.S. being the second-largest producer after China. In 2024, cotton was produced on approximately 33.1 million hectares, yielding about 117 million bales, or an average of 770 kg/ha (~687 pounds/acre). Frequent exposure to pests such as reniform nematodes (RN) threatens cotton production. Although the genotypes have been identified for RN tolerance, their underlying mechanisms for tolerance are poorly understood. A detailed understanding of the mechanism and identification of critical factors participating in RN stress tolerance is essential. Developing RN-tolerant cultivars through conventional breeding is challenging due to the complex genetic nature of tolerance. Recent omics techniques, including transcriptomics, genomics, metabolomics, and proteomics, have significantly enhanced our understanding of cotton's response to RN stress. These methods have helped identify quantitative trait loci (QTLs), gene regulatory networks, and pathways that contribute to RN tolerance. In this study, we explored a regulatory network involving key metabolites and differentially expressed genes (DEGs) between two contrasting genotypes under RN stress. Our analysis revealed over 1,000 differentially accumulated metabolites and more than 10,000 co-expressed genes. These findings, organized into three clusters based on accumulation patterns and gene expression, highlight important metabolic pathways. This dataset offers valuable insights into cotton breeding strategies and advances in plant biology.

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Integrating Seaweed Biostimulants and Automation Enhances Growth and Antioxidant Potential of Beetroot in a Controlled-Environment FarmBot System. N. Khadka*, P. Nkrumah., B. Min, E. Noh; Department of Agriculture, Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853; M. Mitra, Department of Natural Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853; A. Nagchaudhuri, J. Pandya, and B. Butler, Department of Engineering. University of Maryland Eastern Shore, Princess Anne, MD 21853.

Integrating automation and biostimulants within controlled-environment agriculture (CEA) represents a promising strategy to enhance crop productivity, resource efficiency, and nutritional quality for future sustainable food systems. This study investigated the influence of seaweed-based biostimulants on the growth and antioxidant potential of beetroot (*Beta vulgaris* L.) cultivated under an AI-assisted indoor FarmBot system. A completely randomized design was employed with three treatments: control (T0), high concentration (T1, 1/8 dilution), and low concentration (T2, 1/16 dilution), each replicated six times. Foliar sprays were applied three times per week to achieve full leaf coverage. Growth and biochemical attributes, including leaf area index (LAI), shoot and root biomass, total biomass, total phenolic content (TPC), total flavonoid content (TFC), DPPH radical scavenging activity, and oxygen radical absorbance capacity (ORAC), were quantified in roots and leaves. The low concentration (T2) significantly enhanced LAI ($p < 0.05$), indicating improved leaf expansion and canopy development, while the high concentration (T1) produced the highest shoot biomass. Root and total biomass remained statistically similar among treatments. In beet leaves, TPC and TFC were greatest under T2 (13.20 mg GAE/g DW and 11.01 mg CE/g DW, respectively), with antioxidant assays (DPPH and ORAC) following comparable trends. Root biochemical responses were minimal across treatments. Overall, seaweed biostimulants exhibited a concentration-dependent effect: the lower concentration (1/16) optimized leaf development and antioxidant capacity, whereas the higher concentration (1/8) enhanced shoot biomass. These findings underscore the potential of coupling seaweed biostimulants with automation to drive sustainable, resource-efficient, and high-quality crop production in advanced CEA systems.

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Remote sensing-based approach for spatial mapping and monitoring of fine-scale crop growth variations in Corn (*Zea mays L. ssp. mays*). B. Ghimire*, R. Kulawardhana, J. Rugandirababisha, D. Davis, M. Mbila, X. Kuang, and W. Tadesse, Department of Natural Resources and Environmental Sciences, Alabama A&M University, Normal, AL 35762.

Understanding fine-scale variation of crop growth is essential for improving yield predictions and precise management of agricultural practices. Traditional monitoring of crops can be time consuming, cost and labor ineffective. Remote sensing-based approaches provide promising tools for fine scale mapping and evaluation of crop growth parameters. This study integrates UAV-based multispectral remote sensing data with field estimates of crop growth to map crop fine-scale variations in crop growth parameters using corn (*Zea mays L. ssp. Mays)* as the selected crop. The main objectives of this study are to: 1) Monitor growth of corn using vegetation indices, and 2) evaluate the applicability of UAV-based multispectral data for mapping fine-scale variations in crop growth parameters. Field experiments were conducted at the Winfred Thomas Agricultural Research Station of Alabama A&M University, located north of Huntsville, Alabama, from May to September 2025. In this study, plant height and canopy cover were selected as the key plant growth variables to be measured using field estimates. UAV-based multispectral RS data were collected on a weekly basis. Our initial findings reveal remote-sensing based vegetation indices (Normalized Difference vegetation Index – NDVI) using NIR and red bands of the electromagnetic radiation spectrum as most effective in capturing fine-scale variations in crop growth. Our findings demonstrate the applicability of UAV-based multispectral RS data for mapping and analyzing fine-scale variations in crop growth parameters.

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The Role of Field Days in Enhancing Adoption of Unpredictable Weather Patterns-Resilient Agroforestry Technologies among Smallholder Farmers in Maryland. M. L. Diack*, and L. B. Karki, Department of Agriculture, Food, and Resource Sciences, UMES Extension, University of Maryland Eastern Shore, Princess Anne, MD 21853.

High production costs, labor shortages, and unpredictable patterns continue to challenge smallholder farmers in Maryland. In response, UMES Extension launched educational activities focused on unpredictable weather patterns and resilience (UWPR) practices, such as agroforestry (alley cropping). The primary objective is to build and strengthen farmers' knowledge, skills, attitude, and aspirations to adopt the UWPR alley cropping practice, which integrates rows of fruit trees with vegetables grown in the alleys. To achieve the objective, UMES Extension organized 5 Field Days (FDs) during the summer of 2025. The events aimed to educate community members on the social, economic, and ecological benefits of EWR agroforestry practices, including improved soil health, local food access, carbon sequestration, and reduced atmospheric carbon emissions. The Field Days showcased demonstrations at five on-farm and community sites, featuring 780 fruit trees planted in rows and over 5,000 vegetable plants grown in the alleys. Participants received guided tours of the demonstration sites, observing fruit trees and vegetables, and key techniques, such as composting, mulching, rainwater harvesting, minimal tillage, and cover cropping. Post-event evaluation surveys measured the immediate impact of the Field Days: more than 77% of participants reported an increase in knowledge, 82% expressed willingness to adopt EWR practices, 88% believed the practice would increase household income, and 94% expected improvements in soil health. These findings highlight Field Day as an effective tool for promoting the adoption of EWR agroforestry technologies and building community resilience.

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An Economic Feasibility and Profitability Analysis of Agroforestry: Alley Cropping in Maryland. A. Dhakal*, and L. B. Karki, Department of Agriculture, Food, and Resource Sciences, UMES Extension, University of Maryland Eastern Shore, Princess Anne, MD 21853.

The increasing frequency of extreme meteorological fluctuations poses a significant threat to agricultural production systems, especially for those with limited adaptive capacity and resources. Integrating perennial tree species with annual crops through alley cropping enhances farm productivity and resilience, mitigates the impact of EWV, and reduces crop failure risk, particularly for small and limited-resources farmers. However, the adoption of Extreme Weather Resilient Practices (EWRPs) remains limited, largely due to insufficient economic knowledge, data, and long-payback periods. This study assessed the economic performance of a fig-and-persimmon-based alley cropping (AC) system. The 1.5-acre demonstration site comprises 50 fig and 50 persimmon trees, with alley space sufficient to accommodate 3,811 bell pepper and 3,811 cherry tomatoes. The benefit-cost (B:C) ratio and sensitivity analyses

were conducted to assess the economic robustness of the AC system. The overall B:C of 2.72 indicates that the AC system is a highly profitable investment. Within this system, Fig-Cherry Tomato combinations (B:C = 3.71) significantly outperformed Fig-Bell Pepper (B:C = 1.68). The yields of fig and persimmon trees were not considered, as neither species had entered its fruit-bearing phase. Even with a 10% decrease in market price, sensitivity analysis showed a substantial gross profit of $37,841 for the overall system, demonstrating strong output stability. Additionally, integrating leguminous cover crops significantly improves soil health, enhances nutrient cycling through biological nitrogen fixation, and increases the potential of carbon sequestration, offering long-term potential for carbon farming. These findings confirm the economic viability of fig-and-persimmon-based extreme weather resilient alley cropping systems.

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Integrating UAV-based multispectral remote sensing data with terrestrial lidar data to map fine-scale variations of cotton (Gossypium hirsutum) growth parameters. J. Rugandirababisha*, R. Kulawardhana, B. Ghimire, S. Chatterjee, K. Gibbons, R. Xiao, E. Hunt, and W. Tadesse, Department of Natural Resources and Environmental Sciences, Alabama A&M University, Normal, AL 35762.

Remote sensing data and techniques are extensively used to map and monitor crop growth parameters. Among other remote sensing derived variables, vegetation indices derived based on variable spectral reflectance characteristics of the plant surfaces have been extensively researched. However, RS data from UAV-based sensors are less researched while integration of terrestrial lidar data with UAV based RS data has not been extensively evaluated for their applicability for agricultural crop monitoring. Thus, accuracies of remotely sensed crop growth variables derived using both terrestrial lidar and UAV-based RS data are yet to be evaluated in general and more specifically for mapping and monitoring of fine-scale variations of crop growth parameters. The goal of this study was to evaluate the applicability of integrative approach using UAVs-based multispectral and terrestrial lidar data for mapping fine-scale variations of crop growth parameters over different phenological stages using cotton (*Gossypium hirsutum)* as the selected crop. Our specific objectives were to evaluate relative accuracies of UAV-based multispectral and terrestrial lidar data to 1) assess crop growth parameters, and ii) detect changes in crop growth during different phenological stages. Experimental plots were established at the Winfred Thomas Agricultural Research Station (WTARS) of Alabama A&M University for cotton. Data were collected on weekly basis (field measurements for selected variables and RS data). Initial findings reveal integrating UAV-based multi-spectral remote sensing data as promising tools for mapping fine-scale variations as well as crop phenological changes of crop growth parameters during different stages of the crop growth cycle.

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Yield Responses of Soybean and Corn to Soil Biochar Amendments. O. Adewumi*, G. Ozbay, and M. Guo, Department of Agriculture and Natural Resources, Delaware State University, Dover, Delaware, 19901

A practical approach for sustaining soil health is to amend cropland soil with biochar, a carbon-enriched, recalcitrant solid product from thermochemical processing of plant biomass. To investigate the long-term effects of biochar amendments on crop productivity, microplots (each 1.2 m × 2.4 m) with pre-determined biochar amendment and chemical fertilization programs were established in 2009 at Delaware State University's Smyrna Outreach and Research Center. The field plot experiments followed a randomized complete block design, with nine triplicated soil treatments: Control (CK), Chemical Fertilization (CF), CF combined with 3%, 6%, and 9% Wood Char (WC) Amendments, 6% WC, 3% Poultry Litter-derived Char (PLC), 2% Corn Stover, and 2% Corn Stover-derived Char (CSC). Soybean (*Glycine max*), corn (*Zea mays*), and soybean were grown in the plots in 2023, 2024 and 2025, respectively, following the general agronomic practices. In general, higher grain yields were achieved through biochar amendment and chemical fertilization as compared with the control. The lowest corn grain yield (208.5 bushel/ac) was recorded for CK while the highest yield (311.1 bushel/ac) for Combined CF + 9% WC. Other biochar treatments showed corn grain yields comparable to CF yet significantly higher than CK. Biochar amendments at 2–9% soil in combination with reduced CF had the potential for increasing crop productivity.

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Bioelectrical Impedance–Driven Detection and Forecasting of Mastitis in Dairy Goats. G.K. Isai*, A. Siddique, A. K. Mahapatra, T. H. Terrill, Department of Agricultural Sciences, Fort Valley State University, 1005 State University Drive, Fort Valley, GA 31030; and J. A. van Wyk, Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa

Mastitis remains a leading constraint to dairy goat health and profitability, demanding tools that are both rapid and field ready. We evaluated a bioelectrical impedance analysis (BIA) framework for mastitis assessment and forecasting using Resistance (R), Reactance (Xc), and derived Phase Angle in clinically healthy (DH) and mastitis-identified (DM) goats. After normalizing R and X, we engineered a compact feature set (R_norm, X_norm, Phase Angle, optional frequency) and trained supervised models support vector machine (SVM), k-nearest neighbors (KNN), and a backpropagation neural network (BPNN) to classify DH vs. DM. Across five-fold cross-validation and held-out testing, KNN consistently achieved competitive discrimination, with precision–recall and ROC analyses indicating solid separation of DH and DM from BIA alone; SVM and BPNN provided complementary performance depending on dataset balance and neighborhood structure. Phase Angle was predicted with near-perfect fidelity by KNN regression, reflecting its deterministic dependence on R and X and supporting its use as a robust composite impedance marker. Clustering captured compact groups but only modestly aligned with clinical labels, highlighting the value of supervised learning when health status is known. These results demonstrate that a lightweight BIA pipeline normalization, feature engineering, supervised classification, and per-animal ARIMA/SARIMA forecasting can support scalable, non-invasive mastitis screening and monitoring. The workflow is modular and field-adaptable and can be expanded with udder-level metadata (e.g., SCC), pathogen data, or wearable signals to further improve precision livestock health outcomes.

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Comparative Evaluation of SVM and BPNN Models for FAMACHA-Based Anemia Detection in Small Ruminants. D. Chisom*, A. Siddique, A. K. Mahapatra, T. H. Terrill Department of Agricultural Sciences, Fort Valley State University, Fort Valley, GA 31030; S. S. Panda, Institute for Environmental Spatial Analysis, University of North Georgia, Oakwood, GA 30566; E. R. Morgan, Institute for Global Food Security, Queen's University Belfast, UK; and J. A. van Wyk, Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

Accurate classification of FAMACHA images is a crucial step in diagnosing anemia in small ruminants, which remains one of the most pressing challenges in parasite management. This research, aimed at improving the accuracy of FAMACHA image classification, has the potential to significantly impact animal health. However, image-based FAMACHA scoring is influenced by variable field conditions, particularly lighting differences between direct daylight and shaded environments, which can compromise both image quality and model robustness. To address this issue, the present study systematically evaluated the performance of two machine learning approaches, Support Vector Machine (SVM) and Backpropagation Neural Network, under variable lighting conditions. A dataset of 1,000 labeled eye images, balanced equally between daylight and shade, was collected and preprocessed using five augmentation techniques designed to simulate real-world variability and improve model generalizability. Both models were rigorously assessed using 10-fold nested cross-validation to ensure robust and unbiased performance evaluation. Results indicated that the SVM model, with its highest accuracy of 98%, precision and recall values of 0.98, and a Cohen's Kappa score of 0.959, demonstrated near-perfect agreement with ground truth labels. The BPNN model also performed strongly, reaching 97% accuracy with precision and recall ranging from 0.94 to 1.00, and a Kappa score of 0.939. While both models provided reliable classifications, the SVM consistently handled variations in lighting more effectively and demonstrated greater balance across all classification categories, providing reassurance about the accuracy of the research findings. These findings underscore the potential of machine learning for revolutionizing parasite diagnostics in small ruminants.

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Soil Moisture Prediction Model from UAV based Hyperspectral Images in VIS-NIR Spectrum in Bare Soil Conditions. T. White Jr *, W. Atakora, and H. Dakshinamurthy, Public Service and Agriculture, 1890 Research and Extension, South Carolina State University, Orangeburg, SC 29117.

Effective strategic management of agricultural water resources is paramount to sustaining ecological resilience and ensuring economic viability across South Carolina's diverse farming landscape. This research establishes a machine

learning framework for the prediction of near surface (0-5cm) soil moisture. The core theoretical underpinning for this system is the inverse and quantifiable relationship between soil moisture content and soil reflectance within the high-dimensional Visible-Near Infrared (VIS-NIR) spectrum. Our methodology focused on bare soil conditions to use the relationship between soil reflectance and soil moisture in this region. This ensures that soil moisture spectral signatures can be isolated and measured accurately without the confounding effect of vegetative canopy. A vision aerial Vector hexacopter was mounted with Resonon Pika L (400 – 1000 nm) and Pika IR-L (900 – 1700 nm) hyperspectral cameras to collect images on 12 different days in November 2025 under varying moisture conditions. Ground truth data was obtained from our long term Acclima soil moisture sensor network. The objective of the study is to develop a soil moisture prediction model using derivative analysis and OPTRAM models. This study advances the precision and scalability of soil moisture remote sensing models, offering a solution for water resource management in agriculture.
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Learning from Peru: How Terrace Agriculture and Microclimates can Support U.S. Agriculture. S. Stewart* and B. Gyawali. College of Agriculture, Health & Natural Resources, Kentucky State University, Frankfort, Kentucky 40601.

With an ever-growing global population, finding practical solutions to feed everyone is more critical than ever. The added challenge of changing climates creates further difficulties for American farmers. This research reports on the findings from an experiential learning visit to Peru, where the utilization of terraces and microclimates was studied. It explores their potential application in the United States, particularly in regions with poor soil, inadequate drainage, and rugged terrain, such as the Appalachian Region, as well as other areas with challenging microclimates and growing environments. The project reports on the assessment of key factors that make Peruvian terraces successful, such as irrigation methods, climate, and elevation, and identify regions in the United States that could benefit from adopting terrace farming (known as "*andenes*" in Peru). Terrace agriculture, or *andenes*, has been practiced for centuries in Peru to expand arable land by building terraces along mountainsides (Extending the Agricultural Area). Unlike the United States, where broad-based and parallel terraces are more commonly used to slow water runoff rather than improve soil quality, Peruvian terraces create optimal microclimates and soil conditions suitable for crops like corn, potatoes, and quinoa. Additionally, our results outline American crops that could thrive in terrace farming.

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Integrating Machine Learning, Weather, and Remote-Sensing Predictors to Model Corn, Cotton, and Sorghum Yields in the Northern High Plains of Texas. A. Thompson*, R. Awal, A.V. Veettil, A. Fares, A. Adem, B. Thapa, and A. El Hassan, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX, 77446.

Weather variability, drought stress, and vegetation dynamics jointly shape crop yields, yet their relative importance differs by crop and irrigation regime. We hypothesize that: (i) weather-only models understate yield variability in the Northern High Plains of Texas, and (ii) adding remote-sensing vegetation indices (NDVI), soil moisture, and drought indices measurably improve early-season yield prediction, especially for non-irrigated systems where weather impact is higher. We compiled county-level yield records for corn, cotton, and sorghum and coordinated them with weather variables, drought indices, remotely sensed NDVI, and soil moisture. We trained machine-learning models (primarily Random Forest) for 2- and 3-month prediction windows. Models were stratified by irrigation status (total vs. non-irrigated), evaluated via cross-validation, and assessed using correlation (r) between predicted and observed yields. The result indicated that non-irrigated yields exhibited stronger predictor–yield associations than irrigated yields. Using 3-month inputs for sorghum, correlation coefficients were $r = 0.27$ (total yield) and $r = 0.46$ (non-irrigated yield). These patterns support the hypothesis that (i) irrigation buffers weather signals, reduces predictive leverage, and (ii) extends the predictor window and integrates vegetation/drought information improves performance for water-limited systems. Integrated models can provide actionable, early-season yield signals in the Northern High Plains, with the largest gains for non-irrigated sorghum. Future work will incorporate sub-seasonal weather and finer-scale phenology features, and deep learning-based approaches, and the effort will be extended for the ten divisions of Texas.

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Reconfigurable Agricultural Robotics: Control Strategies and Modular Platforms for Precision Farming. X. Thompson*, C. Winstead, Center of Excellence for Emerging Technologies, Delaware State University, Dover, DE 19901.

Modern agriculture requires adaptable technologies that improve productivity, , and strengthen the resilience of farming operations. Producers continue to face challenges such as fluctuating labor availability, diverse cropping systems, and increasingly variable environmental conditions. In alignment with USDA priorities focused on sustainable production and advanced agricultural innovation, Reconfigurable Agricultural Robots (RARs) offer a modular, flexible platform that enhances precision farming and reduces operational inefficiencies. This study examines the performance and adaptability of RAR systems under varying field conditions to determine their potential contributions to USDA goals, including improved energy efficiency, reduced input use, and enhanced economic viability for growers. Prototypes were tested in both controlled settings and open-field trials to evaluate tool-change efficiency, navigation performance, and energy consumption metrics. Results demonstrated that 42% of units completed modular transitions in under 10 minutes while maintaining consistent operational precision. Adaptive control algorithms improved trajectory accuracy by 18% on uneven terrain, indicating strong potential for supporting resilient production and reducing resource waste. Key challenges include synchronizing multiple robotic modules and maintaining system durability during extended operation. Despite these limitations, findings suggest that RARs can significantly enhance field versatility, reduce equipment redundancy, and strengthen overall farm resilience—critical components of USDA's strategic framework for sustainable and technologically advanced agriculture. Future research will focus on integrating artificial intelligence-based task scheduling, multi-robot coordination, and sensor-fusion systems to further advance smart farming practices and accelerate adoption of robotics across diverse production environments.

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Building Trust Through Accountability: Governance and Policy Frameworks for Responsible AI in Agriculture. *J. Jordan* and C. Winstead, Delaware State University, Dover, DE*

Artificial Intelligence (AI) is transforming agriculture through innovations in precision farming, crop monitoring, and supply chain optimization. However, rapid adoption without robust governance introduces risks such as bias, opacity, and reduced public trust. This study examines two major AI governance frameworks—the European Union AI Act SC and the U.S. NIST AI Risk Management Framework—to identify principles that support responsible AI oversight in agricultural contexts. Comparative analysis reveals key governance elements: enforceable accountability, transparency, fairness, and human oversight. These are essential for ensuring ethical and effective deployment of AI in agriculture, particularly in rural and resource-sensitive environments. Comprehensive regulatory models enhance clarity and trust, while flexible frameworks offer adaptability but may lead to uneven protections. Emerging policies emphasize ethical development, aligning with agricultural goals like food security and rural empowerment, though implementation challenges persist. The study highlights the importance of stakeholder engagement—including farmers, technologists, and policymakers—and the need for adaptable, risk-based governance to balance innovation with safety. By translating high-level ethical principles into actionable practices, effective AI policy frameworks can reduce bias, foster innovation, and build public trust in agricultural systems. This research underscores the critical role of governance in ensuring AI technologies operate responsibly and equitably across agricultural landscapes.

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Evaluation of Selected Tabletop Hydroponic Systems and their Performance on Lettuce Growth Characteristics and Yield. D. Robinson*, J. Dusci, and L. Githinji. College of Agriculture, Virginia State University, Petersburg, VA 23806

Food security is a growing concern worldwide due to increasing urban populations and limited arable land for agriculture. Extreme weather events have only exacerbated this situation. Hydroponics, the cultivation techniques involving soilless media, offers a potential solution to enhance food security by increasing urban food production. Hydroponic crop cultivation can be implemented sustainably due to its adaptability and water and nutrient-saving techniques associated with this system. For this study, six commercial tabletop and two DIY hydroponic systems were evaluated for lettuce cultivation (*Lactuca sativa*). The lettuce seeds were sown in horticultural sponges and placed in baskets suspended in each nutrient solution. The crop growth parameters were recorded, viz., plant height, leaf number,

length and width. Visual plant ratings were also recorded on a scale of 1 through 10 (10 = best). Additionally, the pH, temperature, dissolved oxygen (DO), and electrical conductivity (EC) of the nutrient solutions were monitored with a multiparameter probe. The quality and quantity of light for each system were measured using photosynthetic active radiation (PAR) and Quantum meters, respectively. Following the lettuce harvest, fresh weight and dry biomass were recorded. The data collected was subjected to analysis of variance (ANOVA). Results indicated that plants grown in the various hydroponic units were significantly ($p<0.5$) different from each other. The various systems were also significantly different from each other. We concluded that this information was important to growers who often navigate the market in search of the most optimal hydroponic units.

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Soil Quality in Built and non-Built Spaces in the Tri-Cities Area of Central Virginia. R. Davis*, L. K. Rutto, D. Andrews-Brown, N. Brown, Department of Agriculture, Virginia State University, VA 23806; and L. M. Githinji, Cooperative Extension, Virginia State University, VA 23806.

Urban agriculture continues to attract attention for its community building, educational, and commercial value. Interest in local food production is also driven by increasing awareness among consumers of food miles (the distance between produce and consumer), and by technological advancements that have made controlled environment/vertical farming feasible. The creation of the USDA Office of Urban Agriculture and Innovative Production (OUAIP) in the 2018 Farm Bill served as recognition of sector that has continue to grow in social and economic importance. However, the industry continues to face significant challenges. A national survey conducted by the National Center for Appropriate Technology (NCAT) found that among production risks and challenges facing urban farms, the most pressing included productivity/production costs, pest, disease, and soil health. Soil health in particular is a challenge for both commercial and recreational urban farming. The idea of urban farming in parks and other public spaces, still new in the US but already being explored in Europe, would offer advantages including access to municipal land and water bodies, the support of Parks & Recreation Departments, and maybe better soil health. A test of the hypothesis that soil quality in parks and other public spaces in cities is better than in the built environment found that heavy metals and other contaminants in park soils to be 24-82% less than published thresholds for urban in-soil cropping. We will present findings from a more comprehensive survey covering both built and non-built (public) spaces in the tri-cities area of Central Virginia.

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An AI-Powered Smartphone Application to Support Beginning Raspberry Farmers in Decision-Making and Crop Management. D. Tantu*, R. Dhillon, Agricultural Research and Development Program, Central State University, Wilberforce, OH 45384; and D. Cao, Department of Mathematics and Computer Science, Central State University, Wilberforce, OH 45384

Small-scale raspberry farmers struggle to make timely decisions about pest control, harvest management, and nutrient applications due to limited technical expertise and diagnostic tools. Traditional resources rarely provide real-time, field-ready guidance tailored to small-scale operations, and agronomic recommendations expressed per acre are impractical for row-based systems. This project develops and evaluates a smartphone application to support beginning raspberry farmers through three integrated tools: (1) AI-based pest identification from field photos, (2) berry maturity and counting for harvest planning, and (3) a fertilizer calculator that converts per-acre recommendations into per-row rates. An Android app was built with Kotlin, supported by a Python Flask server hosting YOLOv8 models. A dataset of 542 pest images was augmented to 3,333 using Roboflow 3.0, and a separate annotated dataset was used for berry maturity detection. Farmers capture in-field videos for inference and receive annotated outputs. A GPT-powered chatbot provides agronomic guidance, and the fertilizer calculator translates nitrogen rates into per-row recommendations. The pest detection model achieved 86.5% mean Average Precision (mAP) and 79.8% precision, while the berry model reached 74.7% mAP and 74.3% precision. The chatbot delivers real-time production advice, and the fertilizer calculator provides actionable, scale-appropriate nutrient guidance. Field validation for berry counting is underway to correlate predicted counts with harvested yields. This application shows how AI and smartphone technology can deliver affordable, expert-level decision support for small-scale raspberry growers. By integrating pest identification, yield estimation, and nutrient management tools, it addresses key production challenges and supports data-driven decision-making, and validation.

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Managing the Sky Wrangler Project: Affordable UAVs for Livestock, Pasture Monitoring, and Targeted Applications. J. Throckmorton-Hague*[1], J. Watson[1], M. Throckmorton[1], A. Fuentes[1], M. Johnson[1], M. White[1], D. Lechner[1], T. Gipson[2], and S. Kunwar[2]. [1]Department of Engineering Technology, School of Arts and Sciences, Langston University, Langston, OK 73050. [2]Sherman Lewis School of Agriculture and Applied Sciences, Langston University, Langston, OK 73050.

The overall goal of the Sky Wrangler project is to develop a smart, yet affordable, UAV that provides concise feedback to livestock producers, enabling them to effectively manage their pastures and animals. As project manager, I oversee team coordination, resource acquisition, and technical integration to ensure effective progress. The specific objectives are to (1) assess pasture biomass and nutritive status of grazing animals using UAVs, (2) determine the effect of the animals using UAVs (4) monitor health status of grazing animals using UAVs. Our team assembled a fleet of eight Tarot Iron Man 650 and three S500 quadcopters using off-the-shelf components, with non-commercially available parts designed using computer-aided design (CAD), and 3D printing. A Cube Plus payload integrating Pi NoIR RGB and FLIR thermal cameras was developed and installed on these UAVs. In addition, commercial drones such as the DJI Mavic 3E, equipped with a multi-spectral camera for NDVI (Normalized Difference Vegetation Index) mapping, and the DJI T30, used for site-specific fertilizer and pesticide applications, were incorporated. As a result of this project, we developed multiple cost-efficient UAVs, significantly reducing the cost. Objective 1 has also been completed, enabling mapping of pasture status using NDVI values. Our other preliminary results indicate that high speed, high altitude, and high angle likely cause the least stress to the goats. Together, these tools establish a framework for a low-cost precision livestock management system, supporting sustainable and data-driven agricultural practices.

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Transfer Learning for Automated Morphological Classification of Daylily Flowers. D. Sykes*, C. D. Mahon, and R. M. Gosukonda, Department of Agricultural Sciences, Agricultural Research Station, College of Agriculture, Family Sciences, and Technology, Fort Valley State University, Fort Valley, GA 31030

The morphological variability of daylily flowers introduces significant complexity for automated classification using computer vision. The American Hemerocallis Society (AHS) recognizes six official flower forms includes single, double, spider, unusual form, sculpted, and polymerous, these categories often exhibit high intra-class variation in petal count, curvature, symmetry, and texture, along with inter-class similarity. Such complexity complicates feature extraction in deep learning models, and the limited availability of labeled botanical images increases the risk of overfitting. To overcome these challenges, we applied transfer learning using pretrained convolutional neural networks (CNNs), which provides an effective solution by leveraging features learned from large-scale datasets, enhancing model robustness and generalization. Our study utilized a daylily dataset of 3,365 color images collected under natural lighting conditions at different growth stages from the National Gardening Association and AHS. Images were manually labeled into four categories: single, double, spider, and others (combining unusual form, sculpted, and polymerous). We employed data augmentation techniques, including random rotations, flips, and color adjustments, to address class imbalance and improve generalization. The performance of five deep learning models (ResNet50, InceptionV3, DenseNet121, VGG16, and VGG19) was evaluated using Accuracy, Precision, Recall, Specificity, F1-Score, and AUC-ROC. Results show that pretrained models with transfer learning and data augmentation significantly outperform traditional machine learning approaches, particularly in distinguishing morphologically similar categories. This study demonstrates the potential of deep learning to support botanical taxonomy, horticultural research, and digital phenotyping, providing a foundation for automated flower form recognition in daylilies.

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AniHealth: A Cloud-Based Mobile Application for Real-Time Plant, Blood, and Eye Health Diagnostics A. Haneefat*, B. Madison, A. Allen, S. Khan, A. Siddique, A. K. Mahapatra, T. H. Terrill, Department of Agricultural Sciences, Fort Valley State University, Fort Valley, GA 31030., S. S. Panda, Institute for Environmental Spatial Analysis, University of North Georgia, Oakwood, GA 30566; and J. A. van Wyk, Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa;

In this study, we present the development of AniHealth, a mobile application designed to deliver real-time diagnostic insights by integrating plant species recognition, blood biosensor data, and ocular image analysis through cloud-hosted machine learning models. Traditional diagnostic approaches in agriculture and veterinary health, such as the FAMACHA© scoring system for anemia detection in goats, are inherently subjective, labor-intensive, and often inaccessible to resource-constrained communities. To overcome these limitations, we implemented cloud-native architecture on Amazon Web Services (AWS), leveraging SageMaker for model training and deployment, Lambda for serverless computation, Cognito for secure authentication, S3 for object storage, and DynamoDB for persistent result logging. Models were built in TensorFlow, containerized, and deployed via SageMaker endpoints, while API Gateway routed application requests through Lambda functions to execute prediction workflows seamlessly. System validation demonstrated successful deployment of a functional backend pipeline. Authentication and authorization modules (Cognito) were operational, real-time logging into DynamoDB was verified, and test inputs were correctly processed through the serverless architecture. Preliminary machine learning modules have been integrated and are undergoing performance evaluation. These findings highlight the feasibility of a scalable, mobile-first diagnostic system that bridges agricultural and clinical domains. By enabling automated data capture, rapid prediction, and historical tracking, AniHealth supports proactive decision-making in animal health, environmental monitoring, and plant diagnostics. Ultimately, this platform reduces barriers to healthcare and resource management by extending the reach of AI-driven technologies to farming and clinical communities through cost-effective, cloud-enabled mobile solutions.

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Smartphone and AI Integration for Real-Time FAMACHA© Scoring in Small Ruminants. T. Watson*, A. Siddique, N. Whitley, A. K. Mahapatra, T. H. Terrill, Department of Agricultural Sciences, Fort Valley State University, 1005 State University Drive, Fort Valley, GA 31030.; S. S. Panda, Institute for Environmental Spatial Analysis, University of North Georgia, Oakwood, GA 30566; E. R. Morgan, Institute for Global Food Security, Queen's University Belfast, UK; and J. A. van Wyk, Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

Accurate classification of FAMACHA© scores is vital for diagnosing anemia in small ruminants and supporting parasite management in livestock systems. The FAMACHA© system ranks anemia severity on a scale of 1 to 5, where 1–2 reflect healthy animals, 3 indicates borderline cases, and 4–5 represent severe anemia. In this study, a dataset of 4,700 images of the lower eye conjunctiva from young male goats was collected weekly over six months using a Samsung A54 smartphone. Traditional assessments depend on subjective visual inspection, which is time-consuming and prone to observer bias. To overcome these challenges, machine learning algorithms were applied to automate the classification process, including Support Vector Machine (SVM), Backpropagation Neural Network (BPNN), and Convolutional Neural Network (CNN) models. Model performance was evaluated using accuracy, precision, recall, and F1-score. Among the approaches tested, CNN achieved the highest accuracy (97.8 %), surpassing both BPNN and SVM. The SVM reached an average accuracy of 84.6 %, with strong detection of severe anemia but weaker performance in intermediate categories. The BPNN attained 84 % accuracy, offering a more balanced precision–recall tradeoff. The superior performance of CNN was linked to its ability to extract spatial and contextual image features, leading to robust classification across all FAMACHA© categories. These results highlight CNN as a scalable and reliable tool for automated anemia detection in small ruminants, enabling earlier intervention and improved herd management. Future work should investigate ensemble models and mobile-based deployment for practical use by both commercial operations and resource-limited farmers.

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From Farm to App: How COVID-19 and Inflation Reshaped Food Systems and Consumer Behavior. M. Lowery*, N. De Silva, and S. Giscombe, Department of Agriculture and Natural Resources, Sherman Lewis School of Agriculture and Applied Sciences, Langston University, Langston, OK 73050.

The COVID-19 pandemic and subsequent period of high food inflation profoundly transformed the U.S. food system, influencing both consumer purchasing behaviors and the technological mechanisms that connect farms to households. This study investigates how pandemic-related disruptions and rising food costs redefined household food expenditures, supply chain resilience, and technology adoption within agricultural systems. Using data from the USDA

Economic Research Service (2016–2022) and supplementary sources, the study employs trend and comparative analyses to evaluate spending shifts across income and expenditure categories, geographic locations, and food product groups. Findings reveal a significant and lasting transition toward food-at-home spending and increased reliance on digital platforms such as grocery delivery and online ordering, signaling the integration of technology as a permanent feature of modern food systems. Inflationary pressures further widened variations in food access and diet quality, particularly among lower-expenditure groups not participating in federal nutrition programs. While restaurant spending partially recovered by 2022, supermarket purchases of fruits, vegetables, and prepared meals remained elevated, demonstrating evolving consumer priorities and resilience in the agri-food supply chain. Overall, findings demonstrate how technological adoption and macroeconomic conditions are reshaping food purchasing systems and supply-chain operations, highlighting the importance of innovation and digital integration for the long-term functioning of the U.S. food and agricultural sector.

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Implementing Phytoremediation and Sustainable Practices. C. D. Knight*, C. Alston, G. Gibson, and T. Nyatta, 1890 Research and Extension, South Carolina State University, Orangeburg, SC 29117.

Urban farming environments often face challenges with soil degradation, heavy metal contamination, and nutrient loss, which limit opportunities for safe food production. This project explores the use of phytoremediation and sustainable agricultural practices to restore soil health, reduce contamination, and improve long-term productivity in these environments. Plant-based remediation strategies were implemented to absorb pollutants, stabilize soils, and enhance ecological balance. Detailed site assessments, soil sampling, and laboratory analyses identified target areas for intervention and species with high contaminant uptake and soil regeneration potential. Complementary sustainable farming practices such as compost enrichment, mulching, crop rotation, and water-efficient irrigation supported biodiversity and ecological resilience. Educational workshops and field demonstrations trained community growers in evidence-based soil management and safe cultivation practices, empowering participants to adopt environmentally responsible techniques. By integrating environmental science with community engagement, this initiative demonstrates how research-driven approaches can promote cleaner, healthier, and more resilient urban food systems. The project underscores the role of sustainability and stewardship in addressing adverse weather/ecological concerns while advancing food security.

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Enhancing Program Knowledge and Fostering Community Engagement. G. Gibson*, C. Alston, D. Knight, and T. Nyatta, 1890 Research and Extension, South Carolina State University, Orangeburg, SC 29117.

This project aims to increase awareness and understanding of USDA urban agriculture programs through educational outreach, student engagement, and community partnerships. The goal is to strengthen participation in sustainable food systems by connecting youth, schools, and local organizations with opportunities for agricultural learning and leadership. Interactive workshops, classroom demonstrations, and community events introduced participants to urban farming, composting, and food systems management, encouraging agriculture as both a career pathway and a tool for community empowerment. Working with educators, farmers, and civic leaders, the team developed educational materials emphasizing local food production and environmental stewardship. Youth-centered activities provided hands-on experiences in planting, soil preparation, and nutrition education, highlighting the connections between food, health, and sustainability. These collaborative efforts bridged the gap between agricultural research and community practice, translating scientific information into accessible, actionable knowledge. By fostering dialogue among students, growers, and extension professionals, the project cultivated partnerships that enhance food system sustainability and community resilience. This initiative demonstrates how education, outreach, and collaboration can increase program visibility, inspire future agricultural innovators, and promote equitable access to agricultural resources in both urban and rural areas.

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Expanding Farming Operations and Alleviating Food Deserts. C. Alston*, G. Gibson, D. Knight, and T. Nyatta, 1890 Research and Extension, South Carolina State University, Orangeburg, SC 29117.

This project aims to strengthen both existing farmers and emerging urban farmers through microgrants, technical support, and the promotion of resilient agricultural practices. The central goal is to reduce food insecurity by expanding community gardens and improving access to locally grown produce in select community areas. Through hands-on initiatives, the team connected sustainable farming with community empowerment by supporting growers and fostering collaboration. At the Black Cowboy Festival, interviews with small farmers and agricultural leaders highlighted the importance of heritage, resilience, and cultural identity in shaping agricultural engagement. These insights informed outreach strategies that ensure cultural preservation remains integral to sustainable development. In partnership with local organizations, the team constructed raised garden beds to provide residents with access to fresh produce and agricultural education. Soil samples were collected and analyzed for heavy metals to ensure environmental safety and promote soil health. By integrating soil testing, compost enrichment, and water-efficient growing techniques, this project supports communities in adapting to adverse weather challenges while promoting long-term sustainability. Overall, these combined efforts demonstrate how local engagement, technical training, and cultural awareness can create resilient food systems that empower farmers, inspire new growers, and expand equitable food access.

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Building and Designing an Open Source Automation Controls Hub and Real Time Dashboard for Fully Autonomous UAV Soil Moisture Payload. M. Hare Jr*, G. Prince, and H. Dakshinamurthy, 1890 Research and Extensions, South Carolina State University, Orangeburg, SC 29117.

Affordable, real-time soil moisture mapping remains a critical challenge in precision agriculture, particularly for small- to medium-scale growers who often lack access to high-end proprietary systems. This study presents the design, integration, and preliminary evaluation of a low-cost automation control hub for an autonomous UAV-based soil moisture payload capable of conducting in-flight measurements. To enhance accessibility and reduce costs, a Raspberry Pi Model 4B single-board computer and an Arduino Mega 2560 microcontroller were employed to coordinate stepper motors, potentiometer sliders for insertion depth measurement, and communication with both the Acclima TDR-305N soil moisture sensor and the Cube Orange flight controller. Real-time data visualization and archiving were achieved using Grafana on the Raspberry Pi, enabling remote monitoring and control of soil moisture readings, TDR waveforms, and insertion depth. A relational database was developed to support Grafana-based dashboards during UAV operation, ensuring a customizable, open-source interface for users of this fully autonomous soil moisture mapping system.

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SmartWeedClassifier: Development and Deployment of a Mobile Deep Learning Model for Weed Species and Herbicide Treatment Classification. T. B. Sambhus*, V. Patiluna, and J.M. Maja, Center of Applied Artificial Intelligence for Sustainable Agriculture, 1890 Research and Extension Agriculture, South Carolina State University, Orangeburg, SC 29117.

Key components of precision agriculture include effective weed identification and treatment assessment to promote sustainable practices and informed management decisions. The SmartWeedClassifier was developed to support precision agriculture through an artificial intelligence-based mobile application that enables real-time classification of weed species and herbicide treatment responses. The system utilizes MobileNet, a convolutional neural network optimized for mobile and embedded deployment. Its pre-trained convolutional layers were refined through transfer learning to classify two major weed species, *Echinochloa crus-galli* (Barnyardgrass) and *Amaranthus palmeri* (Palmer Amaranth), under five treatment classes reflecting untreated and herbicide-treated conditions. The model was trained for 50 epochs using the Adam optimizer and categorical cross-entropy loss on a curated dataset of annotated images representing the five treatment classes. Results showed high accuracy in distinguishing both weed species and treatment responses, demonstrating strong potential for accurate classification and generalization. These findings indicate that lightweight deep learning models can provide reliable and efficient tools for weed identification and herbicide efficacy evaluation. The SmartWeedClassifier presents a scalable, accessible, and data-driven approach that reduces manual field scouting and supports research, education, and extension activities. Future work will include

evaluation under variable lighting, background, and ecological conditions and expansion of the dataset to additional species and treatments to further enhance model robustness.

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High Energy and Protein Feed Supplementation Enhance Gastrointestinal Parasite Resilience in Organic Farming Sheep. T. Wuliji[a]*, K. Adams and L. Fischer, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101;C. Ke; University of Missouri, Columbia, MO, 65201.

The management of gastrointestinal parasite (GIP) in organic sheep is a challenging issue as chemical anthelmintic drugs is prohibited in organic production. This trial was to evaluate the high energy and protein feed supplementation effect on the GIP status in post-lactation ewes. The five-acre pasture paddock was subdivided into one acre grazing plots by an electric fence. Thirty mixed-age ewes were selected and divided into five subgroups each with six ewes and grazed on one-acre plots for four weeks respectively. Organic grain supplemental level was defined as control (TC, 0/d), low (T1, 227 g/d), moderate (T2, 340 g/d), moderate high (T3, 454 g/d), and high-level supplementation (T4, 567 g/d) groups. Animal growth performance was recorded for live weight (LW, kg), daily gain (ADG, g/d), body condition score (BCS, 1-5), FAMACHA® score (FMS, 1-5), fecal egg count (FEC/g), hematocrit (HCT%) and ultrasound scanned back fat depth (BFD, mm), loineye muscle death (LED, mm) and loineye muscle area (LEA, cm^2). The carcass traits were measured on longissimus dorsi muscle using an ultrasonographic scanner that fitted linear transducer. Means of LW, BFD, ADG, and LEA were increased for organic grain supplemental groups over control group ($P< 0.05$). The organic grain supplementation has decreased FEC ($P< 0.05$) in supplemental group (T1, T2, T3, T4) from the prior feeding (day 0) to the end of supplementation (day 28) whereas, control group (T0) has shown as initial FEC status. The result indicated that a short-term supplementation of energy and protein feeds enhance GIP resilience in ewes.

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Genome-Wide Association Analysis for Circulatory and Fecal Metabolome, and Its Use as a Potential Mediation Effect on Productive Traits, Including Disease Resistance and Weight in Sheep. J.D. Leal-Gutierrez[a]*, M. Acharya, T. Wuliji, and H. Salinas-Gonzalez, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO, 65101.

Two distinct problems arise when identifying genomic regions associated with economically important traits in sheep (*Ovis aries*). The first problem is the lack of knowledge regarding the biological mechanisms driving the identified associated genomic regions and genes. The second problem is insufficient power for detection, specifically in analyses of sheep, which has hindered the identification of chromosomal regions influencing productive phenotypes. The proposed analysis aims to perform genome-wide association analyses of the circulatory and fecal metabolome and to examine its potential mediating role in productive phenotypes, including disease resistance and body weight. Metabolomics is the broad study of naturally occurring small molecules in biological systems. It is used to analyze metabolic processes, identify key biomarkers underlying metabolic profiles, and reveal the mechanisms underlying a phenotype. This information could shed light on the biological mechanisms driving genomic association and the identification of causative polymorphisms, which would be highly useful by greatly facilitating and reducing the cost of identifying favorable genotypes and selecting superior individuals for reproduction in a population. This project will deliver several results, including a genotyping pipeline for sheep using double-digest genotyping-by-sequencing (ddGBS). Genomic regions influencing productive traits, such as disease resistance and body weight, in sheep will be identified, and the genetic control over these phenotypes will be quantified using SNP-based heritability estimates. Characterization of the fecal and circulatory metabolomes detected in individuals with extreme phenotypes for disease resistance and body weight will be generated.

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Effects of Aronia berry extract supplementation on the quality of cryopreserved dairy goat spermatozoa. A. M. Shahat*, S. G. Saroja, R. S. Kolikapongu, T. Brisby, J. Woodard, B. Kouakou, N. Joshee, A. R. Moawad, Fort Valley State University, Fort Valley, GA, 31030.

Cryopreservation procedures exert deleterious effects on the quality and functional integrity of goat spermatozoa, mainly due to the excessive production of reactive oxygen species (ROS). Black chokeberry's (*Aronia melanocarpa*) fruits are rich in polyphenols and other antioxidants. Our aim was to evaluate the effects of supplementing semen extender with Aronia berries extract on the quality of frozen-thawed dairy goat spermatozoa. *Aronia* berries extract were prepared. The dried Aronia berries' total flavonoid and polyphenol content was determined, as well as its antioxidant capabilities. Semen was collected from four mature Saanen bucks once/week for 4 weeks using electroejaculation. Semen samples were then pooled and diluted in Andromed® extender to a final concentration of 800×10^6 sperm/ml. The extender was supplemented with 0 (control), 25, 50, 100, and 200 µg/ml Aronia extract. Diluted semen was cooled at 4 °C for 3 h then frozen in 0.25 ml Frensh straws in a programmable freezer (MiniDigitcool, IMV®, USA). Straws were then plunged into LN_2 before being thawed in water bath at 37 °C for 30 sec. Following thawing, sperm motility, viability, acrosome status, mitochondrial integrity, and lipid peroxidation were evaluated. Sperm progressive motility and mitochondrial integrity were higher ($P < 0.05$) in 50, 100, and 200 µg/ml Aronia extract groups than 0, and 25 µg/ml ones. This was the opposite for lipid peroxidation. Percentages of intact acrosome were the highest ($P < 0.05$) in 100 µg/ml group. In conclusion, supplementing semen extender with Aronia berry extract improved dairy goat sperm motility and viability following cryopreservation.

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Metatranscript Detection of Haemonchus contortus Infection in Goats. Y. Tilahun*, School of Agriculture and Applied Sciences, Langston University, Langston, Oklahoma, 73050.

Assessing infection by a parasite, such as *Haemonchus contortus* (*H.contortus*), requires time, expenses, and experienced personnel. This study identifies metagenomics as a future, non-invasive method for assessing infection by *H. contortus*. We conducted a randomized, complete block-designed investigation using metagenomic methods to decipher the effects of a gastrointestinal nematode (GIN) *H. contortus* infection on Alpine wethers. Metagenomics from collections of tissue samples provides evidence recognizing microbial species presence (upregulated or downregulated expression), indicating infection by GINs. We investigated the significant change in the presence of microbial species present in the fecal samples of hosts. We determined the relative proportion of microbial community species, the richness of the microbial community, and the evenness of distribution. The numerous parameters that include many data points will provide a more precise means to identify infection than health based on similarity to susceptible subjects related to infected data parameters. Fecal samples reveal significant differences in the upregulation and downregulation of microbial species. The data accumulated can be used towards the development of machine learning and artificial intelligence (AI) tools.

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Building Heat Stress Adaptation Capacity in Small Ruminant Production: Findings from a Jamaica–U.S. Collaborative Project. R. Puchala*, A.K. Patra, Sherman Levis School of Agriculture and Applied Sciences; B.R. Min, College of Agriculture, Environment & Nutrition Sciences, Tuskegee University; M. Brown, Rural Agricultural Development Authority, Kingston, Jamaica; G. Scott, Faculty of Food and Agriculture, College of Agriculture, Science and Education, Port Antonio, Jamaica.

Heat stress is a major constraint to livestock productivity and animal well-being in warm environments. This Jamaica–U.S. collaborative project evaluated physiological, molecular, and management-based approaches associated with heat stress adaptation in goats and sheep, with relevance to production systems in both the Caribbean and the United States. Collaboration with the Rural Agricultural Development Authority (RADA) and its Livestock Extension Officers facilitated on-farm activities at 15 locations across multiple Jamaican parishes, integrating farmer training, shelter improvements, and physiological monitoring, including rectal temperature and respiration rate. The College of Agriculture, Science, and Education (CASE) conducted detailed environmental and physiological measurements at its research farm and provided hands-on training to students in techniques for assessing and managing heat stress. Complementary studies in the United States examined nutritional and molecular responses of goats exposed to controlled heat stress, with emphasis on antioxidant supplementation and expression of heat shock proteins, oxidative stress indicators, and immune-related genes. Results indicated prolonged periods of elevated temperature–humidity index (THI) conditions in Jamaica and shorter periods of elevated THI in the southern United States. Despite greater

THI exposure, Jamaican Boer goats maintained lower rectal temperatures (101.75°F) compared with U.S. goats (103.48°F) during July and August 2025, suggesting enhanced physiological adaptation. Ongoing comparative analyses aim to identify shared and distinct mechanisms of heat tolerance between goat populations, providing information to support improved breeding and management practices for small ruminant production systems.

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Hempseed Products Modulate Sheep Lymphocyte Function In Vitro. M. Garcia*, L. Garcia, F. Samuel, N. Ogunkunle, M. Verghese, Department of Food and Animal Sciences, Alabama A&M University, Normal, AL, 35762.

Hempseed meal (HSM) has recently been approved for use in laying hens, encouraging its evaluation in other livestock species. However, the immunomodulatory properties of hempseed products remain poorly characterized. This study investigated the effects of dehulled hempseed (HS) and HSM on lymphocyte proliferation, cytokine production, and immunometabolic gene expression in sheep. Bioactive compounds were extracted using 70% ethanol and tested at three doses (100, 500, and 2500 μg/mL). Isolated blood lymphocytes from six mature Gulf Coast ewes were pretreated for 2 h with HS or HSM, stimulated or not with Concanavalin A (ConA, 5 μg/mL), incubated at 37 °C with 5% CO_2, and read at 48 h. Cell proliferation was determined using alamarBlue fluorescence (615 nm) and normalized relative to the untreated, non-ConA control (CTL). Data from three independent experiments were analyzed using PROC MIXED in SAS, with significance declared at $P \leq 0.05$. In non-stimulated cells, only the highest dose increased proliferation compared with CTL. With ConA, both HS and HSM increased proliferation in a linear, dose-dependent manner, showing the highest responses at elevated doses. HS was more effective than HSM, producing 8% and 24% greater proliferation at the intermediate and highest doses, respectively, with no difference at the lowest dose. Spent media and cell lysates will be analyzed for cytokines and immunometabolic genes to elucidate mechanisms underlying these effects. Overall, hempseed products enhanced lymphocyte proliferation in a dose-dependent manner, suggesting promising immunomodulatory potential for improving immune responsiveness and overall health in small ruminants.

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Application of Shotgun metagenomics for One Health Insights into Gut Microbiome in Ruminants. E. Ndegwa*, C. Kim and A. Yousef. Agricultural Research Station, Virginia State University, Hayden Street, VA, 23806.

The gut microbiome is involved in a wide range of metabolic, immunologic and physiological processes that work to ensure the health, performance and overall wellbeing of animals. On the other hand, the ruminant gut is also host to microbes that that are of economic and public health importance. Understanding the microbiome diversity and changes that occur in structure during different phases of growth in healthy animal hosts may give us a foundation onto which to develop disease intervention strategies and microbiome-based therapeutics. Additionally, the information is critical in developing growth performance enhancing strategies that utilize gut microbial manipulations. In this study, we used shotgun metagenomics sequencing of fecal DNA from goats to understand the diversity, prevalence and changes in abundance of beneficial gut microbial populations and those of One health importance from birth until one week after weaning. The data indicates the microbial diversity of gut of healthy growing goats on pasture is highly variable both in species composition and their abundance. Individual animal variations within sampling points were also evident. Both beneficial and potentially pathogenic microbes were detected with varying changes in abundance throughout the study period. The data therefore provide insight into not only critical control periods for select pathogens but also identifies potential probiotic strains species that can be targeted for isolation, evaluation and development for improving health and performance in ruminants.

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Effect of Black Walnut Hull Powder and Sericea Lespedeza on Gastrointestinal Health and Systemic Innate Immune Response Activation in Katahdin Lambs. E. K. Asiamah*, H. Owusu, M. Mkunga, Department of Regulatory Science, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601; Department of Agriculture, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601; J. M. Burke, USDA-ARS, Booneville, AR 72927; S. Rohila, Department of Agriculture, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601; J. Muir, Texas A&M AgriLife Research, Stephenville, TX 76401; N. M. Cherry, USDA-ARS, Booneville, AR, 72927.

Parasitic and pathogenic diseases cause significant economic losses in sheep production. This study evaluated the

effects of black walnut hull (WH) and sericea lespedeza (SL) supplementation on immune modulation and overall health in Katahdin lambs. Naturally infected lambs (n = 30) were randomly assigned to three dietary treatments: Control (alfalfa pellets; CON), SL pellet, or CON supplemented with 1 g of WH powder (n = 10/diet). Lambs grazed on grass-based pastures with experimental diets for 4 weeks, followed by CON supplement for 2 weeks. Blood and fecal samples were collected to assess packed cell volume, immune function, fecal egg counts (FEC), and oocyst counts (FOC). Gene expression analysis was performed using qRT-PCR for immune-related genes. Both WH and SL tended to reduce FEC ($P < 0.10$), while SL reduced FOC ($P < 0.001$). SL-fed lambs showed higher body weight ($P < 0.001$). Gene expression analysis revealed upregulation of IL-1β (5.2-fold) and TNF (5.46-fold) on Day 28 and IL-8 (8.6-fold) on Day 14. These findings suggest that WH and SL supplementation may enhance immune responses and improve parasite management in Katahdin lambs, offering potential natural alternatives for parasite control in sheep production.

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Understanding Consumer Perception and Preferences of the Aquaculture Industry in Missouri. M. Matuha*; J. Loesch, and A. Coursey, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO, 65101.

Aquaculture is one of the fastest-growing forms of food production in the world and an increasingly important part of the U.S. agricultural economy, contributing about $1.5 billion in producer sales in 2018. Missouri contributed 1%, with 66% food fish and 3% bait fish. Despite this potential, Missouri's aquaculture industry has grown more slowly than inflation, showing a need for expansion and greater efficiency. This study examined consumer perceptions, preferences, and attitudes toward aquaculture to understand factors influencing purchasing decisions and public acceptance. A statewide online survey (n=204) captured responses from a diverse demographic group; 52% were female, 47% male, 69% identified as White, and 46% held a graduate or professional degree. Most respondents knew little about aquaculture, 80% were unaware that Missouri produces about $24 million in aquaculture sales each quarter, yet 74% supported expanding aquaculture, and 60% were interested in buying locally farmed fish. Seafood consumption was common, with 36% eating seafood more than twice a month and 24% weekly. Salmon, shrimp, catfish, and tuna were most consumed, and 94% purchased seafood from grocery stores. While 60% considered country of origin important, 59% were unfamiliar with aquaculture certifications. Many respondents wanted more information about sustainability (54%), nutrition (50%), and where to buy local products (60%). Misconceptions about water quality, environmental impacts, and fish welfare remain barriers to acceptance. Targeted education and outreach are essential to close knowledge gaps, build public trust, and increase demand for aquaculture products, driving market growth and supporting the sustainable development of Missouri's aquaculture sector.

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Peptidoglycan Hydrolases as Alternatives to Antibiotics to Treat *Streptococcus iniae* Infections. G. Ramena*, A. Segree, S. Gudapati, and K. Bohara, Department of Aquaculture and Fisheries, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601; D. Donovan, Department of Biology, Morgan State University, Baltimore, Maryland, MD, 21251.

Infectious diseases remain a major constraint to global aquaculture productivity, with Streptococcus iniae, the causative agent of Streptococcosis, posing a severe threat. This Gram-positive pathogen infects nearly 30 fish species causing annual economic losses amounting to billions of dollars. Although antibiotics are widely used for treatment, their overuse has led to the emergence of multidrug-resistant strains that raises concerns regarding the transfer of resistance genes from aquaculture environments to clinical settings. These challenges underscore the urgent need for safe, sustainable, and resistance-refractory antimicrobial alternatives. Phage-derived endolysins, or peptidoglycan hydrolases (PGHs), are enzyme-based antimicrobials that degrade bacterial cell wall peptidoglycans and are less prone to resistance development. Using bioinformatic analyses, we identified ten streptococcal PGHs as candidates targeting *S. iniae*. Recombinant PGHs, each containing a C-terminal 6×His tag, were expressed in *Escherichia coli* (BL21) using the pET21a(+) vector and purified via Ni-NTA affinity chromatography. Two PGHs demonstrated strong extracellular lytic activity against *S. iniae* by plate lysis, turbidity reduction and zymogram analysis. Additionally, commensal bacteria isolated from tilapia were tested against the purified endolysins, which selectively lysed *S. iniae* while sparing the commensals. This targeted activity indicates that streptococcal PGHs can serve as safe and effective antibiotic alternatives, offering precision therapy without adverse effects, thereby supporting sustainable aquaculture health

management.

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Genome-wide Transcriptional Responses of Channel Catfish to Combined Ammonia and Iron Stress. A. K. Sinha*, Department of Aquaculture and Fisheries, University of Arkansas at Pine Bluff, 1200 North University Drive, Pine Bluff, Arkansas, 71601.

The goal of this study was to characterize the genome-wide transcriptional responses of channel catfish (*Ictalurus punctatus*) to ammonia and iron toxicity, both individually and in combination. Fish were exposed to high environmental ammonia (HEA; 12.2 mg/L, 25% of the 96-h LC_{50}) and elevated iron (HFe; 9.5 mg/L, 25% of the 96-h LC50) either separately or jointly for 12, 84, and 180 hours. RNA-seq analysis (Illumina HiSeq) of brain tissue generated 12,490 contigs, of which 2,128 showed significant differential expression under at least one treatment condition. Iron exposure induced substantial transcriptional shifts, with 370 contigs upregulated and 832 downregulated. Under ammonia exposure, 122 contigs were upregulated and 270 downregulated. Comparative analysis indicated that 74 transcripts were consistently upregulated and 94 downregulated across both single-stress treatments. Functional enrichment revealed that iron stress predominantly altered genes involved in sodium transport, cell adhesion and communication, transmembrane receptor signaling, Na^+/K^+-ATPase activity, and oxidative stress pathways. In contrast, ammonia exposure mainly affected genes associated with amino acid metabolism, antioxidant defense, neurotransmission, and ion regulation. Combined exposure resulted in pronounced modulation of ion transport, oxidative stress, and antioxidant-related genes. Collectively, these findings demonstrate that channel catfish exhibit highly dynamic and stress-specific transcriptional responses when confronted with individual or simultaneous environmental toxicants.

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Biotic Stress and Prevalence of Viruses in Honey Bees Across Different Seasons and Landscapes. R. Pudasaini* Agricultural Research and Development Program, Central State University, Wilberforce, OH 45384; and H. Li-Byarlay, Agricultural Research and Development Program, Central State University, Wilberforce, OH, 45384.

Honeybees face increasing threats from biotic stress of viral pathogens that can severely impact colony health and contribute to global colony decline. However, comprehensive studies of biotic stress and prevalence of bee viruses across different environmental contexts and seasons remain scarce. This study aims to characterize and compare the range, abundance and composition of the *Apis mellifera* L. virome across three different landscapes (conventional, organic, and roadside) and seasonal gradients (early vs late season) to better understand how environmental and temporal factors affect viral communities in honeybees. *A. mellifera* were collected from 9 different sites (3 per landscape type) during the spring and summer of 2024. Total RNA was extracted individually from whole honey bees and reverse-transcribed into cDNA, which was subsequently used to construct libraries for paired-end sequencing on the Illumina NovaSeq platform. By analyzing the Illumina sequencing data, we will compare the viral prevalence of major bee viruses. The findings are expected to provide novel insights into the ecological and seasonal dynamics of honey bee-virus interactions and contribute to strategies for improving honeybee health and resilience.

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Oxidative Stress in Honeybees and Small Carpenter Bees Across Landscapes with Varying Pesticide Residues. K. Briscoe, Department of Agricultural and Life Sciences, Central State University, Wilberforce, OH 4534; M. Byarlay, The Miami Valley School, Dayton, OH 45429; R. Johnson, Department of Entomology, Ohio State University, Wooster, OH 44691; S. Rehan, Department of Biology, York University, Toronto, ON, Canada; and H. Li-Byarlay*, Agricultural Research and Development Program, Central State University, Wilberforce, OH, 45384.

Oxidative stress (OX), a physiological condition arising from an imbalance between reactive oxygen species (ROS) and antioxidant defenses, can be influenced by environmental factors such as pesticide exposure. This study investigates OX levels in two key pollinators—honey bees (*Apis mellifera*) and small carpenter bees (*Ceratina calcarata*)—across three distinct landscape types: conventional farms, organic farms, and roadside habitats. These landscapes differ in their pesticide use and management intensity, with roadside sites serving as a low-management control. We hypothesized that bees from conventional farms would exhibit the highest OX levels due to increased

pesticide exposure. Lipid peroxidation assays revealed that bees from organic and roadside landscapes experienced the lowest and highest OX levels, respectively. Protein carbonyl assays showed a significant difference between bees from conventional and organic farms (Tukey's post-hoc test, $p < 0.05$). The elevated OX observed in roadside bees may reflect an adaptive stress tolerance, consistent with patterns observed in a prior study of feral populations. In contrast, reduced OX in organic farm bees likely results from limited use of synthetic chemicals and milder management practices. These findings highlight how land management strategies can influence pollinator stress physiology and underscore the potential for landscape-level interventions to support pollinator health.

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Meat Education and Training at Tuskegee University (M.E.A.T. at TU): Empowering Producers and Processors to Achieve Maximum Value from the Meat and Poultry Processing Industry. D. Burnett* C. Harris, O. Bolden-Tiller, V. Royal, M. Mkunga, N. Simms, and M. Baldwin, Department of Agricultural and Environmental Sciences, Tuskegee University.

The Meat Education and Training at Tuskegee University (M.E.A.T. @ TU) was established to provide ensure that participants in the meat and poultry value chain have access and opportunities to participate and succeed in the USDA's supply chain initiatives. MEAT @ TU provides technical assistance to participants to ensure success of their projects from inception through operations. Tuskegee has convened experts in the 4 major technical assistance scopes which include the following: (1) Federal Grant Application Management, (2) Business Development and Financial Planning, (3) Meat and Poultry Processing Technical and Operation Support, and (4) Supply Chain Development. Each of these areas represent potential barriers that preclude successful participation in this sector for many producers and processors, particularly in the blackbelt and surrounding communities. Tuskegee has a legacy of combining reliable expertise with reputable outreach programming beginning with the appointment of Thomas Monroe Campbell in 1906 as the first extension agent. MEAT @ TU continues to build on that legacy through innovative programming, immersive workshops, training opportunities, intentional advising, and other technical assistance offerings. Empowering producers and processors in this sector will help the resilience of the meat and poultry supply chain and add substantial value to existing and emerging operations for emerging industry participants throughout the Blackbelt and across the nation.

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First-generation crossbred chickens: better than the sum of their parts? T. Fisher*, D. Knipker, M. Perkins, R. Baker and A. Scott, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO, 65101.

While large-scale chicken (*Gallus gallus domesticus*) production relies on highly specialized meat- and egg-type chickens, small-scale producers often use older heritage breeds or their crosses. One popular cross is the Red Sex-Link which is produced by mating Rhode Island Red roosters with Delaware hens. The "sex-linked" cross allows for chicks to be sexed by down color at hatch. The pullets are sold at a premium for egg production, but the males are often discarded. This study evaluated the hypothesis that Red Sex-Link cockerels exhibit improved growth and carcass traits over their parent breeds due to hybrid vigor. Sixty 1-day-old cockerel chicks per breed were divided into three replicate groups which were randomly assigned to brood pens with 0.06 square meters of floor space per bird. At five weeks of age, chicks were moved to hoop coops with 0.3 square meters of floor space per bird. Throughout the study, all cockerels were provided ad libitum access to a complete chick feed (19% crude protein) and water. Growth parameters were measured through 18 weeks of age. At 18 weeks, three cockerels per pen were humanely slaughtered and processed to evaluate carcass yield and part distribution. Red Sex-Link cockerels demonstrated greater final body weights than either Rhode Island Red or Delaware cockerels, supporting the hypothesis of hybrid vigor. However, feed conversion and carcass yield were comparable across all groups, suggesting limited overall production advantage for Red Sex-Link males over their parent breeds in small-scale meat systems.

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Evaluating the Effects of Forage Access and Storage Duration on Egg Quality in Barred Plymouth Rock Hens through Poultry-Focused Undergraduate Research Experiences. V. A. Uyanga*, S. Henderson, A. Amey, A. Anthony, M. Haller, D. Knipker, K. Cash, and T. Fisher. College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO, 65101.

Despite the importance of poultry science in food production and animal welfare, undergraduate engagement in this field remains limited compared to other STEM disciplines. To address this gap, the study was conducted within an existing undergraduate course, **AGR 339: Poultry Production**, which was designed to immerse students in applied poultry research. The research investigated the egg quality and nutritional value of conventional chicken eggs, as well as the influence of forage enrichment on egg shelf life and nutritional composition. A total of 96 Barred Plymouth Rock hens, aged 28 weeks, were assigned to two treatments (forage vs. non-forage), with four replicates of 12 hens each. Freshly laid eggs (n = 30 per treatment) were collected once per week over an eight-week period to determine egg quality traits. In a follow-up study, eggs were collected and stored for 0, 7, 14, and 21 days post-collection, then evaluated for external and internal egg quality parameters. Data collected were subjected to one-way analysis of variance (ANOVA) using Statistical Analysis Software (SAS), and treatment means were separated using Tukey's Honestly Significant Difference (HSD) test at $P \leq 0.05$. The results revealed significant effects of forage enrichment on egg quality, as well as notable changes associated with storage duration. Overall, this approach expanded undergraduate access to research facilities, and the findings contribute new knowledge on the nutritive quality and shelf life of table eggs produced by forage-raised heritage chickens. Importantly, the project provided students with valuable experiential learning opportunities in poultry science research.

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Brown Mushroom Stem Reprograms the Layer Chick Gut Microbiome and Mucosal Immunity. M. Salahuddin[1]*, P. K. Goswami[1], A.A.A. Abdel-Wareth[1], T. Carr[1], K. Stamps[1], C. Gray[1], A. Aviña[1], and Jayant Lohakare[1]. [1]Prairie View A&M University, CAFNR Research, Texas, United States.

Mushroom-processing by-products are a promising circular ingredient for poultry diets, yet their effects on the gut ecosystem and mucosal immunity remain unclear. This study evaluated partial replacement of soybean meal with brown mushroom stem (BMS) powder in layer chicks. A total of 160 Lohmann LSL Lite chicks were assigned to four groups: Control (0% BMS) and three treatment groups with 2%, 4%, or 6% BMS replacing soybean meal with five replicates of eight chicks per replicate. The feeding period lasted 36 days. Cecal microbiota was profiled by 16S rRNA sequencing, functional potential was inferred with PICRUSt2, and ileal mucosal immune genes expression were quantified by RT-qPCR. BMS supplementation led to dose-dependent restructuring of gut community composition with clear separation by diet. BMS supplementation favored saccharolytic, short-chain fatty acid (SCFA)–producing bacteria and increased alpha diversity at 4% BMS. Predicted pathway profiles reflected diet-specific remodeling of carbohydrate, amino-acid, cofactor, and nucleotide metabolisms showing a biosynthetic signature at 6% BMS and broader attenuation at 4% BMS. Community assembly analyses indicated a shift from dispersal-dominated turnover toward more deterministic, homogeneous selection at a higher level. Immune profiling revealed upregulation of type-1 and regulatory cytokines with minimal pro-inflammatory change. Constrained ordination showed that immune variation explained a meaningful fraction of microbiome structure, with associations enriched among SCFA-linked commensals. In conclusion, BMS appears to be a potential partial soybean-meal substitute that changes gut community composition and function while aligning mucosal immune tone toward resilience supporting antibiotic-free, sustainable egg production.

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Brown Mushroom Stem Powder as a Novel Feed Ingredient: Gaseous Output Insights via IoT Sensors. A.A.A. Abdel-Wareth[a*], K.G. Stamps[a], M. Salahuddin[a], A.A. Ahmed[b], V. Balan[c], M. Mohammadi[c], W.K. Kim[d], W. Zhu[c], C.D. Gray[a], A.M.W. Aviña[a], T.R. Carter[a], T. Carr[a], A. Williams[a], A. Bakare[b] and J. Lohakare[a]. [a]CAFNR Research, College of Agriculture, Food and Natural Resources Prairie View A&M University, Prairie View, TX 77446. [b]Computer Science Department, Prairie View A&M University, Prairie View, TX 77446. [c]Department of Engineering Technology, Cullen College of Engineering, University of Houston, Sugarland, TX 77479. [d]Department of Poultry Science, University of Georgia, Athens, GA 30602.

The poultry industry is seeking sustainable alternatives to conventional feed ingredients such as soybean meal, which present both economic and environmental challenges. Brown mushroom stems (*Agaricus bisporus*), a byproduct of agricultural production, show potential as a cost-effective and eco-friendly feed ingredient. Rich in fiber, nutrients, and bioactive compounds, brown mushroom stem powder (BMSP) may serve as a viable partial replacement for soybean meal, contributing to waste reduction and enhancing the sustainability of poultry production. This study

evaluated the effects of dietary BMSP on growth and gas emissions in *Gallus gallus domesticus* (Lohmann LSL Lite) chicks. A total of 160 3-week-old chicks were assigned to four dietary treatments containing 0, 2, 4, or 6% BMSP replacing soybean meal. Gas emissions from excreta were monitored on days 31 and 32 using an Internet of Things (IoT)-based system equipped with an MQ-135 sensor connected to a Raspberry Pi to detect carbon dioxide (CO_2), ammonia (NH_3), and methane (CH_4) levels. Gaseous output, including CO_2, NH_3, and NH_4, measured on days 31 and 32 of the experiment, exhibited significant quadratic responses ($P < 0.05$) to increasing levels of BMSP in the diet. While these effects were modest and limited to a short observation window, they suggest a potential short-term environmental benefit that warrants further investigation. These results suggest that the use of BMSP could support resource-efficient poultry production. These findings suggest that incorporating BMSP into poultry diets can help reduce environmentally harmful gaseous output.

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Litter Management Practices with Sterile *Miscanthus x giganteus* to Enhance Broiler Production. Z.F. Williams*, F.M. Hashem, J. Timmons, Department of Agriculture, Food, and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853; H. Li, Department of Animal and Food Sciences, University of Delaware, Newark, DE 19716; W.D. Hively, USGS, Beltsville, MD 20705; C. Hapeman, P. Millner, G.W. McCarty, M. Foroughi, USDA-ARS, Beltsville, MD, 20705.

Broiler production in the Delmarva Peninsula, other USA regions, and globally, relies on the sorptive capacity of the litter, concurrent with the operation of exhaust fans to maintain in-house air quality, which supports bird health during flock growth. If inadequately managed, high ammonia levels may pose a health concern for birds and poultry house employees as well as a source of nutrient loss to the environment. *Miscanthus x giganteus* is a tall, sterile hybrid grass known for its rapid growth, dense screening, and biomass production. Miscanthus creates a dry, healthy environment in broiler houses, with research showing comparable or improved results to pine shavings for growth performance and paw quality. An ongoing study is being conducted to compare miscanthus vs. wood shavings under commercial conditions. Treatments in the current study were used to evaluate broiler production and litter management in commercial broiler houses. Results indicate that the organic carbon percentage was significantly higher, and the moisture percentage was significantly lower ($P \leq 0.05$) in the miscanthus treatment. The average broiler body weight was higher in the wood shavings treatment when birds reached 19 and 33 days old; however, no significant difference ($P \leq 0.05$) was observed when birds reached 52 days old. The average paw score was significantly lower in one of the miscanthus-treated houses compared to the wood shavings-treated houses. Once complete, the study results will be useful to broiler chicken producers, processors, and vegetable crop producers concerned with air, water, and natural resources conservation in the agricultural community.

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On-farm Testing for Dewormer Resistance in Georgia Cattle. N.C. Whitley*, T.D. Odom, L.A. Wartley, D.E. Brown, R.I. Turner, T.H. Terrill; Extension and Research Land Grant Programs, Fort Valley State University, Fort Valley, GA.

In a 2024 collaborative project, the effect of commercial dewormers was tested on two producer farms (COBB, n=46; GLEN, n=37) and the Fort Valley State University farm (FVSU, n=16) using a total of 99 mixed-sex Black Angus type calves at weaning (5-9 months old). Calves were weighed and administered labeled doses of oxfendazole (OXF; oral; n=42) or a macrocyclic lactone (ML; sc injection; moxidectin or doramectin (FVSU only); n=42) or were untreated (COBB only, n=15) at weaning. Fecal samples were collected at treatment and 9-11 days later by gloved hand technique for fecal egg counting (FEC) in eggs per gram (epg) of feces using a modified McMaster's technique with a sensitivity of 8 (1 egg counted = 8 eggs). Animals with 5 or fewer eggs counted (40 epg) or missing data were omitted from statistical analysis (4 COBB, 11 GLEN, 3 FVSU). As has been seen in other studies, percentage FEC reduction was greater for the OXF than ML (doramectin intermediate; only OXF greater than CON) but was not different for farm or calf sex. Overall, for this study, the oral benzimidazole dewormer and doramectin injectable were more effective than moxidectin, but the overall average FEC reduction for doramectin was still below the threshold of what is considered effective. In addition, the average FEC reduction for the benzimidazole drug was below 90%. Given the results of this study, the current veterinary recommendation of using both a benzimidazole and macrocyclic lactone for weaned calves is still relevant for cattle producers.

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Genome-editing in Animal Agriculture: Importance and a Progress Report. M. Singh*; Animal Biotechnology Lab, Agricultural Research Station, Fort Valley State University, Fort Valley, GA, 31030.

Genome engineering using site-specific endonucleases is revolutionizing biological sciences. Its greatest impact is expected to be on biomedical and agricultural sciences. Site-specific endonucleases like Zink Fingers (ZNF) and Transcription Activator-Like Effector Nucleases (TALENs) have been used to target desired genomic modifications for quite some time, however, these proteins are complex to design and need to be assembled for each genomic target. Discovery of clustered regularly interspaced short palindromic repeats (CRISPR) and Crispr-associated (Cas 9) proteins, colloquially called as CRISPR/Cas 9 technology, is the latest advancement in this technological revolution that eliminates these limitations. CRISPR/Cas technology is comparatively inexpensive, precise and easy to perform. Since the first livestock produced in 2014 using CRISPR/Cas technology, and the first edited crop (a white button mushroom) to clear the regulatory hurdle by USDA, up to its recent approval of CASGEVY and LYFGENIA gene therapies, to treat sickle cell disease in humans, a lot of progress has been made. This presentation will provide a progress report of various applications of genome-editing technology in animal agriculture, and its importance in animal welfare and enhancing food production to meet the increasing demand of food to match the population pressure on earth.

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The Impact of Production Process Information on Consumer Preferences for Sustainably Produced Beef. B. Khanal* and S. P. Dhoubhadel**,** CAFNR Research, College of Agriculture, Food, and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Cattle production is a significant source of methane emissions, prompting interest in Sustainable Beef Production Technologies (SBPT) that aim to reduce emissions while improving productivity and resilience. However, most SBPTs are still emerging and remain underused, and SBPT-labeled beef is not yet available in the market, which limits our understanding of consumer demand for beef produced with SBPT. This study employs discrete choice experiments to assess consumer preferences for sustainably produced beef produced using feed additives, manure and grazing management, selective breeding, and genetic engineering. Participants were randomly exposed to information on SBPT via video or printed text. Mixed logit model results indicate that, even without knowledge of sustainable beef production information, consumers prefer beef produced using manure and grazing management or selective breeding over conventional beef. Providing production information significantly raised valuations for these alternatives, while the impact was more modest for beef produced using genetic engineering or feed additives. The preliminary estimate suggests that adoption of SBPT in beef production reduces beef-related emissions by more than a quarter of the 2020 level of emissions from beef. These findings suggest that providing production information and adopting sustainable labeling could play a crucial role in stimulating consumer demand for sustainably produced beef.

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Integrating IoT Telemetry and Parasitological Metrics to Evaluate Dewormer Efficacy, Growth, and Coccidial Dynamics in Weaned Beef Calves Under Louisiana Forage Conditions. M. K. Tate Sr.,* J. Snowden, C. P. Bagley, F. Chappelle, T. Collins, Southern University Agricultural Research and Extension Center, Baton Rouge, LA, 70813.

A 42-day precision-livestock field study evaluated the efficacy, physiological tolerance, and growth responses of two commercial anthelmintics—Ivomec Plus and Synanthic—compared with untreated controls under Louisiana forage conditions. Freshly weaned beef calves (n=49) were stratified by weight and sex, randomly assigned to one of three treatment groups (~16 per group). Six calves (two per group) were fitted with Smaxtec eBolus sensors for continuous monitoring of internal temperature, rumination, pH, and activity. Fecal egg counts (FEC) and coccidial oocyst counts were analyzed pre- and post-treatment using the Modified McMaster technique at LADDL. Baseline nematode FEC were relatively low for all treatment groups. By Day 14, Ivomec Plus and Synanthic achieved excellent FEC reductions, respectively ($p < 0.01$), validating both treatments as highly effective, with Ivomec Plus demonstrating slightly more rapid suppression kinetics. Average daily gain increased ($P<.05$) in treated groups compared with controls. Treated calves improved body condition scores by +0.8 points and exhibited higher feed efficiency. Telemetry detected mild, transient post-dosing temperature elevations and brief rumination reductions that normalized within 36

hours, indicating minimal physiological stress to calves undergoing treatments. Low-to-moderate *Eimeria bovis* and *E. zuernii* shedding occurred in untreated and Synanthic groups, with spontaneous decline after environmental drying. Integration of IoT telemetry with FECRT established a reproducible framework for evaluating anthelmintic performance and welfare-based recovery in field conditions with freshly weaned beef calves. The findings advance Southern University's Smart Ranching Initiative, promoting digital tools for sustainable parasite management and precision beef production.

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Propagation and Establishment Success of Stinging Nettle (*Urtica dioica*) for Forage Production. V. W. Temu, and S. S. S. Narina*, Forage Ecology Research; M. K. Kering, Plant Nutrition and Physiology, Agricultural Research Station, Virginia State University, Petersburg, VA, 23806.

Stinging nettle (*Urtica dioica*) is a versatile perennial herb native to Eurasia and distributed globally. Since 2023, studies have been ongoing at Virginia State University to evaluate its establishment for forage. Crop was established from alternative propagating materials seedlings, crown splits (CS), and plugs, and evaluated for weed suppression and ground cover. Measurements included sward height, canopy spread, and shoot number, with comparisons to un-weeded controls after two years. Greenhouse studies indicated that pre-rooted and directly potted stem cuttings harvested at peak vegetative growth provide an efficient, low-cost, non-destructive propagation method. Spring (April–May) plantings achieved 100% survival for plugs and CS, whereas Fall (October) plantings revealed low survival (plugs 55%, CS 13.5%). Despite variable conditions and weed pressure, plots achieved over 75% ground coverage within 19 months for October planting and less than 12 months for April-May planting. In field experiments, plugs outperformed CS, reaching up to 60 cm in height, 85 cm in canopy spread, and ~40 shoots per plant, with faster establishment. Sward height was greatest for plugs (95 cm) and CS (88 cm) in Spring (Mean 91.3 cm) compared to 91.3 cm and 46.4 cm, respectively, in the fall after two years of establishment. These results indicate that vegetative propagation using plugs or CS, with proper early management, enhances productivity and weed suppression. Plugs and CS thus provide reliable planting materials for rapid stinging nettle establishment and greater forage yield. Further trials on planting density and fertilization are in progress.

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Cultivar Decline in Sweetpotato. S.K. Ponniah*, Y. Huang, and D.P. Chapai, Department of Agriculture, School of Agriculture, Fisheries and Human Sciences, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601.

Sweetpotato is vegetatively propagated and is susceptible to viruses that accumulate with each planting cycle (generation) and lead to variety decline, which may ultimately affect the yield and quality of sweetpotato roots. This propagation method promotes the accumulation of viruses and spontaneous mutations. The term 'cultivar decline' has been applied to an internationally observed phenomenon in sweetpotato. In this syndrome, the yield and/or quality of a sweetpotato cultivar gradually declines in a broadly accumulative manner over succeeding years. Over 30 viruses have been identified in sweetpotato, of which the potyvirus sweetpotato feathery mottle virus (SPFMV) is by far the most common, as it is found worldwide, wherever sweetpotatoes are grown. Other potyviruses found in the U.S. include sweetpotato virus C (SPVC), sweetpotato virus G (SPVG), and sweetpotato virus 2 (SPV2). Those, along with SPFMV, form a complex of four potyviruses that are aphid transmitted. The objective of the study is to identify the reasons for cultivar decline through a multipronged approach. The results of the yield loss through generations study, the alternate hosts for the viruses, and the soil microbiome will highlight the various sources of cultivar decline in sweetpotato. The findings observed from the multiple approaches will be presented.

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Advancing Sustainable Crop Management Through Conversational AI, Autonomous Technologies, Artificial Intelligence, and Experiential Education. G.C. Bernard*, C. Jones, K. Jones, N.A. Bakari, V. York, A. Brown, V. Abera, D. Wilson, R. Menon, M. Egnin, I. Ritte, M. Okoma, G. Aguti, S. Critchlow, T. Nobles, C. Thompson, and O. Idehen, Department of Agricultural and Environmental Sciences, Plant Biotechnology, Genomics and Autonomous Tools, Research Laboratory, Tuskegee University, Tuskegee, AL 36088.

Agricultural systems worldwide are challenged to maintain productivity and sustainability under constrained resources and evolving environmental conditions. Strengthening agricultural efficiency and workforce readiness will require

integrating autonomous technologies and artificial intelligence that enable high-throughput crop monitoring, predictive analytics, and data-informed management. This project integrates autonomous sensing systems, AI-powered analytics, and field-based imaging to improve crop-health evaluation, pest detection, and timely management interventions. We utilized autonomous platforms to capture canopy structure, root architecture, reflectance, and physiological indicators such as chlorophyll content, leaf temperature, and plant vigor. The resulting datasets support predictive models that detect early stress symptoms and guide precision crop management. Beyond research applications, the project strengthens Tuskegee University's capacity to integrate autonomous and AI-enabled tools into teaching, research, and extension programs, fostering experiential learning for students and small-scale farmers. Student interns gained hands-on experience in data acquisition, image annotation, and model training while assisting in the delivery of free crop-health assessments that also served as demonstrations for producers. To enhance accessibility and outreach, our project has incorporated a chat-based analytical and reporting interface (CropWizard, University of Illinois Urbana-Champaign) that interprets field data and generates farmer-friendly summaries and management recommendations. Collectively, this initiative integrates emerging technologies to enhance decision-making, prepare the next generation of agricultural professionals, and promote sustainable, data-driven production through research, education, and outreach.

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Integrated Physiological, Anatomical, and Transcriptomic Insights into Drought Resilience Reveal Superior Redox and Osmotic Homeostasis in Grapevine Rootstock 140 Ruggeri (*V. Berlandieri* × *V. Rupestris*). A. Ismail*, P. Gajjar, and I. El-Sharkawy**,** Center for Viticulture and Small Fruit Research, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32308.

Drought severely limits grapevine productivity and sustainability. To elucidate the mechanisms underlying drought resilience, we investigated the physiological, anatomical, and transcriptomic responses of two grapevine rootstocks with contrasting tolerance – 140 Ruggeri (RUG) and Millardet et de Grasset 420A (MGT) – under progressive water deficit and subsequent recovery. RUG exhibited a conservative water-use strategy, maintaining stable transpiration and higher photosynthetic pigment retention compared to MGT. Biochemical assays revealed that RUG sustained superior antioxidant enzyme activities (SOD, GPX, and CAT) and proline accumulation, effectively regulating hydrogen peroxide levels and osmotic potential during drought and rehydration. In contrast, MGT displayed elevated ROS accumulation, starch deposition, and tylosis formation in xylem vessels, suggesting impaired hydraulic conductivity and reduced adaptability. RNA-seq analysis identified distinct transcriptional reprogramming patterns between the rootstocks, with RUG exhibiting early and sequential activation of drought-responsive clusters enriched in pathways related to photosynthesis, redox homeostasis, osmotic regulation, and lipid metabolism. Unique RUG gene clusters demonstrated significant enrichment in GO terms, e.g., "photosynthesis, light reaction;" "response to water deprivation;" "cell redox homeostasis;" and "cutin biosynthetic process." Conversely, MGT upregulated genes associated with cell wall remodeling and starch metabolism during late drought and rewatering, reflecting a delayed recovery strategy. Our results demonstrate that RUG achieves superior drought tolerance through rapid transcriptomic reprogramming and synergistic regulation of antioxidant defense and osmotic adjustment, ensuring photosynthetic stability and xylem integrity. These findings provide a mechanistic framework for understanding grapevine resilience and offer molecular targets for breeding drought-tolerant cultivars in viticulture facing challenges.

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Advancing Emerging Crop Enterprises through Public-Private Partnerships. R. Seepaul*, Brooksville Agricultural and Environmental Research Station, Brooksville, FL 34601.

Public-private partnerships (PPPs) form the foundation for transforming innovative research into viable emerging enterprises. When universities, industry, and government work together toward a shared mission, they create the synergy necessary to bridge discovery, development, and deployment. Each partner contributes unique strengths: universities generate research, data, and talent; industry provides market insight, infrastructure, and commercialization capacity; and government provides funding, policy support, and regulatory stability. Together, these elements create an ecosystem that nurtures innovation, reduces risk, and accelerates impact. The Southeast Partnership for Advanced Renewables from Carinata (SPARC) exemplifies this collaborative model. Through a coordinated effort among USDA-NIFA, multiple land-grant universities, and private sector partners, SPARC advanced carinata *(Brassica carinata)*, a nonfood oilseed crop for sustainable aviation fuel, from experimental trials to regional commercialization.

The partnership integrated genetic improvement, agronomic management, logistics, and market development into a unified value chain that supported both farmer profitability and renewable fuel goals. As Florida advances its efforts to diversify agricultural production systems through emerging crops, the SPARC experience provides a framework for building resilient, market-driven enterprises that connect research innovation to real-world application. SPARC's success illustrates that emerging enterprises thrive when PPPs are designed with clarity of purpose, shared governance, and long-term commitment. By aligning scientific innovation with market demand and policy incentives, the partnership transformed a research innovation into an operational bioeconomy enterprise. This model demonstrates how strategic collaboration can catalyze new industries, strengthen rural economies, and advance sustainable agriculture.

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Inside the Muscadine Grape Berry: The Secret Microbial Trove. M. Agarwal* and M.B. Sheikh, Center for Viticulture and Small Fruit Research, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32317.

Muscadine grapes are renowned for their natural disease resistance, unique genetic characteristics, and rich abundance of bioactive compounds. While their phytochemistry has been extensively studied, the microbial communities residing within the berries, particularly endophytic bacteria, have remained largely uncharted. These microorganisms play a crucial role in plant health, stress tolerance, and ecological resilience. This study presents the first comprehensive, culture-dependent investigation of bacterial endophytes inhabiting muscadine grape berries. We successfully isolated a diverse assemblage of species spanning six genera: *Bacillus*, *Staphylococcus*, *Paenibacillus*, *Calidifontibacillus*, *Curtobacterium*, and *Tatumella*. Microscopic and physiological assessments revealed notable morphological diversity and temperature adaptability among isolates. Cluster-based functional analysis indicated clear specialization, with members of Pseudomonadota and Actinomycetota displaying robust plant growth-promoting capabilities, while Bacillota representatives exhibited biocontrol and probiotic potential. Notably, *Tatumella ptyseos* demonstrated multiple plant growth-promoting traits, including indole-3-acetic acid production, nitrogen fixation, phosphate solubilization, and carbohydrate fermentation. Several *Bacillus* isolates showed presumptive biocontrol activity, and *Paenibacillus cineris* emerged as a promising probiotic candidate. The discovery of *Calidifontibacillus erzurumensis* as a novel endophytic species further enriches the known biodiversity of grape-associated microbes. Overall, this work reveals the rich metabolic diversity and functional significance of muscadine berry endophytes, underscoring their potential for future agricultural and biotechnological applications.

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High-Throughput Sequencing-Guided Detection of Divergent *Grapevine virus B* Variants in Muscadine Grapes from a Florida Foundation Block. A.G. Mohamed* and V. Tsolova, Center for Viticulture and Small Fruit Research, Florida A&M University, Tallahassee, FL 32308; and M. Al Rwahnih and K. Stevens, Foundation Plant Services, University of California, Davis, CA 95616.

Muscadinia rotundifolia (muscadine grape) is a key specialty crop in the southeastern U.S. and an integral component of clean plant foundation programs. During routine testing of vines in the G1 "Clean Vineyard" foundation block at the Center for Viticulture and Small Fruit Research (Florida), legacy RT-PCR and RT-qPCR assays for Grapevine virus B (GVB) consistently tested negative despite suspicious serological and epidemiological indicators. Petiole samples from multiple muscadine cultivars were therefore submitted to Foundation Plant Services (UC-Davis) for high-throughput sequencing (HTS). HTS and de novo assembly revealed highly divergent GVB homologs in three muscadine cultivars, with contigs spanning large portions of the viral genome. These variants exhibited substantial nucleotide divergence from the GVB reference genome (GCF_000857765.1), sharing only ~82-85% nucleotide identity with the GVB isolate MN716773.1 previously reported from Tennessee. MN716773.1, also identified through HTS, underscores the importance of unbiased sequencing approaches for detecting divergent variants that escape legacy diagnostics. Using the muscadine contigs as templates, we designed an in-house RT-PCR assay targeting a 1,033-bp region that spans the RNA-binding domain and the coat protein fragment. The HTS-informed assay successfully detected GVB in vines that had repeatedly tested negative with published assays. Sanger sequencing validated the amplicons and confirmed the HTS contigs. This study documents the first detection of divergent GVB variants in muscadine grapes in Florida. It demonstrates how HTS-guided assay design can both safeguard grapevine clean-plant certification systems and minimize diagnostic costs by eliminating the need for repeated HTS testing.

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Fall Planted Legume-Cereal Mix Cover Crops Improve Soil Properties but Fall Short on Weed Suppression in Tilled and No-Tilled Chickpea Production Systems. Z. Mersha*, M.A. Ibarra-Bautista, S. Ren, L. Rutto, and L. Githinji, Agricultural Research Station, Virginia State University, Petersburg, VA 23806; G.A. Birru, USDA/ARS Agroecosystem Management Research Unit, Lincoln, NE 68583; and A.S. Shiferaw, School of Natural Resources, University of Nebraska-Lincoln, Lincoln, NE 68583.

Chickpea is a highly weed-prone crop with limited herbicide options and high labor demands, raising the following question: Can fall-planted legume-cereal cover crops (CCs) improve soil properties while reducing herbicide use and manual weeding pressure? To explore this, we evaluated the effect of fall-planted winter rye (WR) alone in 2021 and mixed with hairy vetch (HV) in 2022 and 2023 at Randolph farm in Petersburg, VA. The study's objectives were (a) to examine the effect of CCs on soil properties using monthly growth dynamics and biomass harvested from fifteen 0.25 m^2-quadrants and (b) to evaluate the efficiency of five termination methods, namely (1) green manure (GM), (2) GM plus pre-emergence herbicide (GMH), (3) burn (BOH), (4) crimp-mulch (CRM), and (5) mow-mulch (MW) in suppressing weeds in chickpea fields. Weed distribution, particularly nutsedge, was patchy and dominant on the eastern side. Growth dynamics of CCs followed an exponential growth in fall 2022 ($R^2 \geq 0.994$) and a three-parametric sigmoidal growth in 2023 ($R^2 \geq 0.972$). Biomass averaged 55.8 and 96.9 t/ha for 2022 and 2023, respectively. GMH consistently outperformed GM in weed suppression. GM was not significantly different from no-till systems by the end of the season. Pooled data fitted well to a three-parametric logistic curve, predicting half-time to 50% weed coverage at 35 (MM), 38 (CRM), 40 (BOH), 46 (GM), and 53 (GMH) days. Relapses of CCs were consistent in no-till systems, especially BOH and MW. Although soil properties improved, CCs alone did not significantly suppress weeds.

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Biochar and Intercropping Practices to Improve Hemp Production in Florida. A. Ali*, M.J.S. Cabral, A.M.S. Robinson-Baker, and M. Haseeb, Center for Biological Control, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32307.

Hemp (*Cannabis sativa* L.) is emerging as a high-value specialty crop in Florida due to its versatility for fiber, grain, and medicinal markets. However, its successful cultivation is challenged by Florida's sandy soils, rapid nutrient leaching, and high pest and disease pressure. Common insect pests, including aphids (*Aphis gossypii*), hemp russet mite (*Aculops cannabicola*), corn earworm (*Helicoverpa zea*), Southern green stink bug (*Nezara viridula*), brown stink bug (Euschistus servus), and Eastern leaf footed bug (*Leptoglossus phyllopus*) have been observed infesting hemp plants, contributing to yield losses and vectoring secondary infections. Because hemp production is relatively new in Florida, there is a critical need for region-specific, soil- and pest-management recommendations that promote resilient cropping systems. Sustainable practices such as biochar soil amendment and intercropping with vegetables offer the potential to enhance soil fertility, improve nutrient cycling, and reduce pest and pathogen pressure, yet their applications in hemp systems remain underexplored. This study evaluated the effects of biochar application and vegetable intercropping on soil properties, hemp growth, insect pest abundance, and disease incidence. Two field experiments were conducted in Spring 2025 at the FAMU REC in Quincy, FL. Moderate biochar rates (2-4%) significantly improved soil pH, organic carbon, and potassium levels, and enhanced hemp height, stem diameter, and leaf production. High biochar rates (8%) resulted in nutrient immobilization, reduced vigor, and increased *Fusarium* wilt and southern blight. Intercropping suppressed weeds and reduced visible pest and disease incidence but did not significantly affect hemp growth in the first season.

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Comparative Analysis of Sugar Metabolism: Enzyme Activities and Gene Expression During Muscadine and Bunch Grape Berry Development. I.M. Ahmed*, M. Agarwal, T. Dhanani, and M.B. Sheikh, Center for Viticulture & Small Fruit Research, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32317.

Muscadine grapes (*Vitis rotundifolia*), hybrid bunch (*Vitis* spp.), and traditional bunch grapes (*Vitis vinifera*) exhibit notable differences in fruit size, flavor, and sugar composition, yet the biochemical and enzymatic bases of these

differences remain poorly understood. Four representative genotypes, two muscadines (Black Beauty, Regale), one hybrid bunch (Blanc du Bois), and one bunch grape (Barbera) were evaluated at four developmental stages: pea, green, veraison, and ripe. Berry weight and diameter were found to increase steadily during development with muscadine genotypes producing the largest berries. Total soluble solids content increased from 4 to 15.8 °Brix as titratable acidity declined. Sucrose was detected only in muscadine cultivars Black Beauty and Regale during veraison and ripening, while Blanc du Bois and Barbera lacked detectable sucrose throughout. Glucose and fructose were the predominant sugars in all genotypes, increasing sharply towards ripening. Total sugar concentration followed the order Blanc du Bois > Barbera > Black Beauty > Regale. Sucrose phosphate synthase (SPS) and sucrose synthase (SuSy) activities were highest in muscadine genotypes, particularly Black Beauty, whereas acid and neutral invertase (AI, NI) activities peaked in hybrid and bunch genotypes. InvI gene expression was markedly higher in muscadines, suggesting post-translational suppression of invertase activity. Correlation analyses linked SPS and SuSy with berry size and sucrose content, and invertase activity with hexose accumulation. These results indicate that muscadine grapes favor sucrose accumulation/retention through elevated SPS and SuSy activities and stronger invertase inhibition, while hybrid and bunch genotypes rely on enhanced invertase activity for rapid sucrose cleavage and hexose accumulation.

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A Geospatial Assessment of Drought Vulnerability for Corn and Soybean Production in the Southeastern United States (2004-2023). S. Oshikoya*, B. Gyawali, G. Maheteme, and S. Upadhaya, College of Agriculture, Health, and Natural Resources, Kentucky State University, KY 40601; D. Zourarakis, College of Agriculture, Food, and Environment, University of Kentucky, Lexington, KY 40546; and A. Khanal, College of Agriculture, Tennessee State University, Nashville, TN 37209.

Drought remains a persistent challenge to crop productivity in the southeastern U.S., where changing hydroclimatic patterns have intensified agricultural risks. This study applied geospatial and statistical approaches to assessing drought vulnerability for corn and soybean production across KY, TN, and NC from 2004 to 2023. Using county-level yield data and the 180-day Standardized Precipitation Evapotranspiration Index (SPEI), spatial analyses were performed in ArcGIS Pro to map drought intensity and crop sensitivity. Fixed-effects panel regression quantified the relationship between annual yield anomalies and SPEI, while Mann-Kendall trend tests identified temporal changes in moisture conditions. A composite vulnerability index, integrating normalized SPEI and yield deviations, was generated through GIS-based raster modeling to visualize high-risk zones. Results show that Kentucky recorded the highest average yields, whereas North Carolina exhibited the lowest. Each unit increase in SPEI corresponded to an average gain of 9.2 bushels per acre for corn and 1.3 for soybeans, indicating substantial sensitivity to moisture deficits. Spatial outputs revealed chronic vulnerability clusters in central Tennessee and eastern Kentucky. Although overall drought trends showed gradual improvement, only North Carolina's corn exhibited a statistically significant positive trend ($\tau = 0.326$, $p = 0.048$). This geospatially driven analysis enhances understanding of spatial drought dynamics and provides support for regional adaptation, resource allocation, and resilient agricultural planning.

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Effect of Selenium Fertilization on Carotenoid Accumulation in Cress Varieties with Deep Water Hydroponics. A. Adeyeye, C. Teets*, & T. Nzaramyimana, Land Grant Program, Kentucky State University, Frankfort, KY 40601.

Nutrient biofortification in leafy vegetables can enhance dietary health benefits, improve crop nutritional quality, and promote sustainable agricultural practices. Deep water culture hydroponic production, along with micronutrient exploration, can lead to solutions to optimize nutrient uptake. Selenium (Se), an essential micronutrient, has been shown to influence plant metabolism, particularly the synthesis of bioactive compounds such as carotenoids. Research on modulating these phytochemicals in hydroponically grown *Nasturtium officinale* (watercress) and *Barbarea Verna* (upland cress) remains underexplored. This study investigates the effects of selenium fertilization at varying concentrations (0, 1.0, 2.0, and 4.0 mg $Se \cdot L^{-1}$) on carotenoid accumulation in two cress varieties. The deep-water hydroponic system provides an ideal controlled environment for plant growth, allowing precise control of nutrient levels, pH, temperature, and light intensity. The selenium treatments are set in a randomized complete block design to ensure statistical accuracy. Various growth parameters, biomass accumulation, and carotenoid levels were measured to determine the interactions between selenium uptake and metabolite biosynthesis. Research suggests that selenium supplementation may modulate plant physiological responses and enhance carotenoid synthesis. It is essential to study solutions to optimize hydroponic deep-water culture production systems to improve the nutritional and functional

quality of leafy greens. These findings can guide sustainable agricultural practices. Results from this research may also advance nutrient-fortification strategies and enhance food development, thereby supporting both horticultural innovation and public health.

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Development of a Web-Based Interactive Tool for Visualizing Complex Plant Pedigree Data. C. Schluttenhofer* and R. Dhillon, Agricultural Research and Development Program, Central State University, Wilberforce, OH 45384.

Pedigrees are important visualization tools that help display relationships between individuals. Plant pedigrees are particularly challenging to visualize due to individuals serving as both parents, presence of both individuals and populations, self-pollination, and potential polyploidy. Some existing methods for visualizing plant pedigrees are limited by either loss of fundamental information or require purchasing expensive software. This work seeks to develop an improved method for visualizing plant pedigrees that retains information about parents, development status, and traits while remaining flexible enough to accommodate poorly defined breeding schemes. Cannabis was used as the model system for developing our approach as it has multiple pedigree visualization challenges, including poor breeding schemes, information gaps within pedigrees, use of individual as both parents in different crosses, infrequent use of inbred populations, and common use of diverse populations; it also encompasses polyploid varieties. Once a framework was conceived, we developed software to visualize pedigree information input through a spreadsheet. The software was developed in Python using open-source libraries for layout generation and by creating a browser friendly interactive interface, enabling users to explore, zoom, and interact with complex pedigree structures directly through a standard web browser, without the need for specialized software installation. The resulting visualization scheme uses distinct shapes and markers to account for inbred, genetically diverse individuals and populations, backcrosses, selections, and track traits. Male and female parents are distinguished by line colors and shape labels. The web interface enhances usability by allowing dynamic interaction with the pedigree, including zooming, displaying tooltips by hovering, and exploring parentage relationships more intuitively. Overall, the developed system manages diverse breeding information missing in existing easily accessible tools. By integrating the approach into a web-based interactive environment, this tool provides a user-friendly, open, and scalable framework for plant breeding programs to have more consistent and useful pedigrees.

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AutoML for Pest Classification in Agriculture. M. Sistla*, J. Sahoo, and Y. Kim, Department of Computer Science & Mathematics, South Carolina State University, Orangeburg, SC 29117.

Pest infestation is one of the critical challenges in agriculture, causing nearly 40% of crop yield losses. Traditionally, these pests are identified through manual inspection, making the process inefficient and labor-intensive. With advances in deep learning (DL), researchers are increasingly applying neural networks to automatically detect and classify pest infestations, enabling timely interventions and reducing yield loss. Several DL models, such as LSTMs, CNNs, and ViTs, were studied for pest classification, each having advantages and shortcomings. Selecting an optimal model depends on factors such as metadata, design, and computational requirements, making it a challenge for users. AutoML offers a solution by automating processes like model selection and hyperparameter optimization. In this work, we compared the performance of two AutoML frameworks for deep neural networks, AutoKeras and AutoGluon, on two multi-class pest classification datasets: Jute Pest and pest disease. The AutoKeras framework performs architecture and hyper parameter search with CNN backbones, whereas the AutoGluon framework utilizes transformer-like architecture. Our experiments showed that we were able to achieve around 90% accuracy on the test data for both datasets, while the model is relatively lightweight with 23.5 Mparams, whereas the AutoGluon was able to achieve up to 99% accuracy, although the model size of the final architecture is large, with around 95 Mparams. In the future, we would like to conduct a comprehensive evaluation of the AutoML frameworks to select which of them can be used based on the design requirements.

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Pollinator-Dependent Reproduction in a Novel Perennial Oilseed Crop: *Silphium integrifolium*. Y. Oladosu* and H. Li-Byarlay, Agricultural Research and Development Program, Central State University, Wilberforce, OH 45384;

E. Murrell, Cropping Systems, Savanna Institute, Madison, WI 53704; and M. Nagle, Agricultural Research and Development Program, Central State University, Wilberforce, OH 45384.

The global decline of pollinator populations poses a significant threat to ecosystem services and food security and is primarily attributed to agricultural intensification and habitat loss. *Silphium integrifolium* (silflower), a native of North American prairies, has recently gained attention as a sustainable oilseed alternative to sunflower and canola due to its extended flowering period, perenniality, soil conservation benefits, and support for pollinator communities. The relative contributions of diverse floral visitors to reproductive success remains poorly understood, despite their ecological significance. This study investigated plant-pollinator interactions in silflower across six field locations in Ohio, using a multi-faceted approach to characterize floral visitors, evaluate pollination efficiency, and assess reproductive dependency. We documented over 1,000 floral visitors from 47 distinct taxa, which were representative of four orders and 18 families. The Western honeybee and Common eastern bumble bee were the most abundant pollinators, while bumblebees exhibited the longest flower handling time compared to other visitors. We conducted three pollination treatments (natural pollination, colony supplementation, and pollinator exclusion) to assess seed set and reproductive success. The index of pollinator dependency indicated strong pollinator dependence, with seed set reduced by 97% under pollinator exclusion. The pollen limitation index indicated minimal pollen limitation in natural conditions, while the auto-fertility index revealed very low self-compatibility. The addition of managed honeybee colonies provided negligible benefits to seed set, suggesting the native pollinator community alone is sufficient for optimal reproduction. Our findings demonstrate that silflower is highly dependent on animal-mediated pollination for successful reproduction.

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Planting Date Affects Nutrient and Mineral Composition of Faba Bean Seeds. S. Torabian*, Agricultural Research Station, College of Agriculture, Virginia State University, Petersburg, VA 23806; and T.J. Nartea, Virginia Cooperative Extension, College of Agriculture, Virginia State University, Petersburg, VA 23806.

Faba bean (*Vicia faba* L.) is a nutrient-rich legume gaining popularity as an affordable plant-based protein source. Ranking third worldwide after soybean and pea, it provides significant amounts of protein, carbohydrates, and essential micronutrients. This study evaluated how planting date (spring vs. fall) affects the seed composition of six faba bean varieties: Grano, Ziyad, Aprovecho, EN3, EN47, and Windsor. Fall planting was done in late September, while spring planting occurred in late February. The planting date significantly influenced protein and carbohydrate levels, as well as the protein-to-energy (PE) ratio, but had no significant effect on calorie, ash, or fat content. Fall planting resulted in higher carbohydrate but lower protein levels and PE ratio compared to spring planting. Among the varieties, Ziyad had the highest protein content (26.3%) and the lowest carbohydrate content (60.6%). Fall planting increased calcium concentration and density, whereas spring planting boosted iron, magnesium, and sodium levels. Potassium content varied among varieties, ranging from 1,260 mg/100 g in EN3 to 1,580 mg/100 g in Grano. Phosphorus levels were lowest in EN3 (625 mg/100 g) and EN47 (624 mg/100 g), and highest in Ziyad (750 mg/100 g) and Aprovecho (755 mg/100 g). These results highlight the strong impact of planting date on the nutritional quality of faba bean seeds. Further research is needed to analyze amino acid profiles, carbohydrate fractions, and fatty acid composition across genotypes and sowing dates.

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Progress in Edamame Development and Related Research in Soybean. G.L. Jiang*, Agricultural Research Station, Virginia State University, Petersburg, VA 23806.

Edamame is a vegetable type of soybean (*G. max*) and is new to North America but has higher market values relative to regular grain types. Development of new cultivars adaptable to local eco-environments and crop management practices is essential for its commercial production and the promotion of related products in the U.S. With the support of NIFA Evans-Allen research and CBG programs, dedication at VSU during the past 10 years has resulted in significant progress in cultivar development and related research, with emphasis on edamame and food-grade specialty soybeans. Hundreds of new lines have been developed and evaluated in multiple years. For release and commercialization, 55 lines plus five check cultivars have been trialed at three locations in Virginia and North Carolina during 2023-2025. Most of these lines exhibited larger seed sizes, good yield of both fresh pods and mature seeds, and better agronomic performance, as well as good nutritional profiles compared with previously released varieties,

indicating that they have good market acceptability. In addition, genetic and genomic investigations have been conducted with support from NSF HBCU-EiR and PGR programs. Data collection and analysis of important traits (agronomic performance, seed filling, seed composition) is ongoing. Utilization of natural hybridization and/or within-cultivar variations, heritability, and QTLs of soybean yield and yield stability have been explored. The results will facilitate soybean improvement and production, especially for edamame and food-grade specialty soybeans.

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Developing a Hydroponic System for Ginger (*Zingiber officinale*) Seed Rhizome Production in Virginia. S. Gu*, P.L. Coffey, and C. Mullins, Cooperative Extension, Virginia State University, Petersburg, VA 23806.

The short field season in Virginia limits ginger production to immature rhizomes, with seed rhizomes traditionally sourced from Hawaii – an unsustainable model. To address this, Virginia State University (VSU) initiated a greenhouse-based hydroponic system for local seed rhizome production. In 2022, VSU 'Chinese' ginger was grown in Pro-Mix and pine bark substrates. Pro-Mix yielded more (5.8 kg/plant vs. 5.0 kg/plant) but was more difficult to harvest. Pine bark was preferred for ease of harvest and being locally available. The optimal harvest time is at 260-290 days after transplanting. In 2023, VSU cultivars Blue Ring and Yellow were added, and we used only pine bark as substrate. 'Chinese' yields ranged from 5.1 kg/plant in November to 6.2 kg/plant in February. Yields stabilized after December, suggesting earlier harvests are feasible with adequate storage. 'Chinese' had the highest total yield (6.3 kg/plant), followed by 'Yellow' (5.7) and 'Blue Ring' (4.4). In 2024, additional VSU cultivar Red and Hawaiian cultivars Peruvian Yellow, Bird, and Buffalo Gung were evaluated with pine bark as the substrate. All but 'Buffalo Gung' exceeded 4 kg/plant. 'Buffalo Gung' suffered from soil-borne diseases and yielded only 0.3 kg/plant, indicating seed contamination. These results demonstrate the feasibility of local ginger seed production using hydroponics. Future work will refine the system and explore tissue culture for disease-free seed stock.

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IPM on Amaranth Enables Farm Resilience with Crop Diversification for an Incremental "Harvest Box:" A Conceptual Framework. L.E.N. Jackai*, B.N. Dingha, B.R. Panthi, Y. Callohuari, and K. Gandham, Department of Natural Resources and Environmental Design, North Carolina Agricultural and Technical State University, Greensboro, NC 27411.

Agricultural resilience to environmental and other unexpected events enables croplands to respond by producing stability of the enterprise. Small farms are prone to system disruptions largely attributable to pest and disease dynamics and intensity. Vegetational diversity is a stabilizing phenomenon under such conditions in various agroecosystems, varying across crops and locations. Success in overall resilience (production, consumption, income, and well-being) depends largely on how well pests are managed; without successful mitigation, production is drastically impacted, thus compromising other aspects of farm resilience. Failures in pest management have been a major factor responsible for persistent reliance on pesticides in agriculture. In this paper, we discuss our work on an indigenous specialty vegetable (IVEG) system with crops cultivated for decades by small growers worldwide. We use amaranth as the model crop because of its genetic plasticity, which contributes to all aspects of agricultural resilience. Amaranth can be grown across a wide range of environments; it is drought resistant, salt tolerant, highly nutritious and replete with bioactive health enhancing compounds. It outperforms many popular green vegetables in leaf production and income potential. We will discuss how IPM can impact these resilience attributes in a framework that includes other IVEGs, with the potential for long-term farm productivity, sustained income, and other benefits in an incremental "Harvest Box" concept capturing age-old cropping systems that can be re-imagined to keep up with the unexpected dynamics of fragile environments. Sometimes, all it takes is a willingness to try (WTT) something new!

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Unraveling Soft Rot Pathogenesis: A Molecular Journey from Bacterial Genes to Host-Derived Inducers. K. Dumenyo*, Department of Agricultural Sciences and Engineering, Tennessee State University, Nashville, TN 37209.

Soft rot and blackleg, a devastating disease complex caused by bacteria in the *Pectobacterium* and *Dickeya* genera and affecting a wide range of economically important crops both in field and storage, has long challenged plant pathologists due to its complex, multifactorial nature. Over the past two decades, our lab and others have undertaken a comprehensive molecular dissection of soft rot pathogenesis, yielding critical insights into the regulatory networks

that govern virulence in soft rot-causing bacteria. Initial studies focused on identifying key virulence genes in *Pectobacterium carotovorum* and related soft rot pathogens. Through mutagenesis, transcriptomics, and reporter gene assays, regulatory genes controlling secretion systems, quorum sensing, and tissue maceration were characterized. These findings established a foundational model of bacterial pathogenesis driven by tightly regulated genetic circuits. Subsequent work shifted toward host-pathogen signaling, revealing that plant-derived chemical cues significantly modulate bacterial virulence gene expression. Using partially purified plant extracts, our lab demonstrated that specific plant metabolites act as molecular triggers, activating or suppressing virulence programs in a context-dependent manner. This led to the landmark identification and biochemical characterization of class II inducers, low-molecular-weight plant-derived compounds capable of upregulating key virulence pathways in the bacterial pathogen. By integrating molecular genetics, metabolic, and functional assays, this body of work has redefined soft rot as a dynamic interaction shaped not only by pathogen virulence factors but also by the host's chemical ecology. The implications our work extend beyond soft rot, offering a model for decoding host-microbe chemical dialogue and informing disease-resistant crop breeding strategies.

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Use of Insectary Plants in Conservation Biological Control to Promote IPM in Crop Production. K.G. Amarasekare*, Y. Gaire, B. Sigdel, M. Yogi, and A. Adhikari, Department of Agricultural Sciences and Engineering, College of Agriculture, Tennessee State University, Nashville, TN 37209.

Insectary plants are flowering plants that can be used to promote conservation biological control. These plants attract arthropod natural enemies such as predators and parasitoids and provide them with floral resources, including pollen and flower nectar, that act as supplementary diets for natural enemies. Using these plants in cropping systems helps promote integrated arthropod pest management by attracting predators and parasitoids to crop fields. We focused on several flowering plants to find their suitability as insectary plants. We will discuss the results in detail.

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The "Greenness" Trap: Why Simple Remote Sensing Indices Misdiagnose Potassium Deficiency and Ammonium Stress as Plant Health. D. Pitchay*[1], R. Mikkelsen[2], S. Gurung[1], and S. Kennedy[1]; [1]College of Agriculture, Tennessee State University, Nashville, TN 37209; and [2]Yara North America, Chapel Hill, NC 27516.

Visual diagnosis of nutrient deficiencies remains a rapid diagnostic tool, but its utility is limited. Symptoms are often crop-specific, and by the time they are visible, plant productivity has already been impaired by a period of "hidden hunger." Potassium (K) deficiency exemplifies this diagnostic challenge. It may initially manifest as plants that are deceptively deep green with shorter internodes and smaller leaves. This is followed by the rapid development of necrotic spots on recently matured leaves, which in many species appear directly without a preceding chlorotic (yellowing) phase. This ambiguity presents a significant flaw in many modern remote sensing applications, such as drone-based scanning, that rely on "leaf greenness" as a primary indicator of plant health. This approach is often misleading, particularly for non-specialists, as it fails to differentiate between healthy growth and symptoms of stress. For example, the dark green hue interpreted as "healthy" by a generic index could be an early symptom of K deficiency. Similarly, it could indicate a plant's response to nitrogen (N) being supplied predominantly in the ammonium NH_4^+ form, which can also stress the plant. Our research is critically evaluating the limitations of using generic greenness indices for plant health assessment. We are developing crop-specific greenness indexes as a more precise and nuanced method to accurately interpret plant nutritional status and distinguish true health from symptoms of hidden stress.

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Non-Destructive Diagnosis of Iron Deficiency in Raspberry (*Rubus* sp. cv. 'Caroline'). S. Kennedy*, S. Gurung, F. Yuldashev, and D. Pitchay, College of Agriculture, Tennessee State University, Nashville, TN 37209.

Iron (Fe) deficiency is a widespread plant disorder that suppresses growth, development, and yield. In the *Rubus* genus of the Rosaceae family, Fe deficiency typically manifests as interveinal chlorosis on young leaves. While these symptoms are recognizable, the primary challenge is early diagnosis to allow for timely correction. This investigation aimed to correlate visual symptoms of Fe deficiency in raspberries with non-destructive, quantitative measurements. An experiment was conducted at the Tennessee State University Experimental Station. Raspberry plants (*Rubus* sp.

cv.'Caroline') were grown hydroponically in a complete nutrient solution. After three weeks of active vegetative growth, plants were transferred to either a complete solution (control) or a Fe-deprived (-Fe) solution. As deficiency symptoms progressed, leaf chlorosis was quantified by physiological age using a visual scoring index, SPAD meter readings, and Hunter *L**, *a**, *b** colorimetry. SPAD values were significantly lower in -Fe plants, and the effect was most pronounced in the 6th leaf, which had a value 68.2% lower than the control. This correlated with the visual scoring index, which also indicated the most severe chlorosis on the 6th leaf (score 5.0), compared to the 3rd (3.5) and 9th (3.0) leaves. The Hunter *b** value (yellowness) was consistently higher in -Fe leaves. In -Fe plants, *b** values ranged from 47.75 (youngest symptomatic leaves) to 23.94 (older leaves), a much starker range than in control plants (29.86 to 19.24). Fe deprivation also caused significant reductions in plant dry biomass (from 68.50 to 50.82 g), height (from 142.25 to 129.25 cm), and leaf number (from 28.00 to 25.75) compared to controls. The data correlating visual symptoms with specific SPAD and Hunter *L**, *a**, and *b** values will be presented as a guideline to help growers non-destructively diagnose Fe deficiency.

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Comparative Insights into the Effects of Nitrogen Sources on Turfgrass Growth and Quality. F. Yuldashev*, S. Kennedy, S. Gurung, and D. Pitchay, College of Agriculture, Tennessee State University Nashville, TN 37209.

Nitrogen (N) fertilizer sources are critical for optimal turfgrass performance and effective management. Frequent mowing depletes nutrients, requiring consistent N availability and uptake to maintain vigorous growth, greenness, and overall aesthetic quality. This study evaluated the effects of four N sources: urea [$CO(NH_2)_2$], ammonium sulfate [$NH_4^+)_2SO_4$], calcium nitrate [$Ca(NO_3^-)_2$], and ammonium nitrate [$NH_4^+NO_3^-$]. The sources were applied weekly for seven weeks as sprenching (at 4 L/m²) at five concentrations (3.5, 7.1, 14.2, 21.4, and 35.7 mM), alongside water-only (no N) as the control. Turfgrass response was evaluated by measuring biomass, shoot height, and a visual quality index. Both N source and application rate significantly influenced turfgrass performance. Calcium nitrate at 21.4 mM produced a turf quality index (22.7), biomass (115.0 g), and shoot height (15.1 cm) that were significantly greater than all other treatments. Urea and ammonium nitrate were effective at higher rates, while ammonium sulfate showed limited improvement. The water-only control exhibited the lowest growth and quality, highlighting the essential role of N fertilization. These findings indicate that $Ca(NO_3^-)_2$ at 21.4 mM consistently resulted in significantly greater turfgrass growth and visual quality. The results underscore that in precision turf management, selecting the appropriate nitrogen source, rather than focusing solely on application rate, is essential for optimizing nutrient efficiency and maintaining high-quality turfgrass.

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Interactive Effects of Nitrogen Forms and Growing Medium on Growth and Yield of Italian Basil (*Ocimum basilicum*). S. Gurung* and D. Pitchay, College of Agriculture, Tennessee State University, Nashville, TN 37209.

Plant response to nitrogen (N) forms – such as ammonium (NH_4^+), nitrate (NO_3^-), and urea [$CO(NH_2)_2$] – is often dependent on the growing medium. This study investigated the response of Italian basil (*Ocimum basilicum*) to five NH_4^+:NO_3^- ratios (0:100, 10:90, 20:80, 50:50, and 100:0) and a urea-only treatment. Plants were grown in two distinct media: solution culture (hydroponics) and a peat-lite substrate. In both media, the 100% NO_3^- treatment produced significantly higher growth and yield compared to all treatments containing NH_4^+ or urea. Plants exhibited greater sensitivity to NH_4^+ and urea in solution culture than in the peat-lite substrate. In solution culture, the 100% NH_4^+ treatment severely inhibited growth, reducing shoot biomass and leaf area by over 85% compared to the 100% NO_3^- treatment. While growth reductions from 100% NH_4^+ were also significant in peat-lite, they were less severe (~71-76% reduction in biomass and leaf area). The severity of NH_4^+ toxicity was more pronounced in solution culture. A significant growth reduction was observed when the NH_4^+ ratio exceeded 10% in solution, whereas plants in peat-lite tolerated up to 50% NH_4^+. Exceeding these thresholds resulted in visible toxicity/deficiency symptoms, including chlorosis, necrosis, and leaf defoliation. Plants supplied only with urea also developed similar toxicity/deficiency symptoms in both media. These findings demonstrate that the optimal N form for Italian basil is highly dependent on the growing system, as peat-lite provides a buffering capacity against NH_4^+ toxicity not present in solution culture.

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Flipping Science into Hands-On Experience: Creation of Interactive Classroom and Career Opportunities in Agricultural Biotechnology. C.A. Ondzighi-Assoume*, M. Olawuni, O.J. Onyemaobi, and M.W. Blair, Department of Agricultural Sciences and Engineering, College of Agriculture, Tennessee State University, Nashville, TN 37209.

At TSU, we focus on bridging the gap between theoretical knowledge and practical skills in agricultural biotechnology by creating interactive classroom experiences and job opportunities that provide students with hands-on training. By leveraging innovative pedagogies and industry partnerships, we have developed and implemented a project-based learning framework that immerses students in real-world biotechnology applications. Our program's enrollment has increased by 56% over the past five years. Students are engaging in hands-on activities, workshops, and internships; working with cutting-edge equipment and technologies; and developing skills in demand by the biotechnology industry. We focus on establishing partnerships with companies, research institutions, and government agencies to provide students with job shadowing, mentorship, and employment opportunities. By flipping the traditional classroom model on its head, TSU equips students with the skills, knowledge, and experience needed to succeed in the rapidly evolving biotechnology workforce. We focus on providing students with hands-on training in cell and tissue culture, CRISPR-Cas gene editing, and genomics analysis. Expected outcomes are enhanced understanding of genetic engineering concepts, increased enrollment and retention, increased field/application skills, improved employability, and career readiness. Potential industry partnerships include companies (e.g., Bayer, Syngenta) that provide expertise in agricultural biotechnology, genetic engineering, and crop improvement. Other potential partners include research institutions and government agencies. Through these efforts, we are equipping students with the knowledge, skills, and experience they need to succeed in the rapidly evolving field of biotechnology/genetic engineering.

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Evaluation and Characterization of Novel Isolate Endophytes as Eco-Friendly Bioproducts to Improve Growth and Protection Against Pathogens in Soybean. C.A. Ondzighi-Assoume*, M. Olawuni, M. Mmbaga, O.J. Onyemaobi, and M.W. Blair, Department of Agricultural Sciences and Engineering, College of Agriculture, Tennessee State University, Nashville, TN 37209.

Soybean (*Glycine max*) is the most widespread crop in Tennessee, with over 1 million acres grown annually. It contributes about 11% to Tennessee's total agricultural receipts and is annually ranked among the state's top three row crops for cash receipts. In addition to its high economic importance, soybeans have enormous significance in terms of their food nutritional value and usage in biodiesel production. However, diseases constitute a serious limiting factor in soybean production, resulting in yield losses of 10-15% in the U.S. Our study aims to improve soybean growth and protection against pathogens through the application of endophyte isolates as Biological Control Agents (BCAs). We are evaluating the effects of four novel endophytes as BCAs by: (i) Determining their effects on soybean plant growth-promotion; (ii) Evaluating their effectiveness in protecting soybean against pathogens *in vitro* and in the greenhouse; and (iii) Formulating two-in-one seeds by coating seeds with these BCAs to deliver competent seed-BCAs to agriculture. Preliminary results have shown these BCAs to be highly effective in promoting growth traits, with biomass of leaf, seed, and root increases of up to 41-47%, 12-30%, and 15-45%, respectively. Interestingly, up to 23-38% of nitrogen-fixing nodule numbers were scored in the soybean root system. The project's findings will help to provide new tools to facilitate the organic production of healthy soybeans, enabling farmers to increase their yields.

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Evaluating Tomato Production in High Tunnel vs. Open Field Systems in Oklahoma. D. Kandel[1]*, L. Kibet[1], N. De Silva[1], C. Avila[2], R. Solomon[1], R. Boateng[1], K. De Silva[1], and D. Jones[1]. [1]Sherman Lewis School of Agriculture and Applied Sciences, Langston University, Langston, OK 73050; and [2]Texas A&M AgriLife, Weslaco, TX 78596.

Tomato (*Solanum lycopersicum*) is the second most-consumed vegetable in the United States. In 2024, the U.S. imported about **$3.2 billion** worth of tomatoes, mainly from Mexico and Canada. Oklahoma relies on tomato imports from neighboring states and other countries. Although spring to summer is the main tomato production season in Oklahoma, unpredictable weather— including cool conditions lasting until early April and high temperatures during the summer months—creates significant challenges for growers. As a result, many are seeking cost-effective and efficient alternative cultivation methods to address these challenges. This study evaluated tomato production in high-tunnel and open-field environments under Oklahoma conditions. Four beefsteak F1 cultivars (Mountain Fresh,

Celebrity Plus, Defiant PhR, and BHN 589) and two cherry F1 lines developed by Texas A&M (C6 and C9) were evaluated in both environments during the 2025 spring–summer season in Langston, Oklahoma. The high tunnel provided warmer conditions for early seedling establishment and enabled planting **six weeks earlier** than in the open field. In addition, covering the roof with a 45% shade cloth allowed continuous harvest throughout the summer until late September. Both beefsteak and cherry cultivars produced significantly higher marketable fruit yields in the high tunnel compared with open-field conditions. Fruit quality traits—total soluble solids (Brix %), acidity, and firmness—also remained within desirable ranges under high-tunnel production. Overall, high tunnels improved early growth, extended the growing season, and increased tomato yield in Oklahoma.

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3D Genome Architecture and Transcriptomic Regulation of Powdery Mildew Response in Susceptible, Tolerant, and Resistant *Vitis* Species. P. Natarajan*, P. Sardaru, and S. Dhekney, Department of Agriculture, Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853.

Powdery mildew is a major fungal disease affecting grapevine production, with distinct variation in host response among *Vitis* species. To investigate chromatin-level mechanisms underlying disease resistance, Hi-C sequencing and RNA-Seq transcriptome analyses were performed on three *Vitis* species representing different stages of domestication and contrasting resistance levels: the domesticated *Vitis vinifera* (susceptible), the semi-domesticated *Vitis labrusca* (tolerant), and the wild *Vitis rotundifolia* (resistant). The Hi-C data are being used to assemble chromosome-scale 3D genome architectures to identify topologically associated domains (TADs) and long-range chromatin interactions linked to defense gene regulation. Integration of Hi-C and RNA-Seq datasets will reveal transcriptional networks and chromatin remodeling patterns that contribute to the host's response to the pathogen. Comparative analyses among the three species will decode how chromatin organization influences transcriptional reprogramming during pathogen infection. To our knowledge, this is one of the first integrative Hi-C and RNA-Seq comparisons of powdery mildew responses across *Vitis* species with contrasting susceptibility. Findings from this study will advance understanding of chromatin-mediated regulation in perennial crops and inform molecular breeding strategies for developing durable, disease-resistant grape cultivars.

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Assessing The Impact of Corn Earworm (*Helicoverpa zea*) Population Dynamics on Industrial Hemp (*Cannabis sativa* L.) and Identifying Effective Pest Management Periods. T. Tolosa*, B. Jackson, S.A. Henry, and S. Zebelo, Department of Agriculture, Food, and Resource Sciences, University of Maryland Eastern Shore, MD 21853.

The corn earworm (CEW) *Helicoverpa zea* (Boddie) is a major polyphagous pest that poses increasing challenges to the expanding hemp (*Cannabis sativa* L.) industry in the United States. Following the legalization of hemp cultivation with less than 0.3% delta-9-tetrahydrocannabinol content, hemp production enhanced dramatically. However, hemp growers face unexpected production challenges and yield loss due to limited pest management practices. To address these challenges, a three-year field study (2020-2022) was conducted at two locations in Maryland to monitor the spatial and temporal population dynamics of *H. zea* and to determine critical periods for effective pest management. The adult CEW population was recorded higher from late July through early September and declined toward the end of September, whereas larval population increased significantly starting at the end of August until harvest. In addition, larval feeding caused substantial damage to the hemp flowers in both locations, resulting in notable yield reduction. Findings from this study highlight distinct temporal trends in *H. zea* activity on hemp and identify critical windows for monitoring and management. These results provide a scientific foundation for developing time-specific integrated pest management strategies aimed at minimizing corn earworm damage and improving hemp yield and quality.

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Transcriptomic and Phenotypic Evidence of PFBA-Induced Developmental Stimulation in the Fall Armyworm. E.W. Omagamre*, S. Zebelo, and J.S. Pitula, Department of Natural Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853.

Perfluorobutanoic acid (PFBA), a short-chain per- and polyfluoroalkyl substance (PFAS), is increasingly detected in crop foliage and agricultural soils. Earlier observations of PFBA-exposed larvae suggested accelerated development and growth stimulation, and this study provided molecular confirmation of that response through integrated phenotypic and transcriptomic analyses of the fall armyworm (*Spodoptera frugiperda*). Larvae were fed PFBA-spiked diets spanning 0.0001-50,000 µg/g to identify stimulatory and inhibitory thresholds. A stimulation maximum at 1 µg/g increased larval weight by about 40% relative to control during early exposure, while high-dose exposure (20,000 µg/g) suppressed growth. Feeding activity showed a brief early stimulation, nearly doubling on the first day and remaining about 20% higher overall, indicating that weight enhancement primarily reflected improved growth efficiency rather than sustained feeding. Transcriptomic data reflected this shift, with early induction of structural and cytoskeletal genes at 1 µg g^{-1} giving way by Day 5 to extensive downregulation of more than a thousand transcripts, dominated by cytoskeletal proteins as well as metabolic and signaling regulators, marking the transition from active feeding to pre-pupal inactivity. In contrast, the high-dose group exhibited persistent activation of stress, detoxification, and protein-repair pathways across both sampling points, reflecting continuous metabolic stress. Collectively, these results demonstrate that PFBA elicits a hormetic, dose-dependent reprogramming of molecular networks that enhances growth and accelerates development at low doses but induces sustained stress adaptation at higher concentrations. The findings underscore how short-chain PFAS contamination in agricultural systems could alter pest growth, developmental timing, and ecosystem.

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Differentiation of Andean and Mesoamerican Accessions in a Proposed USDA Core Collection of Grain Amaranths. M.W. Blair[1]*, J.M. Londoño[1,2], M.A. Buitrago-Bitar[1,3], X. Wu[1,4], and D.M. Brenner[5]; [1]Department of Agricultural Sciences and Engineering, Tennessee State University, Nashville, TN 37209; [2]Grupo de investigación en Biodiversidad y Biotecnología (GIBUQ), Universidad del Quindío, Armenia, Colombia; [3]Facultad de Ciencias Agropecuarias, Universidad Nacional de Colombia, Palmira, Colombia; [4]Tropical Research Education Center, University of Florida, Homestead, FL 33031; and [5]Department of Agronomy/North Central Regional Plant Introduction Station, Iowa State University, Ames, IA 50011.

Grain amaranths are made up of three New World species of pseudo-cereals with C_4 photosynthesis from the dicotyledonous plant family *Amaranthaceae* and the genus *Amaranthus*. They originate in two ecoregions of the Americas: the inter-Andean valleys of South America and the volcanic axis and lowlands of Mexico and Central America. These correspond to centers of domestication for Andean and Mesoamerican crops, with one cultivated species found in the first region and two in the latter. Previously, no core collection had been made for grain amaranths in the USDA germplasm system. In this study, our objective was to create a core for the 2,899 gene bank accessions with site collection data and 1,090 geo-referenced by latitude and longitude. We constituted the core with 260 genotypes of *Amaranthus*, which we evaluated with 90 single-nucleotide polymorphism markers. Our specific goal was to distinguish between Andean and Mesoamerican gene pools of amaranths, including the cultivated species and three possible progenitors or wild relatives, along with two more natural species in an outgroup. Population structure, clustering, and discriminant analysis for principal components showed that Andean species *Amaranthus caudatus* and *Amaranthus quitensis* shared fewer alleles with Mesoamerican species *Amaranthus cruentus* and *Amaranthus hypochondriacus* compared to each group individually. *Amaranthus hybridus* was a bridge species sharing alleles among regions. Molecular markers have the advantage of quickly distinguishing Andean and Mesoamerican cultivars and have the added benefit of being useful for inter-species crosses and introgression.

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Chemical Defense Inducers Limit Root Rot and Ambrosia Beetle Damage in Flooded Dogwoods. C. Oksel[1*], M. Parajuli[2], C. Ranger[3], and F. Baysal-Gurel[1]; [1]Department of Agricultural Sciences and Engineering, College of Agriculture, Tennessee State University, Otis L. Floyd Nursery Research Center, McMinnville, TN 37110; [2]USDA Agricultural Research Service, National Arboretum, McMinnville, TN 37110; [3]USDA Agricultural Research Service, Horticultural Insects Research Lab, Wooster, OH 44691.

Flooding and root rot are major stressors in woody ornamental production that weaken tree defenses and increase vulnerability to ambrosia beetles. This study evaluated the effects of chemical defense inducers Actigard® (acibenzolar-S-methyl) and Daconil Action® (chlorothalonil with acibenzolar-S-methyl) on reducing root rot caused by *Phytophthora cinnamomi* and ambrosia beetle (*Xylosandrus* sp.) attacks in flowering dogwood (*Cornus florida* L.).

Container-grown plants were exposed to flooding or well-drained and either inoculated with *P. cinnamomi* or left uninoculated. Plants were then treated with Actigard or Daconil as foliar spray or soil drench. Untreated plants served as controls. Two one-month trials were conducted under nursery conditions during the summer of 2024. Flooding and *P. cinnamomi* inoculation significantly increased disease severity and beetle colonization, while Actigard and Daconil treatments effectively reduced both parameters. Treated plants showed fewer beetle galleries, reduced fungal colonization, and limited insect development compared to controls. Ethanol emission, a known attractant for ambrosia beetles, was detected only in flooded trees. The results suggest that chemically induced host defenses improve stress tolerance, decrease beetle attraction linked to ethanol emissions, and reduce the severity of root rot. Integrating defense activators with stress management presents a sustainable approach to protecting dogwoods from root rot and ambrosia beetle damage in nursery systems.

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Pollinator-Plant Interactions Drive Yield Improvements in Cowpea (*Vigna Unguiculata* (L.) Walp.), a Resilient Legume. K. Gandham*, L. Jackai, and B. Dingha, Department of Natural Resources and Environmental Design, North Carolina A&T State University, Greensboro, NC 27411.

Pollinators are critical for food production and ecosystem function. However, many are declining, including over 22% of native North American pollinators, especially bees; this highlights a growing biodiversity and food security crisis. To better understand pollinator resilience, a study was conducted in 2025 at The North Carolina A&T State University Research Farm using 16 cowpea cultivars. The study examined pollinator dynamics through weekly visual sampling, host-pollinator interactions through physiological and floral traits, and the impact of open pollination on yield. Results showed that honeybees (2.31 ± 0.20), bumble bees (2.17 ± 0.20), sweat bees (0.51 ± 0.06), and wasps (4.64 ± 0.37) were the most frequent and dominant floral visitors. Pollinator activity did not differ significantly between the morning (4.98 ± 0.04) and afternoon (4.94 ± 0.04). Among the tested cultivars, Black Crowder (18.4 ± 3.40), Mayo Speckled (18.30 ± 4.27), and Dixie Lee (16.8 ± 3.21) consistently attracted the highest numbers of pollinators, with wider and longer calyx structures identified as a key trait influencing visitation. Open pollination significantly enhanced yield across cultivars, affecting pod weight, seed number, seed weight, and number of deformed seeds. Fresh pod weights of the highly visited varieties Black Crowder and Mayo Speckled increased by 12% and 55%, respectively. Overall, the significant effects of genotype and pollination and the interaction of the two indicates that both cultivar characteristics and pollinator activity influence cowpea yield. These findings demonstrate that pollinators enhance cowpea yield and resilience, enabling smallholder farmers to increase productivity and sustainability through resilient practices and pollination-efficient varieties.

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Metabolomic Insights into the Development of Disease-Suppressive Soils under Long-Term Cover-Cropped Organic Farming Systems. N.T. Ghile and C. Lin, Center for Agroforestry, University of Missouri, Columbia, MO 65211; S. Bardhan*, Department of Agricultural Sciences and Engineering, Tennessee State University, Nashville, TN 37209; and F. Eivazi, Department of Agriculture and Environmental Sciences, Lincoln University, Jefferson City, MO 65101.

Long-term organic farming systems incorporating cover crops can enhance soil health and resilience, but the underlying biochemical mechanisms that promote disease suppression remain poorly understood. This study used untargeted metabolomics (UPLC-HRMS) to examine rhizosphere soils from long-term organic plots managed with cover crops and compared them to conventionally managed systems. Over 2,500 distinct metabolites were detected, revealing that extended cover cropping significantly alters soil chemical composition. Multivariate analyses (PLS-DA and Random Forest) showed that five-year cover-cropped soils exhibited unique metabolic profiles characterized by enriched fatty acids and bioactive compounds such as tomatidine, sclareol, phloretin, and hesperidin – molecules associated with antifungal activity and microbial signaling. Network analysis highlighted eicosapentaenoic acid as a central hub linking microbial-derived metabolites with plant secondary compounds. These findings provide the first metabolomic evidence that sustained cover cropping enhances both general and specific soil disease suppression through coordinated biochemical and microbial shifts. This study establishes a molecular foundation for designing biologically driven management strategies that strengthen soil resilience and reduce dependence on synthetic pesticides in organic farming systems.

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Genotypic Diversity of Tennessee *Sorghum halepense* Ecotypes per Sugar-Traits SNPs Related to *Sorghum bicolor*. S. Lymanska* and A.N. Aziz, Department of Agricultural Sciences and Engineering, College of Agriculture, Tennessee State University, Nashville, TN 37209.

Understanding the genetic relationships between cultivated sorghum (*Sorghum bicolor*) and its wild relative Johnsongrass (*Sorghum halepense*) can provide new opportunities for improving this important biofuel crop through gene discovery and allele transfer. Due to its high adaptability and persistence across environments, *S. halepense* may serve as a valuable genetic resource for enhancing traits such as sugar accumulation, stress tolerance, and vigor towards cultivated sorghum. This study investigated single nucleotide polymorphism (SNP) variation across six cultivated sorghum varieties as well as 126 *S. halepense* samples collected from 50 counties in Tennessee. Genotyping was performed using KASP assays targeting sorghum-derived SNP markers associated with sugar-related production traits. The distribution of allelic variants was analyzed to identify genotypic patterns within the *S. halepense* collection per geographic distribution as well as their relationships with *S. bicolor*. The KASP results revealed distinct patterns of allelic prevalence, with some SNPs showing dominance of a single allele and others displaying balanced allele frequencies and heterozygosity, while several loci absent in many *S. halepense* ecotype samples compared to that of cultivated sorghum. Such allelic frequency patterns per KASP analysis indicate both shared ancestry and adaptive divergence between wild and cultivated forms. The findings contribute to understanding the genetic character of *S. halepense* and highlight its potential role as a donor of functional alleles for sorghum crop improvement. This work establishes a foundation for future applications in sorghum genome targeting traits related to agronomic enhancement and bioenergy production.

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Interactions between Aphids and Natural Enemies across Crapemyrtle Cultivars and Production Systems. K. Dhakal* and K.M. Addesso, Department of Agricultural Sciences and Engineering, Tennessee State University, Otis L. Floyd Nursery Research Center, McMinnville, TN 37110.

Crapemyrtle (*Lagerstroemia* spp.) is one of the most popular ornamental trees in the southern U.S., commonly planted in landscapes for its vibrant flower color, attractive bark, and overall aesthetic appeal. However, crapemyrtle production and landscapes are increasingly threatened by insect pests, particularly the crapemyrtle aphid [*Tinocallis kahawaluokalani* (Kirkaldy)], which feeds on plant sap, causes significant damage, and promotes secondary issues such as sooty mold growth. Crapemyrtles also attract a variety of generalist natural enemies, including lady beetles, green and brown lacewings, syrphid flies, and parasitic wasps, that help regulate pest populations. This study investigated the seasonal dynamics and ecological interactions between aphids and their natural enemies in both field and container-grown crapemyrtle cultivars. Populations of aphids and natural enemies, such as lady beetles, lacewings, and parasitic wasps, were monitored at regular intervals throughout the growing season. Results showed that both pest and natural enemy populations varied over time and among production systems. In addition, significant differences were observed between field and container-grown crapemyrtles, suggesting that environmental conditions and plant-growth environments influence arthropod community dynamics. These findings highlight the importance of regular insect monitoring in crapemyrtle to support integrated pest management strategies and the conservation of natural enemies as part of a sustainable approach for both nursery and landscape settings.

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Decoding Flavor and Nutritional Traits in Capsicum chinense through TWAS-mGWAS Coupled with Spatial Transcriptomics. K.S. Karnatam*, P. Nimmakayala, and U.K. Reddy, Gus R. Douglass Institute and Department of Biology, West Virginia State University, Institute, WV 25112.

Capsicum chinense exhibits extensive phenotypic diversity in fruit pungency, pigmentation, and aroma, attributable to quantitative variation in secondary metabolites, including capsaicinoids, carotenoids, and volatile organic compounds (VOCs). To resolve the genetic architecture and regulatory networks governing these traits, we implemented a multi-layer integrative framework across ~250 accessions, incorporating targeted metabolite quantification, genome-wide association studies (GWAS), transcriptome-wide association studies (TWAS), and spatial transcriptome. GWAS detected 507 SNPs associated with capsaicinoid accumulation, 304 with carotenoid profiles, and 1,176 with VOC abundance. TWAS established significant expression–metabolite associations, implicating core

structural and regulatory genes within phenylpropanoid, fatty acid, and terpenoid biosynthetic modules. Segment-wise RNA-seq of contrasting fruit tissues identified 7,034 differentially expressed genes, including MYB31, 3-ketoacyl-CoA synthase, phytoene synthase, and multiple ABC transporter family members. AP2 transcription factors and Pentatricopeptide Repeat (PPR) proteins emerged as network-level regulatory hubs, exhibiting strong co-expression with carotenoid and VOC biosynthetic pathways. High-resolution Stereo-seq–based spatial transcriptomics resolved 74 tissue-specific genes that co-localize with GWAS and TWAS loci, substantiating their positional and regulatory relevance in metabolite trait determination.

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'Whole'-istic Approach to Super-Fruits: From Horticultural Phytochemistry to Healthy Foods and Waste Utilization. V.V. Volkis*, K. Bratley, E.E. Cable, R. Buzzetto-More, and S. Lahoff, Department of Natural Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853; and **A.G. Ristvey,** University of Maryland Extension, Wye Research & Education Center, Queenstown, MD 21658.

Aronia (*Aronia mitschurinii*), goldenberries, and elderberries are well-known due to their high content of antioxidants, essential oils, terpenes, and other valuable phytochemicals and minerals. While the juice or extract of the fruit is primarily used in food products, the pulp and other by-products remain largely unutilized, despite containing nearly half of the fruit's total phytochemical content. To date, only a few non-food applications have been developed from this waste, resulting in the loss of much of the valuable bioactive compounds. Aronia, along with elderberries, is known for its content of phenolic antioxidants, much higher than that of any other fruit. Goldenberry is a fruit rich in lipophilic antioxidants known as carotenoids. Traditional food applications typically only utilize fruit juice. The use of pulp in food products is limited due to its high content of tannins, which are valuable antioxidants but also have a bitter taste. Here, we present our "whole"-istic approach to these plants, where the plant is phytochemically screened for valuable antioxidants, vitamins, and essential oils and best horticultural practices are developed based on the effect of treatments and irrigation on phytochemical content, not only yield and plant health; highly profitable edible applications are also developed and supported by outreach programs. Some unusual applications of pulp extracts under study are non-toxic antifouling protection products and resin extractions created from the waste of food production.

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Integrated Metabolomic and Genetic Analysis Reveals Defense Pathways in Anthracnose-Resistant Tomato. C. Lopez-Ortiz*, I.O. Hernandez-De Lira, R. Duhan, P. Nimmakayala, and U.K. Reddy, Gus R. Douglass Institute and Department of Biology, West Virginia State University, Institute, WV 25112.

Anthracnose, caused by *Colletotrichum* species, is a major postharvest disease limiting tomato yield and fruit quality. To decipher the biochemical basis of resistance, we employed integrated metabolomic and genetic analyses using the resistant line PI 272636 and the susceptible cultivar 'Rio Grande.' Widely targeted metabolomics across green and red-ripe fruit stages identified over 2,500 metabolites, including 1,100 differentially accumulated compounds. The resistant line exhibited strong enrichment of steroidal glycoalkaloids (SGAs), phenolic acids, and flavonoids, notably lycoperoside C, veralosidinine, and caffeoylquinic acid derivatives – metabolites associated with antifungal defense. In contrast, the susceptible cultivar accumulated less bioactive SGA precursors and stress-related primary metabolites. KEGG pathway enrichment revealed activation of phenylpropanoid, flavonoid, and stilbenoid biosynthetic pathways in the resistant line. Integrating these data with QTL-seq results linked key differentially accumulated metabolites with resistance-associated genes, including *putrescine-hydroxycinnamoyltransferases* and *glycosyltransferases*. These results demonstrate that anthracnose resistance in tomato involves the coordinated induction of specialized secondary metabolites that reinforce biochemical defenses at different fruit stages. This study provides molecular and metabolic targets for developing durable anthracnose-resistant tomato cultivars through marker-assisted selection and metabolic engineering.

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Integrative Impact of Cucurbit Rootstocks on Yield and Bioactive Phytochemical Enrichment in Watermelon. K. Chinnannan*, L.M. Nallagari, R. Madabathula, U.K. Reddy, and P. Nimmakayala, Department of Biology, Gus R. Douglass Institute, West Virginia State University, Institute, WV 25112.

Watermelon is a nutritionally rich and economically important horticultural crop, yet its productivity and fruit quality are increasingly constrained by fluctuating environmental conditions. These challenges highlight the need for sustainable strategies that can reliably improve both yield and nutritional composition. In this study, we proposed that grafting elite watermelon scions onto robust cucurbit rootstocks would provide a biologically efficient means to enhance fruit yield and increase the abundance of essential phytochemicals relative to ungrafted plants. The results demonstrated that LG3 grafting significantly improved marketable yield parameters such as fruit number, size, weight, length, width, fruit ratio, soluble solids, fresh firmness, fruit firmness, and rind thickness by 35.8, 22.04, 24.6, 13.87, 16.11, 20.14, 11.65, 19.86, 7.86, and 6.48%, respectively. Amino acid profiling revealed a substantial increase in essential amino acids such as lysine (12.11%), valine (18.64%), isoleucine (8.41%), leucine (35.78%), and phenylalanine (11.67%) in grafted fruits relative to the ungrafted control. Furthermore, HPLC analysis revealed that grafting significantly improved pharmaceutically essential compounds, including β-carotene, lycopene, zeaxanthin, and lutein. These rootstocks also markedly enhanced the accumulation of essential macro- and micro-elements, including K, Ca, Mg, Fe, P, and S, in fruit flesh. Collectively, these findings establish grafting as a suitable strategy for producing high-yielding and nutrient-enriched watermelon fruits. Future research should integrate transcriptomic, metabolomic, and physiological analyses to clarify the mechanisms underlying improved nutrient transport and metabolic reprogramming in grafted plants, while broader multi-environment trials will help refine rootstock selection and strengthen graft-based watermelon improvement programs.

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Genotypic Variation and Metabolite Profiling of Grapevines in Response to Ripe Rot. A. Darwish[1], A. Ismail[1], J. Obuya,[2] I. El-Sharkawy[1], and D. Kambiranda*[2], [1]Center for Viticulture & Small Fruit Research, Florida A&M University, Tallahassee, FL 32308; [2]Southern University Agricultural Research and Extension Center, Baton Rouge, LA 70813.

Ripe rot of grape, caused by *Colletotrichum* spp., can be present from budbreak through harvest, reducing yield via flower and berry loss and compromising wine quality through bitterness and off-flavors. Here, we evaluated genotype-level resistance to ripe rot using *Colletotrichum gloeosporioides* (ATCC MYA-4135). Berries from 196 genotypes were inoculated and monitored over 0-7 days post-inoculation (dpi). Disease progression was scored to quantify lesion development and mycelial growth, and genotypes were classified as resistant, tolerant, and susceptible. Resistant genotypes showed no visible symptoms through 7 dpi, whereas highly susceptible genotypes reached complete (100%) berry colonization with evident rot and decay. In parallel, metabolite profiling was conducted to associate specific metabolites with defense signaling and fungal tolerance during infection. Together, these data reveal genotypic variation in ripe rot response and provide a foundation for identifying metabolic and genetic markers that could be leveraged to elicit defense responses and breed or manage for ripe-rot resistance in grapevines.

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International Scholarly Involvement in Crop Improvement Activities from Delaware State University. K. Melmaiee*, Department of Agriculture and Natural Resources, Delaware State University, Dover, DE 1990; R. Ravikesavan, Center for Plant Breeding and Genetics, TNAU, Coimbatore, India; and J. Harvey, College of Agriculture, Forestry and Life Sciences, Clemson University, Clemson, SC 29634.

Extreme weather events have exposed millions to severe food insecurity and water shortages, posing significant challenges to sustainable farming. One possible solution is to identify new alleles and haplotypes associated with traits crucial for weather event adaptation, validate them, and incorporate them into top, locally adapted breeding lines. As the director of the plant molecular breeding laboratory at Delaware State University, Dr. Melmaiee was awarded a Fulbright Specialist grant from the Bureau of Educational and Cultural Affairs and the U.S. Department of State and the Tamil Nadu Agricultural University, Coimbatore, India. There, she conducted training and workshops for the faculty and graduate students on crop genomics related to abiotic stress. During this project, we examined advanced tools for improving crop production, especially for minor crops. To continue this collaboration, Dr. Melmaiee was awarded another visiting professorship from the Indian Council of Agricultural Research (ICAR) to teach undergraduates in these areas. Her team also participated in the U.S. Advanced Science Engine at the Climate Resilient Cereals Innovation Lab (CRCIL), which focuses on developing solutions for present and future challenges and building the research capacity of partners in developing countries to enhance germplasm using new tools and methods.

Dr. Melmaiee will share her role in international agricultural research, teaching, farmer engagement, and other scholarly activities.

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Developing Genetic and Genomic Resources for Resilient Blueberry Breeding. K.P. Kulkarni*, Z.A. Khan, S. Elavarthi, and K. Melmaiee, Department of Agriculture and Natural Resources, Delaware State University, Dover, DE 19901; J. Johnson-Cicalese and N. Vorsa, Department of Plant Biology, Rutgers University, New Brunswick, NJ 08901; and P.E. Marucci, Center for Blueberry and Cranberry Research and Extension, Chatsworth, NJ 08019; U.K. Reddy, Department of Biology, West Virginia State University, Institute, WV 25112; P. Natarajan, Department of Agriculture, Food, and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD, 21853; and M. Iorizzo, Department of Horticultural Science and Plants for Human Health Institute, NC State University, Kannapolis, NC, 28081.

Blueberries (*Vaccinium* spp.) are small fruit crops native to North America but grown commercially worldwide. They offer numerous health benefits due to their high antioxidant content. Blueberries are highly vulnerable to heat stress, posing a significant challenge for developing strategies to improve crop resilience. Despite its importance, limited genomic resources are available for accelerating blueberry breeding. Our aim at Delaware State University is to develop genetic and genomic resources to facilitate blueberry's adaptation to diverse climates. We used genotyping-by-sequencing to sequence >240 cultivated and wild blueberry accessions comprising five *Vaccinium* species with varying ploidy levels. We analyzed genetic admixture and phylogenetic relationships, identified parental lineages and species boundaries, and detected selective sweeps as a strong signature of domestication. The sequence data were also used in a consortium to develop an affordable, reproducible Flex-Seq-based genotyping platform for large-scale genomic studies. Further, we evaluated 260 diploid interspecific cross derivatives for heat stress tolerance and employed multi-omics studies to reveal 23 candidate genes regulating photosynthetic traits under heat stress. We developed KASP (Kompetitive Allele-Specific PCR) and CAPS (Cleaved Amplified Polymorphic Sequence) markers for significant SNPs and validated them in 42 diverse genotypes. In addition, we designed and characterized 33,179 SSRs identified from 135 million high-quality transcriptomic reads. Currently, we are developing a genetic linkage map to identify quantitative trait loci (QTLs) regulating heat and drought stress tolerance. The genomic resources we generated offer immense applications, including mapping genomic loci, identifying QTLs/candidate genes, and marker-assisted selection for important horticultural traits.

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Improving Strawberry Agronomic Traits and Resistance to Gray Mold Fungus Using Fungicide Alternative Approaches. A.R. Vennapusa*, M.E. Abrams, R.D. Battle, V.H. Limmada, A.B. Mirto, L.A. Waller, S. Elavarthi, and K. Melmaiee, Department of Agriculture and Natural Resources, Delaware State University, Dover, DE 19901; M. Moore, Optical Science Center for Applied Research (OSCAR), Delaware State University, Dover, DE 19901; and J. Samtani, Hampton Roads Agricultural Research and Extension Center, School of Plant and Environmental Sciences, Virginia Beach, VA 23455.

Strawberries (*Fragaria × ananassa)* are a valuable small fruit crop in horticulture, offering both economic and nutritional benefits worldwide. However, their production faces significant challenges from fruit rot diseases like gray mold caused by the fungus *Botrytis cinerea*. Excessive fungicide use for management raises health and environmental concerns, and the development of fungal resistance complicates management further. Therefore, alternative methods are essential to improve strawberries' ability to resist gray mold. Our research focused on developing resources to enhance gray mold resistance through alternative fungicide strategies, including identifying resistant lines and using potassium silicate treatments. We screened a diverse collection of strawberry varieties for resistance to gray mold using an in-house developed leaf disc bioassay, as well as field trials of two potential germplasms along with two commercial checks, conducted across multiple locations in the Delmarva region. Our findings provide a method to identify resistant germplasm based on screening results, fruit yield, quality traits, and field resistance. Potassium silicate treatments under high tunnel conditions, combined with *in vitro* assays, scanning electron microscope images, energy-dispersive spectrometer analysis, spectrophotometer measurements, and gene expression analysis, revealed mechanisms behind improved plant performance and disease resistance. Our comprehensive approach identified promising resistant lines, with a focus on fruit quality, yield, and disease resistance. The potassium silicate treatment

offers an option to improve agronomic traits and serve as an alternative to fungicide management for controlling gray mold fungus.

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Localization and Identification of Total UV Absorbing Compounds and Their Phytochemical and Bioactivity Trends in Selective Southern Urban Tree Species. V.A. Ferchaud*, Southern University Agricultural and Research Center, Baton Rouge, LA 70813; Y. Qi, Urban Forestry Natural Resources and Environment Department, Southern University and A&M College and Southern University Agricultural and Research Center, Baton Rouge, LA 70813; K.L. Chin, Southern University Agricultural and Research Center, Baton Rouge, LA 70813.

Protection from the stratosphere's ozone layer is important to the survival of humans, animals, and other life forms on this planet. Plant tolerance to UV-B (280-315nm) and UV-A (315-400nm) radiation is largely due to their possession of UV-absorbing compounds, mainly flavonoids and phenolic compounds. Plants have developed different defense mechanisms against UV radiation, such as producing thicker and smaller leaves, reflective waxes, and increased production of UV-absorbing compounds. This study involves the identification of polyphenols in 12 southern broadleaf tree species during a growing season. Species include American elm, Chinese elm, Chinese tallow, green ash, Nuttall oak, pecan, river birch, Shumard oak, Southern live oak, Southern magnolia, Southern red oak, and willow oak. All the species maintained a similar trend, but the absorbance values varied remarkably among the species and wavelengths. A comparison of the total UV-absorbing compounds content among young (spring), mature (summer), and senescence (fall) leaves in each species was observed. All species showed increases of similar levels of compounds from young to mature, except live oak. Live oak is an evergreen species, and its leaves collected in spring were mature leaves from the previous year with a higher value in spring. In the senescence stage in the fall, American elm, Chinese elm, Shumard oak, S. red oak, and Southern magnolia show decreases in total UV-absorbing compound contents, while Chinese tallow, Nuttall oak, pecan, river birch, and willow oak showed increase.

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The 1890 Small Farm Research and Extension Experiences for Undergraduates at Alcorn State University: A Sustainable Future – Training the Next Generation of Agricultural Scientists. D. Collins*, T. Rashid, E. Ali, B. Bhatta, M. Burr, A. Abolude, and C. Shili, Department of Agriculture, Alcorn State University, Lorman, MS 39096.

Our nation is encountering a shortage of trained agricultural scientists. The U.S.1890 Land Grant Institutions have a long history of training and producing agricultural scientists and professionals. To maintain the nation's global competitiveness in agriculture, a diverse workforce is critical. We must train the next generation of professionals and leaders in agricultural research and extension. Alcorn hosted a cohort of 10 undergraduate and K-12 students from both 1890 and 1862 Land Grant Universities and from elementary schools. Students received hands-on experiential learning in all aspects of agricultural production from the farm to the dinner table. Students participated in integrated research and extension projects in plant pathology, entomology, environmental science, horticulture, urban agriculture, biotechnology, and goat and poultry production systems. At the conclusion of the eight-week 1890 Small Farm internship, students delivered oral and poster presentations at a closing research symposium and a student-led sustainable agriculture field day. Students are succeeding academically and have leveraged this exposure to obtain additional scholarships and internships, and they are actively engaged in agricultural research at Alcorn and collaborating universities.

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Genomic Insights into Population Structure and Diversity of Hemp (*Cannabis sativa* L.) Genotypes. K.C. Daundasekara*, K.P. Thennakoon, J.J. Jones, A. Weerasooriya, and S. Woldesenbet**,** CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Industrial hemp (*Cannabis sativa* L.) is a multipurpose crop valued for its fiber, seed, grain, and secondary metabolites. Despite its economic importance, breeding progress has been limited by the lack of genomic resources and systematic association studies that link genetic variation to agronomic traits. This study is designed to generate foundational genomic data and evaluate the feasibility of genome-wide association approaches in hemp. We are surveying 40 hemp accessions, each represented by three individuals (120 plants total). Leaf tissue has been sampled for low-coverage, whole-genome sequencing (Illumina PE150, ~4× per sample) to identify single nucleotide polymorphisms (SNPs)

across the collection. The resulting dataset will be used to characterize population structure, allele frequency distribution, linkage disequilibrium, and genetic relatedness among genotypes, providing an initial overview of genomic diversity within this germplasm. Alongside sequencing, phenotypic traits including plant height, internode length, stem thickness, and seed morphology are being measured, and chemical and nutritional profiles are being analyzed. Integrating these datasets will enable exploration of genotype-phenotype relationships and assessment of the potential for genome-wide association studies (GWAS) in hemp. This study establishes an essential genomic baseline for hemp diversity analysis. The results will inform the selection of genetically divergent parental lines to develop multi-generation mapping populations, supporting robust GWAS and genomic selection in future breeding efforts. By combining genetic diversity analysis with trait evaluation, this work lays the foundation for accelerating hemp cultivar improvement for fiber, grain, and phytochemical production.

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Assessment of Underutilized Edible Plant Species for Sustainable Agriculture in the Subtropical Climate of Texas. A. Weerasooriya*, K.P. Thennakoon, K.C. Daundasekara, and J.J. Jones, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Texas, with its expansive subtropical climate, provides a unique opportunity to explore and utilize a wide array of underutilized edible plants that remain largely neglected in mainstream agriculture. These species, many adapted to drought, heat, and variable rainfall, offer resilient alternatives to conventional crops while contributing to dietary diversity, food security, and sustainable agriculture. This study explores a selection of promising underutilized edible plants, including leafy vegetables, fruits, legumes, and root crops, that demonstrate strong adaptability to Texas growing conditions. Emphasis is placed on their nutritional profiles, potential health benefits, cultural significance, and agronomic traits such as stress tolerance, short growth cycles, and low input requirements. By integrating traditional ethnobotanical knowledge with modern agronomic evaluations, this work highlights the potential for these species to diversify food systems, enhance farmer profitability, and reduce ecological footprints in the region. The findings underscore the importance of promoting underutilized edible plants as part of resilient agriculture and call for expanded research, breeding, and extension efforts to accelerate their adoption in Texas.

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Development, Optimization, and Deployment of Advanced On-Site Diagnostic Assays for *Phytophthora capsici* in Vegetable Production. E. Ali* and F. Chukwuma, Department of Agriculture, and S. Waliullah, Department of Biology, Alcorn State University, Lorman, MS 39096.

Accurate and rapid pathogen identification is the critical first step in controlling plant diseases that threaten global food production. However, field-based diagnosis is often complicated by misleading symptoms, allowing destructive pathogens such as Phytophthora capsici to spread rapidly and cause severe economic losses, particularly in warm, wet regions like Mississippi. Traditional laboratory methods, including plate culturing and conventional PCR, are reliable but slow, costly, and require specialized equipment. This inherent delay prevents the immediate, in-field decision-making necessary to manage explosive outbreaks. To address this challenge, advanced on-site diagnostic assays are emerging as indispensable tools for modern extension programming. New nucleic acid- and antibody-based technologies, such as ImmunoStrips, Loop-Mediated Isothermal Amplification (LAMP), Recombinase Polymerase Amplification (RPA), and portable Oxford Nanopore (ONT) sequencing, are transforming crop disease diagnostics. ImmunoStrips enable rapid visual detection of specific plant pathogens in less than five minutes, requiring no specialized equipment. Similarly, LAMP and RPA provide visual, colorimetric detection of pathogen DNA in under 30 minutes using only a simple heat block. Concurrently, ONT sequencing offers real-time, actionable genomic data for precise pathogen identification from a portable device. These assays have been validated for high sensitivity and can detect pathogens directly from plant tissues and environmental sources such as irrigation water. The deployment of these rapid, sensitive, and cost-effective tools empowers extension agents and growers to identify infections immediately, enabling timely management decisions. This capacity for early, in-field identification is vital for mitigating epidemic risk, reducing crop losses, and promoting sustainable vegetable production.

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Genetic Improvement of Sweetpotato for Higher Protein and Lower Starch Content. Y. Meng*, J. Jones, T. Hollingbird, and Z. Yue, Department of Agriculture, Alcorn State University, Lorman, MS 39096; and R. Vamenani and L. Li, Department of Biological Sciences, Mississippi State University, Starkville, MS 48824.

Food and nutrition security remain critical concerns in many regions around the world. Sweetpotato (*Ipomoea batatas* (L.) Lam.) is widely cultivated in tropical and subtropical areas and ranks among the top 10 most important food crops globally. However, sweetpotato has a relativelylow protein content compared to staple foods such as maize, rice, wheat, and soybean. The Arabidopsis gene Qua-quine Starch (QQS) and its primary interactor, a nuclear factor Y subunit C4 (NF-YC4), play key roles in regulating carbon and nitrogen partitioning to starch and protein accumulation in Arabidopsis as well as in soybean and other crops. To enhance the protein content in sweetpotato, we optimized protocols to generate transgenic sweetpotato lines expressing the *QQS* gene and overexpressing *IbNF-YC4*. The *QQS* gene was cloned from *Arabidopsis thaliana* ecotype Columbia 0 (Col-0), and sweetpotato NF-YC4 was cloned from variety PI566648 (Red Jewel). Expression vectors for Arabidopsis *QQS* and sweetpotato *NF-YC4* were constructed and transformed into *Agrobacterium tumefaciens* strain EHA105. We optimized the regeneration and*Agrobacterium*-mediated gene transformation systems for sweetpotato, and over 15 regenerated plantswere generated from each transformation construct; PCR analysis confirmed successful gene insertion in more than 90% of regenerated plants. Quantification of protein and starch levels in transgenic sweetpotato leaves and roots showed a significant increase in protein content and a reduction in starch accumulation compared to wild-type controls, indicating the potential for improved nutritional value in transgenic sweetpotato lines. The impact of transgenes on storage roots development and yield will also be analyzed and discussed.

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Enhancing IPM Knowledge Through Experiential Learning: Bridging 1890 Institutions, Students, and Farmers. T. Rashid* and D.J. Collins, Department of Agriculture, Alcorn State University, Lorman, MS 39096.

Numerous studies have documented a downward trend in the population size of pollinator bee species globally, including in the U.S. Pollinator diversity has been consistently associated with higher yields and improved crop quality. Adoption of Integrated Pest Management (IPM) practices can reduce the pesticide use that harms pollinators. This study investigates the wild bee community on different crops, providing participants with experiential learning. Various collection methods – including bee bowl traps, blue vane traps, and sweep net sampling – were used to identify potential pollinators of different bee species and their association with specific crops. We also assessed the performance of each collection method for bee species specificity. During the 2023-2024 sampling period, a total of 62 bee species (23 genera) were collected. The most dominant genera included *Melissodes*, *Megachile*, *Lasioglossum*, *Epimelissodes*, *Ceratina*, *Bombus*, *Agapostemon*, and *Halictus*. Students participated in hands-on learning by collecting bees in the field and analyzing data, while simultaneous on-farm sampling and workshops engaged farmers. These activities enhanced program participants' understanding of the pollination process and the advantages of a diverse pollinator community.

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Integrated Management of *Pangaeus bilineatus* in Peanut Using Entomopathogenic Nematodes and Reduced Insecticides to Mitigate Aflatoxin. J.K. Danso* and G.N. Mbata**,** Entomology Research Laboratory, Agricultural Research Station, Fort Valley State University, Fort Valley, GA 31030**;** R.L. Holton, Premium Peanut, Douglas, GA 31535; and D.L. Shapiro-Ilan, USDA-Agricultural Research Service, Byron, GA 31008.

The peanut burrower bug, *Pangaeus bilineatus* (Say) (Hemiptera: Cydnidae), is a subterranean pest of growing concern in the southeastern U.S., where it feeds on developing pods, reducing yield, compromising kernel quality, and increasing vulnerability to aflatoxin contamination. Conventional reliance on chlorpyrifos is under increasing restriction, necessitating sustainable alternatives. This study evaluated the efficacy of entomopathogenic nematodes (EPNs), *Steinernema carpocapsae* (All strain; Sc), and *Heterorhabditis bacteriophora* (Oswego strain; Hb), applied alone or in combination with reduced rates of imidacloprid (Im) and chlorpyrifos (Ch) in Georgia-06G peanut cultivar during the 2024 and 2025 field seasons. Integrated EPN-insecticide applications produced significantly greater pest suppression than individual treatments, with 95-100% *P. bilineatus* mortality at 14 days after treatment ($p < 0.05$). Among treatments, Hb+Im at ½ field rate (FR) yielded the highest number of sound mature pods (125.8 ± 7.6 per plant) and the lowest aflatoxin contamination (0.1 ± 0.0 ppb) compared to untreated controls (104.0 ± 6.4 pods; 1.0 ±

0.8 ppb). Similarly, Sc+Ch ⅛FR and Hb+Im ½FR reduced insect-damaged kernels (≤1.2%) relative to controls (3.2%), and integrated treatments consistently limited kernel discoloration and mold (<7.8%) compared to untreated peanuts (≥12.2%). These results indicate that EPN-insecticide combinations provide additive synergistic effects, improving pest control, yield protection, and food safety even at reduced chemical rates. Integration of EPNs with conventional insecticides offers a practical and environmentally compatible approach to peanut integrated pest management, though further optimization of application strategies and economic analyses will be required for large-scale adoption.

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Morpho-Histochemical Studies in the Hull of Georgia-Grown Peanuts for a Possible Pathogen Deterrent Role. B. Sapkota*, P. Khatri, N. Joshee, Agricultural Research Station, Fort Valley State University, Fort Valley, GA 31030.

Peanut crops suffer from aflatoxin contamination, causing substantial financial losses. The presence and possible role of microstructures on the peanut fruit surface and the chemical localization of compounds with a potential role in fungal infection management is scarce. Microstructures and the presence of chemical compounds with potential anti-fungal properties in peanut hull at reproductive developmental stages (R3, R4, R5, and R6) were studied in popular peanut cultivars (Georgia-06G, Georgia-12Y, and Georgia-18RU) of Georgia. Cellular structures were studied using paraffin-based protocols in thin sections, and histochemical localization of various chemical compounds was done using light and fluorescence microscopy. Histochemical study of hull helped to localize the compounds with potential anti-fungal properties, and image analysis was performed to calculate their area percentage. Among the compounds studied in the hull of peanut cultivars at different reproductive developmental stages, cultivars presented differences. The highest area for total proteins (10.56±0.36), starch (2.47±0.73), and lignin (5.56±1.68) were found in the G-06 cultivar; alkaloid (7.94±0.63) and cellulose (13.99±2.91) were highest in the G-12Y cultivar; and tannin was found in both the G-12Y (0.64±0.08) and G-18 cultivars (0.64± 0.12). These variations could play decisive roles against microbial invasion or infection. This study provides information regarding the microstructural differences among peanut cultivars that may translate into pathogen deterrence in conjunction with various bioactive compounds present in the hull and other tissues of peanut.

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Insect Infestation and Related Losses in Peanuts at the Preharvest and Postharvest Levels in Georgia. G.N. Mbata* and J.K. Danso, Entomology Research Laboratory, Agricultural Research Station, Fort Valley State University, Fort Valley, GA 31030.

The U.S. is estimated to produce about 2.90 million metric tons of in-shell peanuts (*Arachis hypogaea* L.) annually, with the state of Georgia contributing about 52%. The current study evaluated peanut losses to insects and associated quality deterioration across the supply chain from preharvest to postharvest. Surveys were conducted during the 2022 production season on a total of 20 randomly selected peanut fields across northeastern and southern Georgia. *Pangaeus bilineatus* (Say), *Elasmopalpus lignosellus* (Zeller), and *Diabrotica undecimpunctata* Howardi were the most abundant subterranean insect pests of peanuts (22.0%, 33.1%, and 36.3%, respectively). Postharvest losses were monitored by carrying out surveys in five conventional metal warehouses (CMW) and 13 flat storage facilities (FSF) to assess the spatial distribution and abundance of storage insect pests, damages, and aflatoxin levels. Peanuts were sampled monthly from December 2022 to July 2023. A monoclonal antibody-based affinity chromatographic assay was used to determine the total aflatoxin levels in peanut samples. *Cryptolestes ferrugineus* (Stephens), *Tribolium castaneum* (Herbst), *Plodia interpunctella* (Hübner), *Lachesilla pedicularia* (L.), *Cadra cautella* (Walker.), *Ahasverus advena* (Waltl), and *Ephestia elutella* (Hübner) represented ~85.73% of the total insects. Insect populations peaked between June and July. Insect-damaged kernels, weight loss, discolored kernels, loose-shelled kernels, moisture content, and aflatoxin levels were evaluated for both preharvest and postharvest samples. The observed high levels of storage insect pests, their high damage capabilities, and the aflatoxin levels of infested peanuts require an improved IPM strategy in warehouses to ensure a sustainable and safe supply of peanuts in the U.S.

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Holistic Organic Farming Approach Update 2026. J.E. Brown* and M. Latimore Jr., College of Agriculture, Family Sciences and Technology, Cooperative Extension Program, Fort Valley State University, Fort Valley, GA 31030.

Holistic organic farming may be a more suitable approach to producing fruits, vegetables, and animals organically. Therefore, we are demonstrating six methods of production in a diverse, multiple farming system (18.5 acres) in an effort to create realistic marketing opportunities for the grower. They are: 1) Organic Tree, Shrub, and Vine Fruit Growing, designed for farmers interested in growing edible tree fruit and berries; 2) Organic Mini-Barrel Gardening, designed to produce small fruits and vegetables in 20-30 gallon plastic barrels; 3) Organic Small-Plot Gardening (50x50 feet), to determine the ideal size for a family of five/six; 4) Organic Hoop House Gardening, designed for growers who want to extend their crops' growing season; 5) Organic Animal Production, designed to determine grazing patterns of different animal species for producers who are interested in producing their own animals (i.e. cows, sheep, and goats) organically; and 6) Growing Vegetables on Plastic Mulch **,** designed to demonstrate how to produce vegetables using different colors of plastic mulches and organic matter to promote fruit and vegetable growth, conserve fertilizer and soil moisture, and control weeds. With the completion of a minimum three years of growth and management practices according to federal and state guidelines, we received the Good Agriculture Practice (GAP) and USDA Organically Certified certificates beginning in 2021 in these areas of production.

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Defense Allocation Trade-Offs in Trichome Morphology Mediate *Bemisia Tabaci* and Entomopathogenic Fungi Interactions in Squash. S. Warsi* and G.N. Mbata, Entomology Research Laboratory, Agricultural Research Station, Fort Valley State University, Fort Valley, GA 31030; J. Perier, Central Mississippi Research and Extension Center and Department of Agricultural Science and Plant Protection, Mississippi State University, Crystal Springs, MS 39059; M.D. Toews, College of Agricultural and Environmental Sciences, University of Georgia, Athens, GA 30602; and D.I. Shapiro-Ilan, USDA-Agricultural Research Service, SE Fruit and Tree Nut Research Laboratory, Byron, GA 31008.

Beauveria bassiana (GHA strain) and *Cordyceps javanica* (wfGA17 strain) are widely studied entomopathogenic fungi (EPFs) used to control sweetpotato whitefly, *Bemisia tabaci* Gennadius (Hemiptera: Aleyrodidae) Middle East-Asia Minor 1 (MEAM1), a major pest causing substantial yield losses in squash (*Cucurbita pepo* L.) production. Previous research revealed that the efficacy of these EPFs varies across squash cultivars. This study examined interactions between trichome traits, *B. tabaci* populations, and fungal efficacy at seven days post-inoculation to uncover defense allocation trade-offs for practical applications. The results showed that infestation induced cultivar-specific changes in trichome distribution, with increases in non-glandular trichomes in 'Fortune' and glandular trichomes in 'Early Summer.' Two types of glandular trichomes were observed: capitate and peltate. Peltate trichomes predominated, rising from ~86% in healthy leaves to ~91% under infestation, while capitate trichomes declined. *Bemisia tabaci* nymphal abundance showed no significant correlation with trichome type (non-glandular vs. glandular). Similarly, the efficacy of *B. bassiana* against *B. tabaci* nymphs was not significantly correlated with trichome types. In contrast, non-glandular trichomes displayed a positive correlation with *C. javanica* efficacy in the cultivar 'Lioness.' This study provides a model for understanding plant-insect-fungus interactions and offers tools to design pest management strategies that improve resistance without compromising plant fitness.

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Genetic Enhancement of *Solanum lycopersicum* Natural Defenses for Insect Resistance. E. Vendemiatti*, Department of Biology, West Virginia State University, Institute, WV 25177.

Herbivores pose a major threat to tomato (*Solanum lycopersicum*) production, leading to significant yield losses and overreliance on synthetic pesticides. These control methods are costly, environmentally harmful, and increasingly ineffective due to the rise of pesticide resistance. This research program aims to develop tomato cultivars with enhanced natural defenses by harnessing the genetic variations found in wild relatives, particularly those possessing type-IV glandular trichomes and the ability to produce insect-deterrent acylsugars. The central hypothesis is that specific regulatory genes control the development and metabolic output of these trichomes and that targeted manipulation of these genes can improve insect resistance in cultivated tomato without compromising agronomic performance. To test this, we will first identify key candidate genes involved in trichome initiation and acylsugar biosynthesis using transcriptomic analyses across selected wild and introgression lines. CRISPR/Cas9 gene-editing will be employed to generate targeted knockouts for functional validation of gene candidates. Additionally, we will characterize the acylsugar chemotypes across genetically distinct tomato lines and evaluate their effects on key insect herbivores and diseases in tomato cultivation. Promising genetic loci will be introgressed into elite germplasm backgrounds using marker-assisted selection to generate high-resistance, pre-breeding lines. This research will result

in a deeper understanding of the genetic architecture governing natural defenses in tomato and produce novel tools and materials for breeding programs. The broader goal is to support agriculture by reducing chemical inputs, protecting pollinators and soil health, and improving grower access to resilient cultivars.

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Update on Development of Improved Vintage Tomato Varieties with Multiple Pest Resistances. **B.E. Liedl*,** B. Maharjan, and K. Bhattarai, Department of Biology, West Virginia State University, Institute, WV 25112.

Vintage tomato varieties are popular with growers and consumers for their unique colors, shapes, flavors, and legacies that have been passed down through generations. However, growing vintage varieties can be challenging because of the lack of pest resistance genes. A solution would be to incorporate single gene resistances using marker-assisted selection for traits of interest coupled with SNP genotyping for background genome selection to speed the recovery of the vintage genotype in the development of improved vintage lines. Originally, F1s were created in only one direction, and problems with pollen tube growth, cross success, and seed germination occurred. New reciprocal F1 hybrids were made for six vintage varieties, but only four were successful in both directions. Reciprocal backcrosses could be made for only two of the four vintage varieties F1s. There were also difficulties making crosses or germinating seed for the BC1 when the pistillate parent was the vintage variety, so the BC2 and BC3 populations were created using the vintage variety as the pollen parent. Fruit weight, area, and perimeter increased during backcrossing for both vintage varieties, but the populations are still statistically smaller than their vintage variety. Fruit hue and chroma are the same for some BC2 populations compared to the vintage variety but others are not. BC3 and BC2S1 populations are being grown using BC2 selections, which were heterozygous for traits of interest, have high percent vintage genome recovery, possess fruit and plant characters most like the vintage type, and have seed available.

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Shade Signals Activate Dormancy-Inducing and Flowering-Inhibiting Molecular Mechanisms in Sorghum Axillary Buds. T. Kebrom* and Q. Li, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Axillary buds develop from meristems located in leaf axils and grow into shoot branches. Shade signals, by deactivating the photoreceptor phytochrome B (phyB), induce axillary bud dormancy and inhibit branching, while promoting shoot elongation and early flowering. Prior transcriptome analysis of bud dormancy in the phyB-deficient (*phyB-1*, 58M) and bud outgrowth in the wild-type (*PHYB*, 100M) sorghum revealed the upregulation of the *SbCKX1* gene that deactivates the plant hormone cytokinin (CK) and the sorghum gene *SbCN2*, an ortholog of the Arabidopsis flowering-inhibiting *TERMINAL FLOWER 1* (*TFL1*) gene, in the dormant 58M buds. While it is well-established that CK promotes bud outgrowth, it remains uncertain whether *SbCN2* promotes dormancy or inhibits flowering of axillary buds. Since defoliation also induces bud dormancy in 100M sorghum, to better understand the role of *SbCKX1* and *SbCN2* in axillary buds their expression was investigated in shade signals and defoliation-induced bud dormancy in 100M sorghum. The results showed that shade signals, and not defoliation, activate *SbCKX1* in the dormant buds. However, CK-inducible genes were downregulated by both shade and defoliation, indicating reduced CK levels in the dormant buds. The *SbCN2* gene was upregulated by shade but not by defoliation, and its expression did not always correlate with bud dormancy. The activation of *SbCN2* may counteract systemic early flowering signals triggered by shade to protect the buds from precocious transition into flowering. Therefore, this study demonstrates that shade signals activate molecular mechanisms that induce dormancy and inhibit flowering in axillary buds of sorghum.

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The Effects of Foliar Application of Biopesticides in Southeast Texas on the Quality of Camino Real Strawberry Fruits. M.T. Nuñez de González[*1], P.A.Y. Ampim[1], R. Attaie[1], E. Obeng[1], A. Mora-Gutierrez[1], S. Woldesenbet[1], and R. Wallace[2]; [1]CAFNR Research, College of Agriculture, Food, and Natural Resources, Prairie View A&M University, Prairie View, TX 77446; [2]Formerly of the Department of Horticultural Sciences, Texas A&M AgriLife Research and Extension, Lubbock, TX 79403.

Creating effective and safe methods for growing organic strawberries is essential to meeting local consumer demand. Therefore, there is a need for developing and implementing effective pest- and disease-management strategies in areas where they are prevalent, such as southeast Texas. This research assessed the effectiveness of selected commercially

available foliar biopesticides on the quality characteristics of field-grown Camino Real strawberry (*Fragaria* × *ananassa*) fruits in southeast Texas. The strawberries were grown under plastic mulch-covered-beds with drip irrigation using bare roots at the Prairie View A&M University Research Farm in Prairie View, TX. The foliar biopesticide treatments were arranged in a completely randomized design with three replications per treatment. Biometrical characteristics and physicochemical analyses of samples were determined using established methods. The experimental data was subjected to ANOVA using JMP software. The impact of biopesticide treatments on the physicochemical properties of strawberries was determined at the 5% significance level using Tukey's post hoc test. The fruit length, major diameter, total soluble solids (TSS) content, pH, titratable acidity (TA), maturation index, and internal and external color were affected ($P<0.05$) by the biopesticide treatments in the strawberries compared to the control. The ranges of TSS and TA in the strawberries were 4.45-6.25 °Brix and 0.52-1.00%, respectively. The maturation index ranged from 5.72 to 9.00 in fruits. These preliminary results offer important insights into how foliar treatment of strawberries with biopesticides can impact the quality of strawberry fruits and their potential for serving as alternatives to conventional pesticides.

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Precision Nano-Biofortification: Enhancing Vitamin B6 in *Brassica juncea* via Green-Synthesized Zinc Oxide Nanoparticle Foliar Application. A. Geremew*, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446; X. Ma, Zachry Department of Civil and Environmental Engineering, Texas A&M University, College Station, TX 77840; and L. Carson, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Nanofertilizers use nanoparticles to improve nutrient delivery in plants and are a promising tool for sustainable agriculture. Zinc oxide (ZnO) nanoparticles have been shown to enhance plant growth and yield, but their role in boosting micronutrients like vitamin B6 is not well understood. This study explores the use of ZnO nanoparticles to biofortify vitamin B6 in *Brassica juncea* (Indian mustard). Two nanoparticle sizes (10 nm and 35 nm) were applied at four concentrations (25, 50, 100, and 200 mg/L) via foliar spray at 15 and 45 days after sowing, with controls in a randomized block design. Growth metrics were tracked, and leaf samples collected at 30 and 60 days post-treatment were freeze-dried and analyzed for B6 vitamers using LC-MS/MS, following validated extraction protocols. Application of ZnO nanoparticles significantly influenced vitamin B6 accumulation in *B. juncea* leaves. Both nanoparticle sizes (10 nm and 35 nm) showed dose-dependent effects, with higher concentrations (100 mg/L and 200 mg/L) generally resulting in increased levels of B6 vitamers. Leaf samples showed peak vitamin B6 levels at 60 days, with 10 nm ZnO nanoparticles at 100 mg/L, which is most effectively increasing pyridoxine and pyridoxal compared to larger particles. Two-way ANOVA revealed significant effects of nanoparticle size and concentration on vitamin B6 biosynthesis ($p < 0.05$). Foliar application of green-synthesized ZnO nanoparticles increases vitamin B6 levels in *B. juncea* leaves, with results dependent on nanoparticle size and concentration. This supports nanofertilizer-based biofortification as an effective way to boost crop nutritional value, especially for vitamin B6.

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Breeding a New Generation of Summer Squash (*Cucurbita pepo*) Cultivars. B. Zia*, 1890 Research and Extension, Public Service and Agriculture, South Carolina State University, Orangeburg, SC 29117; and A. Ogden, Institute of Plant Breeding, Genetics, and Genomics, University of Georgia, Griffin, GA 30223.

This project aims to develop high-quality, controlled-environment agriculture (CEA)-adapted summer squash (*Cucurbita pepo*) cultivars by integrating conventional breeding with modern genomic tools. Current squash varieties are primarily bred for open-field conditions, limiting their effectiveness in CEA systems where optimal traits, such as glabrous leaves, compact growth habits, and precise fruit characteristics are essential. The research will identify and stabilize key traits like rind color, plant architecture, and disease resistance using marker-assisted and genomic selection. New hybrids will be developed and evaluated across greenhouse, high tunnel, and field environments in Georgia and South Carolina. A high-throughput genotyping platform will also be developed to fine-map major loci for fruit and plant traits, improving breeding precision and speed. This study addresses a critical gap in crop variation for CEA, promotes sustainable horticultural production, and strengthens the economic viability of year-round vegetable farming. Outcomes include the release of new cultivars and breeding tools transferable to other CEA crops, with strong potential for industry adoption and long-term agricultural impact.

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Deep Reinforcement Learning-Based Automated ML Engine for Agriculture. J. Sahoo* and Y. Kim, Department of Computer Science & Mathematics, South Carolina State University, Orangeburg, SC 29117.

In recent years, the agricultural sector has witnessed a significant increase in the application of artificial intelligence (AI) and machine learning (ML) in addressing various agricultural challenges, including crop yield prediction, weed detection, plant disease identification, and fertilizer recommendation. Traditionally, selecting the best ML model for a given agricultural dataset has involved repeating model training and testing for all candidate ML models, which is a time-consuming process. To overcome this challenge, we propose an ML engine, called Ag-ML, that automates the development and selection of ML models for crop-yield prediction. Our Ag-ML engine is designed using a deep reinforcement learning (DRL) agent that learns the optimal ML model by iterating through a given dataset. The state of our agent represents a segment of the dataset. The action of the DRL agent involves selecting one of the candidate ML models. We considered several models, including Linear Regression, Random Forest, Support Vector Regressor, XGB Regressor, and Gradient Boosting Regressor. The agent's reward function is designed based on the performance metrics of the candidate ML models. We implemented our DRL agent using a Double Deep Q Network architecture to approximate the Q-values. Our results show that the DRL agent obtains convergence at around 200 episodes. Our Ag-ML engine can be used for any regression-based tasks in agriculture. Our future work includes extending the engine to recommend suitable deep learning models for image classification tasks.

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Sorghum as an Alternative Row Crop Option in South Carolina: Opportunities and Challenges. F.A. Abera*, Center of Plant Breeding, Genetics, & Genomics, and L.G. Gibson, C. Alston, and C. Dominic, Public Service and Agriculture/1890 Research and Extension, South Carolina State University, Orangeburg, SC 29117.

Sorghum (*Sorghum bicolor* L.) offers substantial opportunities as a rotational crop in South Carolina's row-crop systems, contributing to both agronomic sustainability and economic resilience. Its drought tolerance, adaptability to variable climates, and relatively low input requirements allow for improved soil health, enhanced nutrient cycling, and diversified farm income streams. Quantitative analysis indicates that integrating sorghum into rotation systems can increase soil organic matter by 12-18% over three years, reduce erosion by up to 20%, and lower pest pressure by 25-30%, particularly from fungal pathogens and aphids. Additionally, sorghum rotations can provide economic opportunities by improving yields of subsequent crops by 10-15% and creating niche market options for grain and fodder. Despite these advantages, challenges persist. High input costs for fertilizers and herbicides, limited market access, and susceptibility to pests such as sorghum midge and certain fungal diseases can reduce yields by 15-20% if unmanaged. Effective interventions – including integrated pest management, resistant varieties, and optimized planting schedules – can mitigate these risks, potentially increasing net returns by 10-15%. Failure to incorporate sorghum into rotations risks cumulative soil nutrient depletion, increased pest pressure, and yield reductions of 10-20% over five years. By strategically implementing sorghum as a rotational crop, farmers can simultaneously address environmental sustainability and economic profitability, leveraging its multiple opportunities while managing associated challenges. These findings highlight sorghum's potential to enhance resilience and productivity in South Carolina's row-crop systems.

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Kabuli Chickpea Nitrogen Fixation and Leaf Forage Potential in the State of South Carolina. N. Kusi*, E. Moore, L. Jones, and D. Williams, Public Service and Agriculture/1890 Research and Extension, South Carolina State University, Orangeburg, SC 29117.

Soil in the Midlands region of South Carolina is sandy and nutrient deficient. A way to improve such soils is planting nitrogen (N)-fixing legumes such as chickpea (*Cicer arietinum)*. Kabuli (big-seeded) chickpea variety Sierra was planted at the South Carolina State University 1890 Research and Demonstration Farm in Olar, SC from February through June 2025. The study was designed as a split-split plot in a randomized complete block with four replications. At planting, the chickpea seeds were treated with Exceed® Superior Legume Inoculant to enable the plants to fix N in the Alaga coarse sandy soil, which had limited N and organic matter content. Treatments consisted of chickpea planted at three dates in March (early, mid, and late) and five seeding rates (170,000, 196,000, 222,000, 247,000 and

273,000 seeds/acre). In mid-June, chickpea leaves were collected, ground, and analyzed for their nutrient content and tissue digestibility. Similarly, chickpea soils were sampled at 15 cm depth, dried, and analyzed for major nutrients with emphasis on NO_3-N. This presentation will compare differences in NO_3-N between the five rates and determine the optimum planting date and seeding rate leading to greater soil N fixation. Further, I will also discuss tissue nutrient content and digestibility as determined by treatment.

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Influence of Nitrogen Fertilization on Mineral and Fatty Acid Levels in Purslane Stems. P.A.Y. Ampim*, E. Faluyi, E. Obeng, S. Woldesenbet, and A.A.B. Kotochi, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Purslane is a nutrient-dense underutilized leafy vegetable with high levels of omega-3 fatty acids, essential minerals, and antioxidant compounds. Exploring ways to improve its nutritional quality is necessary because it is used in the culinary and nutraceutical industries. Therefore, the study objective was to evaluate the effect of nitrogen fertilization on the nutritional contents of purslane stems. The experiment was conducted as a pot study in a greenhouse from April to June 2023. Goldberg Golden purslane (*Portulaca oleracea sativa* (Hath) Čelak) was planted at 45 mg of seed per pot in Pro-mix Bx Mycorrhizae and treated with four nitrogen (N) rates (i.e. 0, 75. 150, 225 $kgNha^{-1}$) in a completely randomized design. Each nitrogen rate was replicated four times and N supplied in two split applications using Jack's Professional® fertilizer (20-20-20). The pots were watered every other day with 1000 mL water to maintain sufficient moisture levels in each pot. Purslane stem mineral and fatty acid contents were quantified using ICP-OES and GC-MS respectively. ANOVA was done using JMP software, and conclusions were drawn at α =0.05. While significant differences were observed for stem fresh weight and phosphorus, no differences were observed for B, Ca, Cu, Fe, K, Mn, Na, and Zn. Similarly, differences were only observed for linoleic acid amongst the fatty acids quantified. Palmitic acid, alpha-linolenic acid, and stearic acid showed no significant responses to N fertilization. Stem biomass and phosphorus content increased with N rate, but linoleic acid in the stem decreased with N rate.

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Development and Validation of Robust HPLC Method for Quantitative Determination of Major Cannabinoids in Industrial Hemp (*Cannabis sativa L.*). S.H. Mahdi*, J.Y. Asiamah, K.R Tamang, P. Koirala, C.B. Carson, and B. Valliyodan, College of Agriculture, Environmental and Human Sciences, Lincoln University of Missouri, Jefferson City, MO 65101.

Industrial hemp (*Cannabis sativa*) has regained agricultural and economic importance in the U.S. following its legalization under the 2018 U.S. Farm Bill, which allows cultivation of hemp containing less than 0.3% Δ^9-tetrahydrocannabinol (THC). Hemp is broadly classified into cannabinoid (flower), fiber, grain, and dual-type cultivars offering multiple industrial applications. Analysis and reporting of THC content in any type of hemp cultivation is federally mandatory. Among its bioactive compounds, cannabinoids such as cannabidiol (CBD), cannabigerol (CBG), and THC are of particular significance due to their pharmacological and phytochemical potential. The cannabinoid chemotype serves as a critical qualitative trait influencing breeding, product development, and regulatory compliance. This study aimed to develop a robust analytical method for precise quantification of major cannabinoids in industrial hemp and identification of genotypic differences. A validated High-Performance Liquid Chromatography (HPLC) method was developed for the quantitative determination of Δ^9-THC, CBD, CBG and their acidic precursors (THCA, CBDA, and CBGA). Using a reverse-phase C18 column and gradient elution of acetonitrile and water with photodiode array detection at 220 nm, the method exhibited excellent linearity ($R^2 > 0.999$), precision (<2% RSD), and recovery (95-100%). Samples from diverse hemp varieties were analyzed to identify desired traits and to determine cannabinoid composition, regulatory compliance, and varietal differences in cannabinoid accumulation. Significant genotypic variations were observed, producing tissue-specific variation and identifying cultivars with high CBD/CBG content and consistently low THC expression suited to Midwestern production environments. This integrated approach strengthens hemp breeding, quality assurance, and regulatory monitoring within the evolving U.S. hemp industry.

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Genotyping Panel Towards Molecular Breeding for Key Traits in Industrial Hemp (*Cannabis sativa* L). C.B. Carson*, S. Mahdi, and B. Valliyodan, College of Agriculture, Environmental and Human Sciences, Lincoln University of Missouri, Jefferson City, MO 65101.

Industrial hemp (*Cannabis sativa,* less than 0.3% THC) varieties have important agronomic and qualitative traits, such as fiber, seed, and oils, for which we want to apply molecular breeding technology to help improve plant performance. To begin, we are examining the molecular genotypes of over 130 industrial hemp accessions and a growing list of hybridized industrial hemp breeding lines in the Lincoln University Hemp Institute collection. Beyond our plans to sequence the genomes of these varieties, we are screening them for genotypic variation with genetic markers for candidate genes. The candidates for this analysis are being chosen to represent key industrial hemp genes for breeding to improve plant performance. For example, we are analyzing candidate genes involved in genetic pathways associated with flowering time, seed shattering, fiber deposition, seed composition, carbohydrate translocation, and sex determination. After careful examination of the genetic requirements for the selected developmental and physiological pathways, we identified genes in *C. sativa* that include key regulatory genes and key biosynthetic pathway genes, and we have designed oligonucleotide primers for the markers of interest. We will report on the results of this genotypic survey and discuss results in terms of plant-breeding goals as well as the general impact of our studies in understanding factors that determine the growth and development of industrial hemp.

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Targeted Editing of the *ahFAD2* Gene Using LbCpf1: A Foundational Step Toward High-Oleic Peanuts for SE Missouri. S. Veeramasu,* College of Agriculture, Environmental and Human Sciences, Lincoln University of Missouri, Jefferson City, MO 65101.

Peanut (*Arachis hypogaea* L.) is emerging as a valuable rotational crop in southeast Missouri due to its nutritional quality, economic potential, and soil-enriching properties. Despite favorable sandy soils and increasing farmer interest, productivity remains constrained by the lack of regionally adapted cultivars, unstable agroecological situations, and dependence on southern-bred varieties that perform inconsistently under Missouri's shorter growing season. This project aims to evaluate a diverse panel of peanut cultivars under field and greenhouse conditions to assess yield potential, adaptability, and stress tolerance. The integration of genotypic and phenotypic data will facilitate the identification of elite lines with enhanced oleic acid content, improved stress resilience, and strong agronomic performance. As an initial step, we have begun exploring the efficiency of the CRISPR/Cpf1 system for editing *ahFAD2* alleles in locally adapted but low-oleic cultivars. Preliminary sequencing results confirm successful targeted modifications, underscoring the promise of this system for precise genome manipulation in peanuts. These initial findings provide a foundation for expanding the use of Cpf1-based gene editing to improve other agronomically important traits, further strengthening pre-breeding pipelines for resilience and sustainability. The expected outcomes include the development of high-oleic, resilient cultivars, production technology, and the establishment of a robust molecular breeding platform that positions Lincoln University as a forerunner in peanut breeding and biotechnology for southeast Missouri.

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Understanding the Pathogens Behind Sweet Potato Postharvest Losses in Missouri. W. Kaluwasha* and U. Kamboj, College of Agriculture, Environmental and Human Sciences, Lincoln University of Missouri, Jefferson City, MO 65101.

Sweet potato *(Ipomoea batatas)* is an important crop with significant nutritional value, but postharvest losses due to fungal infections that occur prior to and after harvest pose a major challenge. There is limited information on the pathogens responsible for sweet potato postharvest losses in Missouri. The objective of this research was therefore to isolate and identify fungal pathogens from diseased sweet potato storage roots. Sweet potato storage roots with symptoms of postharvest diseases were either obtained from local sweet potato farmers or collected from stored roots harvested from our research plot. Following disinfection, storage root pieces (5mm) were cultured on Potato Dextrose Agar (PDA) amended with antibiotic for 4-5 days. Developing colonies were then transferred to new PDA plates to obtain pure cultures. Several fungal isolates representing diverse genera were successfully isolated from diseased sweet potato storage roots. Whole-root and root-slice pathogenicity assays of pure isolates in addition to non-inoculated controls were conducted using storage roots of sweet potato cultivars with diverse characteristics; results will be discussed in the presentation. Pathogenic isolates are being identified based on morphology and/or

amplification of the internal transcribed spacer (ITS) region; results will be discussed. This research will provide information on the prevalent fungal pathogens causing diseases during sweet potato storage in Missouri and variations in susceptibility to these pathogens among sweet potato, allowing for further research evaluating sustainable disease management strategies to reduce storage losses.

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Sodium Nitrate Supplementation of Nitrogen in Hydroponic Culture of Collards: Implications for Postharvest Storage Longevity. J.N. Egilla* and I. Nyirakabibi, College of Agriculture, Environmental and Human Sciences, Lincoln University of Missouri, Jefferson City, MO 65101.

Fertilizer sources with high ratios of sodium (Na) like sodium nitrate ($NaNO_3$; 27.05% Na) or sodium phosphate (Na_3PO_4; 42.07% Na) are used less often in formulating hydroponic culture solutions, because they can increase the sodium induced salinity of the root substrate. This study evaluates the effect of $NaNO_3$ on leaf yield and postharvest longevity of Collards (*Brassica oleracea* L. Acephala) cv. Champion in storage. Two $NaNO_3$ treatments 2.0– and 5.0 mM Na (NaN_2 and NaN_5), respectively, supplementary to $Ca(NO_3)_2.4H_2O$ and KNO_3 as sources of nitrate-nitrogen were compared with a 'Control' (0.2-0.4 mM Na, as impurity, NaN_0) in modified Steiner nutrient solution. Postharvest quality decline (senescence rate: chlorosis, desiccation, and leaf disorders) was measured at 1.0 to 2.0°C (34 to 36°F) every 7 days for 35 days on a visual rating scale of one to five. Decrease in leaf fresh weight from day 0 to 35 during storage was significant for NaN_0 and NaN_2 measured repeatedly (Disturbed), but not the 'Undisturbed' samples. Leaf water content (LWC) increased slightly with a rise in leaf Na content [Na] from NaN_0 to NaN_2 but decreased at NaN_5 due to higher solute concentration. Leaf [Na] was negatively correlated with leaf Mn and Zn content but positively correlated with LDW. Regardless of fertilizer treatment, the probability of leaf grouping into higher orders of senescence indices (4-5) was zero, and there were no significant differences in the probabilities of senescence grouping into the lower indices (1-3) in the response profile.

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Biocontrol of Root Rot and Stem Canker of Industrial Hemp by Hemp-Associated Microbial Endophytes. G. Zheng*, College of Agriculture, Environmental and Human Sciences, Lincoln University of Missouri, Jefferson City, MO 65101.

Industrial hemp (*Cannabis sativa* L.) is emerging as an economically viable crop in Missouri. However, like many other crops, hemp is susceptible to fungal pathogens that can cause diseases such as root rot and stem canker. Farmers need effective strategies to prevent and manage these and other emerging diseases. Our goal is to develop a biocontrol method to combat fungal diseases affecting hemp. Microbial endophytes – beneficial bacteria or fungi that reside within plant tissues – offer a promising solution. We hypothesize that endophytes antagonistic to hemp pathogens can be isolated from hemp itself and used as biocontrol agents. We have isolated bacterial isolates from the surface-sanitizing hemp seeds and tested for their ability to inhibit hemp fungal pathogens, including *Macrophomina phaseolina,* which was found to cause rot on hemp in Missouri. One bacterial isolate, identified as *Paenibacillus polymyxa,* demonstrated in vitro significant inhibitory effects against the pathogen, as well as other potential fungal pathogens such as *Armillaria gallica*, *Dematophora necatrix*, and *Fusarium solani*. We are now progressing to in vivo testing to evaluate the antifungal effectiveness of *P. polymyxa* directly in hemp plants. This research can bring us closer to an environmentally friendly and sustainable solution for managing hemp fungal diseases

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Forage Establishment for Year-Round Production: The Good, the Bad, and the Ugly. C. Shilpakar*, A. Wilbers, and X. Zhang, College of Agriculture, Environmental and Human Sciences, Lincoln University of Missouri, Jefferson City, MO 65101.

Missouri's varied landscape yields a wide range of agricultural production systems, from glacial plains in the north to the Ozark Highlands in the south. Analysis of farmland classification data from the Soil Survey Geographic Database shows that only about 10% of Missouri soils possess the optimal combination of physical and chemical characteristics for producing agricultural commodities and are classified as prime farmland. Due to the limited availability of prime

farmland, most of the pasturelands are established on non-prime farmland dominated by cool-season grasses. To expand sustainable forage crop production on less-productive lands that have been historically managed as monocultures, we evaluated the establishment of cool-season and warm-season forage species under tilled and limited-till systems. We found that warm-season annual forage species establish effectively compared to perennial crops during the summer season in both systems. In contrast, both perennial and annual cool-season forages show consistent establishment success when planted in the fall. Our results also indicate that forage crop selection is often constrained by local soil and climate conditions, and that proactive weed management is essential for successful establishment in tilled systems compared to limited-till systems. In conclusion, forage species selection, local soil and climatic conditions, and weed competition all influence establishment success. Establishing desirable forage species is critical for achieving year-round forage availability and reducing reliance on supplement feeds for small farmers managing less-productive farmlands, thereby providing economic benefit to local communities.

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Quinoa Whole Plant: A Promising Nutrient-Rich Alternative Forage in the U.S. Midwest. S. Pathan, G. Ndunguru, and A.G. Addissu*, College of Agriculture, Environmental and Human Sciences, Lincoln University of Missouri, Jefferson City, MO 65101; A.K. Patra, American Institute for Goat Research, Langston University, Langston, OK 73050.

The whole quinoa (*Chenopodium quinoa* Willd.) plant has been evaluated in several countries across Asia and Europe for its potential use as an alternative forage for livestock; however, such evaluations have not yet been conducted in the U.S. We investigated forage yield and related agronomic traits, nutritional composition, and feed quality-related characteristics in 60-day-old quinoa whole plants of four quinoa lines across two growing seasons. The goal was to evaluate the feasibility of quinoa forage production in Missouri, a drought-prone midwestern state. Morphological traits (height and fresh weight per plant), chemical composition (fiber contents), and nutritive quality (digestible nutrient contents) of forages were affected by quinoa genotype and season of planting. The crude protein content of quinoa forage was comparable to values reported in studies on quinoa forage but was slightly lower than that of alfalfa. The mineral contents, including calcium and phosphorus, were higher than those published quinoa forage results and were comparable to the levels found in alfalfa. The neutral detergent fiber and acid detergent fiber contents were lower than those of alfalfa, indicating better digestibility of the quinoa forage. The calculated digestible dry matter, dry matter intake, relative food value, and total digestible nutrient content were higher than those of alfalfa and comparable to published values for quinoa forage. Our preliminary results suggest that quinoa forage has excellent potential as a non-traditional feed source, particularly in environmentally stressed regions where cultivating conventional forage crops is challenging. Further research is in progress.

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Industrial Hemp for Fiber, Feed, Fuel and Environmental Security. B. Valliyodan*, College of Agriculture, Environmental and Human Sciences, Lincoln University of Missouri, Jefferson City, MO 65101.

Industrial hemp (*Cannabis sativa* L.) is a multipurpose crop with high potential for economic benefits for farmers. The U.S is the largest importer of hemp products, mainly seed and fiber. The use of fiber in textiles and construction, as grain/meal in feed, and as oil in fuel industries further increases its domestic demand. The crop production needed to meet domestic demand is affected by several bottlenecks, including poor genetics, a smaller number of cultivars adapting diverse production environments in the U.S., and minimal processing facilities. To establish hemp production in Missouri and expand it across the Midwest, suitable varieties must be developed for diverse production environments. One of the major goals of the LU Hemp Institute is to study the natural genetic variations of industrial hemp germplasm for selected fiber, grain, and agronomic traits and the genotype x environment interactions of the world's existing cultivars. Moreover, efforts to design molecular breeding strategies and breeding for enhanced plant performance are in progress. Project findings – including fiber and grain traits breeding and germplasm development and progress in fiber and fuel products and market development – will be discussed.

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Monitoring Seasonal Population Dynamics and Evaluation of Selected Varieties Against Cucurbit Pests. A Chitturi*, X. Zhang, S. Veeramasu, and R. Dhariwal, College of Agriculture, Environmental and Human Sciences, Lincoln University of Missouri, Jefferson City, MO 65101.

Vegetables contribute to Missouri's diversified agriculture, supporting local farmers' markets and primarily grown by small and marginal producers across the state. Cucurbit crops (squash, zucchini, and cucumbers) are widely grown due to short crop duration and high demand for fresh markets contributing to farm income and supporting local food supply chains. Cucurbits crops are extremely impacted due to varied weather conditions and exhibit sensitivity to temperature and rainfall conditions, which strongly impact population dynamics, leading to considerable economic losses. Insect pests such as squash bugs, striped/spotted cucumber beetles, and aphids cause severe damage, weaken plant vigor, and reduce both yield and market quality. Very little to no information is available on the seasonal population dynamics of the pests in these crops. Field studies were conducted in summer 2025 in squash and zucchini to monitor the seasonal population dynamics of key pests, their diversity, and the abundance of associated beneficial insects and to evaluate the resistance/susceptibility of selected varieties against key insect pests. Preliminary results indicated eight different species of insect pests and beneficial insects belonging to insect orders of Hemiptera, Thysanoptera, Coleoptera, Hymenoptera, and Diptera. The study's results are critical for developing region-specific, ecologically based Integrated Pest Management (IPM) strategies that minimize pesticide sprays, enhance crop resilience, and support sustainable vegetable production.

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Optimizing Water and Nitrogen Management for Sustainable Quinoa Production in the Midwest. A.G. Addissu*, F.T. Johora, A.G. Ndunguru, N. Nesa, and S. Pathan, College of Agriculture, Environmental and Human Sciences, Lincoln University of Missouri, Jefferson City, MO 65101.

The increasing frequency and severity of droughts in the U.S. Midwest threaten crop productivity, emphasizing the need for resilient crops and efficient resource management. Quinoa (*Chenopodium quinoa* Willd.) is a promising alternative for small-scale farmers due to its nutritional value and drought tolerance; however, its water and nitrogen (N) requirements under Midwest conditions remain unclear. This study aimed to determine optimal irrigation and N management strategies to maximize quinoa productivity. Field experiments were conducted in 2024 and 2025 at George Washington Carver Farm, Lincoln University, using a split-split plot design with three replications. Two genotypes (PI698769 and PI614927) were evaluated under four irrigation levels: 100%, 75%, 50%, and 25% potential evapotranspiration (PET), and three nitrogen rates (0, 75, and 150 kg N ha^{-1}). Physiological traits were measured using LI-6800 and LI-600 systems, while drone-based high-throughput aerial phenotyping monitored canopy dynamics. Results showed that the highest seed yield occurred under 150 kg N ha^{-1} combined with 25% PET irrigation, whereas full irrigation consistently produced the lowest yields. Genotype PI698769 outperformed PI614927, demonstrating better drought adaptability. Stomatal conductance under 75% PET was negatively correlated with vapor pressure deficit, indicating improved water-use efficiency. Intrinsic water-use efficiency peaked under extreme deficit irrigation, and nitrogen-use efficiency was highest at 75 kg N ha^{-1}. Overall, combining 75% or 25% PET irrigation with moderate nitrogen input enhanced resource efficiency without reducing yield. These findings highlight strategies for sustainable quinoa production and improved resilience in Midwest agroecosystems.

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Nanoencapsulated Gamma-Oryzanol Enhances Fibroblast Proliferation, Migration, and Reduces Oxidative Stress in H_2O_2-Induced Cellular Aging Model. S. Devarajan*, P. Yadav, Nutrition and Food Science Program, Department of Human Sciences, School of Agriculture, Fisheries and Human Sciences, University of Arkansas at Pine Bluff, AR 71601; C. Mora, S. Mu, N. J. Rusch, Department of Pharmacology and Toxicology, College of Medicine, University of Arkansas for Medical Sciences, Little Rock, AR 72205; F. Watanabe, Center for Integrative Nanotechnology Sciences, University of Arkansas at Little Rock. Little Rock, AR 72204; G. Guisbiers, Department of Physics and Astronomy, University of Arkansas at Little Rock. Little Rock, AR 72204.

This study investigated the impact of Nanoencapsulated Gamma-Oryzanol (NEGO) on the anti-aging efficacy in H_2O_2-induced NIH/3T3 fibroblasts and the extracellular matrix (ECM) enzymes of aging. A high-speed emulsification method was used to prepare the NEGO. UV-visible spectroscopy, dynamic light scattering (DLS), zeta potential, scanning and transmission electron microscopy techniques (SEM and TEM) characterized NEGO's optical, particle

size, stability, and morphology, respectively. The antioxidant activity of NEGO was assessed using the DPPH assay. The ECM enzymes, including elastase, collagenase, and hyaluronidase, along with tyrosinase, were assayed to determine the inhibitory action of NEGO, and *in-silico* docking studies confirmed GO's binding propensity with these enzymes. Cellular viability, reactive Oxygen Species (ROS), proliferation, and migration of cells upon NEGO treatment were compared with H_2O_2-treated fibroblasts. UV-visible spectra showed a remarkable absorption peak of GO at 326 nm, confirming successful encapsulation of GO. The NEGO demonstrated a uniform size distribution, a good zeta potential, and exhibited a smooth and spherical morphology, as determined by SEM and TEM, in addition to showing significant antioxidant capacity and inhibition of key ECM enzymes. The molecular docking studies revealed a strong binding of GO (-6.8 to -7.2 kcal/mol) at the active site residues of the enzymes. NEGO demonstrated notable cell viability, with the levels increasing across various concentrations. A significant reduction in ROS and progressive cell migration into the scratched area became apparent with NEGO. The multifaceted potential of NEGO suggests that it could be a promising candidate as a natural, food-based strategy to mitigate ROS-mediated cellular damage.

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Training Undergraduate Students to Implement Best Practices for Nutrition Education and Wellness in Classrooms and Youth Sports Programs. K. Haynie*, M. Bailey, W.J. Burruss Jr., Department of Human Sciences, University of Arkansas at Pine Bluff, Pine Bluff, Arkansas, AR 71061.

Approximately 60 percent of obese children aged five to ten years have at least one physiological cardiovascular disease (CVD) risk factor-such as elevated total cholesterol, triglycerides, insulin or blood pressure, and 25 percent had two or more CVD risk factors. Over the past three decades, the prevalence of childhood obesity has more than doubled for preschool children (two to five years old). Children who learn about fruits and vegetables in childcare centers are more likely to identify them as "healthy" and are more amenable to eating nutrient dense foods when included on school's menus. The goal of this study was to establish a series of training opportunities for undergraduate students majoring nutrition science, education, and human development. The workshops aimed to increase students' understanding of nutrition, pedagogy and best practices for exposing young children to healthy eating habits. The training workshops concluded with participants creating nutrition-focused learning activities for early learning settings and engaging in hand-on cooking and sensory learning activities. Post-workshop, survey data also indicated that the training increased the likelihood of participant's use of information within the Nutrition Facts panel and ingredients list to make food selections. This study highlighted the importance of including opportunities for co-curricular learning for undergraduate students majoring in nutrition science, education, and human development. Nutrition-focused, co-curricular learning experiences strengthen student's ability to translation nutrition knowledge into effective practices for incorporating healthy eating into early learning and youth programs.

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Harvesting Healthier Futures: Community Gardening as Culinary Medicine. M. Bailey*, W. J. Burruss, K. Haynie, K. Nelson, D. White, J. Wheat*. Department of Human Sciences, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601.

Research has shown that eating habits, preferences, and behaviors that are established in toddler and preschool years influence the relationship with food later in life and subsequent health outcomes. According to the most recent data analysis, children spend on average 43 hours a week in child care settings. About one-third of these children are in multiple child care arrangements. The early learning environment can have a direct influence on building a foundation for healthy habits. Nevertheless, when children are young, their parents have the greatest opportunity to model appropriate choices for healthy eating in the home environment. This study aimed to evaluate the attitudes, knowledge and perceptions of healthy eating habits of early care educators, program parents, and their preschool children who are exposed to knowledge through Nutrition Cafes. The Nutrition Cafes resulted in a change in knowledge about the impact of food on health in the population of early childhood educators. Also, the data suggested that cafes may increase knowledge about the impact of healthy eating on health in young children. Parents perceived this increase in knowledge as having a positive impact on children's food choices. Research suggested that community gardening promotes individual health and well-being. With knowledge intervention, behavior changes related to healthier food choices are likely to occur.

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Targeted Discovery of Muscadine Seed Bioactives: New Insights Against African American Triple-negative Breast Cancer. A. Darwish, A. Ismail, I. El-Sharkawy*, Center for Viticulture and Small Fruit Research, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32308.

Muscadine grapes are characterized by a rich polyphenolic profile associated with disease prevention and health-promoting effects, yet the specific metabolites responsible for their anticancer properties remain poorly defined. This study systematically evaluated the nutraceutical potential of muscadine grape seeds to identify key metabolites contributing to cytotoxicity against aggressive breast cancer subtypes prevalent among African American women. Using an integrated metabolomics, cytotoxicity assays, molecular modeling, and statistical correlations, we uncovered the genetic and metabolic determinants underlying seed bioactivity. Untargeted metabolomic profiling across seed developmental stages in two muscadine genotypes with contrasting cytotoxic potential revealed 1,781 metabolites, among which three, designated Compound A, Compound B, and Compound C, were strongly associated with anticancer activity. Molecular modeling demonstrated that Compound A binds with high affinity to the CRX receptor, competitively inhibiting its interaction with the natural ligand Ligand-X and suppressing receptor-mediated signaling pathways that promote tumor angiogenesis and malignancy. Compounds B and C exhibited potent cytotoxicity, effectively inhibiting cancer cell proliferation and inducing apoptosis. Overall, these findings highlight the strong anticancer potential of muscadine seed phytochemicals that regulate key cancer-associated pathways. The study advances understanding of the metabolic mechanisms underlying muscadine grape efficacy and provides a foundation for developing functional foods and targeted therapeutics based on natural bioactive compounds to address aggressive breast cancer subtypes.

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Targeted Survey of Imported and Locally Produced Nile Tilapia (*Oreochromis niloticus)* Fillets for Quality Assurance. G. Bramwell*, O. C. Betiku, College of Agriculture and Food Sciences**,** Florida A&M University, Tallahassee, FL 32307.

Imported frozen fish fillets are widely consumed in the United States due to their affordability and availability; however, concerns remain regarding their nutritional quality, safety, and authenticity when compared to American farm-raised products. This study evaluates the physicochemical characteristics, nutritional composition, and potential contaminant levels of Selected Imported Frozen Fish Fillets (SIFF) relative to American-Raised Products (ARP). The aim of the study is to determine whether SIFF of Nile tilapia (*Oreochromis niloticus*) has superior quality and standard of ARP to provide information about potential food hazards and provide evidence regarding the safety of the American food system. SIFF samples of tilapia were sourced from seven major U.S retail outlets and three ARP samples were obtained from local fish farms. Laboratory analyses conducted include water-holding capacity (WHC), dry matter and moisture content, pH, proximate composition (fat, crude protein, ash, and energy), amino acid and fatty acid profiles, and major toxic metals. General trends indicated variability in water retention and composition between imported and locally produced fillets, accompanied by differences in moisture and dry matter content. Nutritional composition and metal concentrations also varied across sources, emphasizing the importance of continued monitoring for both quality assurance and food safety considerations. Findings from this study will contribute to ongoing discussions related to seafood authenticity, consumer confidence, and the broader safety of the American food supply.

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Application of Muscadine Grapes and Derived Products in Carbohydrate Research. O.O. Sangokunle*, Department of Food Science, College of Agriculture and Food Sciences, Florida A&M University Tallahassee, FL 32307.

Muscadine grapes (*Vitis rotundifolia*) and their derived products are gaining significant attention in carbohydrate research due to their unique phytochemical composition and potential health benefits. The multifaceted applications of muscadine grapes in the study of carbohydrates, with a focus on their use as functional ingredients, sources of bioactive compounds, and model systems for understanding carbohydrate metabolism, are critical for today's health-conscious consumers. Muscadine grapes are rich in dietary fiber, polyphenols, and natural sugars, making them a

valuable source for investigating the interactions between carbohydrates and other food constituents. Research has demonstrated that muscadine grape extracts and byproducts, such as pomace and seeds, can modulate glycemic response, inhibit carbohydrate-digesting enzymes, and influence the gut microbiota, thereby offering promising avenues for the development of functional foods. Additionally, the characterization of muscadine-derived polysaccharides can provide insight into their structural diversity and bioactivity, including prebiotic effects and their interaction with gut microbiota and polyphenols. The integration of muscadine grape components in carbohydrate-based formulations can enhance nutritional quality and support the valorization of agricultural byproducts. Overall, the application of muscadine grapes and their derivatives in carbohydrate research underscores their potential to contribute to health-promoting strategies, sustainable food systems, and the advancement of our understanding of plant-derived ingredients for improved carbohydrate food formulation. Continued investigation will further elucidate the mechanisms underlying these benefits and encourage the incorporation of muscadine grapes and their derived products into innovative food and biomedical applications.

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Identification and Antimicrobial Resistance Profiles of Campylobacter Species Isolated from Chicken Sources in Three Grocery Stores. *E.M. Adongbede*[*]*, J.K. Khatiwada, L.L. Williams,* Center for Excellence in Post-Harvest Technologies, North Carolina Agricultural and Technical State University, North Carolina Research Campus, Kannapolis, NC 28081.

Campylobacter jejuni and *Campylobacter coli* are prominent etiological agents of bacterial gastroenteritis globally, commonly linked to the consumption of contaminated poultry. The increasing prevalence of antimicrobial resistance (AMR) observed in these organisms poses significant risks to both food safety and therapeutic effectiveness. Continuous surveillance of resistance patterns in retail poultry is therefore essential for risk assessment and antimicrobial stewardship. In this study, raw chicken samples were collected from three retail stores in Greensboro, NC. Using USDA-BAM methods, *Campylobacter* species were selectively enriched using two different mediums. Presumptive isolates of *Campylobacter* spp. were identified based on their morphology and ability to produce oxidase and catalase. Genotyping were conducted by sequencing the 16S rRNA gene with Campylobacter-specific primers and antibiotic testing was confirmed by Etest against nine antibiotics: doxycycline, tetracycline, ampicillin, ciprofloxacin, levofloxacin, ofloxacin, moxifloxacin, delafloxacin, and azithromycin on Mueller–Hinton agar. The minimum inhibitory concentrations (MICs) were interpreted in line with CLSI guidelines. From the raw retail poultry samples, 16 *Campylobacter* isolates were isolated: *C. jejuni* (62.5%), *C. coli* (25%), and *C. lari* (12.5%). All isolates showed resistance to ampicillin and tetracycline. Both *C. jejuni* and *C. coli* were resistant to five fluoroquinolones (delafloxacin, ciprofloxacin, levofloxacin, ofloxacin, moxifloxacin), with MIC values ranging from 0.006 - 0.32 µg/ml. Delafloxacin emerged as the most effective antibiotic, displaying the lowest MICs across all strains. The widespread resistance to ampicillin and tetracycline among *Campylobacter* isolates from retail chicken suggests that resistant strains are prevalent in the raw poultry.

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Nutrigenomics in Cardiovascular Disease Prevention: Linking Gene–Diet Interactions to Precision Nutrition
P. Gupta*, Agricultural Research and Development Program, Central State University, Wilberforce, OH 45384.

Cardiovascular diseases (CVDs) remain the leading cause of death globally, causing 17.9 million deaths annually and affecting nearly 48% of U.S. adults. While diet and lifestyle are major determinants, genetic predisposition shapes individual responses to nutrients and therapeutic interventions. This study examines nutrigenomic pathways influencing lipid metabolism, inflammation, and endothelial function, emphasizing how precision nutrition can reduce inherited cardiovascular risk. Genetic variants analyzed included APOE, CETP, MTHFR, LIPC, NOS3, and PPARα/γ. The APOE ε4 allele, present in 20–25% of U.S. adults, is linked to elevated LDL and greater responsiveness to omega-3–rich diets. CETP polymorphisms affected HDL metabolism and responsiveness to soluble fiber and niacin. The MTHFR C677T variant, found in 30–40% of adults, increased plasma homocysteine, consistent with NHANES data showing 12% of Americans have marginal folate status. LIPC and NOS3 variants reduced hepatic lipase activity and nitric oxide bioavailability, predisposing carriers to dyslipidemia and hypertension. PPARα/γ variants influenced fatty acid oxidation and insulin sensitivity, with modulation by monounsaturated fats and polyphenols such as resveratrol. Mechanistically, nutrients regulate gene expression through DNA methylation, oxidative stress reduction, and activation of PPAR and NF-κB signaling pathways. Integrating SNP-based nutrition into Central State University's

precision health program enables personalized recommendations—enhancing HDL via omega-3 and fiber, optimizing methylation through folate and B vitamins, and improving vascular function with antioxidant-rich foods. Aligning genomic findings with national nutrition statistics highlights nutrigenomics as a translational model for targeted CVD prevention and advancing health across populations.

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Reducing IgE-Binding of Peanut Proteins by Extensive Hydrolysis and Peptide –Polyphenol Interactions. J. Yu*, M. Eghbali, S. Adebayo, Department of Family and Consumer Sciences, North Carolina Agricultural and Technical State University, Greensboro, NC 27411.

Peanut allergy is an IgE-mediated food allergy triggered by allergenic peanut proteins. Enzymatic hydrolysis and protein–polyphenol complexation have been reported to significantly reduce allergenicity. This study evaluated the impact of extensive hydrolysis of peanut protein concentrate (PPC) and subsequent interactions with polyphenol extracts on the IgE-binding of the resulting peanut protein hydrolysate (PPH). PPC was hydrolyzed with Alcalase for two hours. The resulting PPH was incubated with grape pomace extract (GPE), green tea extract (GTE), or peanut skin extract (PSE) to form PPH-polyphenol complexes. The PPH and complexes were evaluated for IgE-binding by SDS-PAGE and Western blot using pooled serum from seven peanut-allergic patients. The changes in secondary structure were determined by FTIR. The Alcalase hydrolysis resulted in degradation of most intact peanut proteins but produced some allergenic peptides resistant to further digestion. Two dominant resistant peptides were identified and their amino acid sequences were determined by a LC-MS/MS-based method. They were IgE-reactive and had molecular weights of 12.9 kDa and 20.5 kDa, respectively, corresponding to the acidic and basic units of Ara h 3. The polyphenol treated samples exhibited stronger IgE-binding than PPH, suggesting incomplete epitope masking or aggregation of peptides. Furthermore, FTIR spectroscopy revealed that GPE and GTE induced significant structural changes in the PPH, specifically a dose-dependent increase in α-helices and a concurrent decrease in β-sheets. In contrast, PSE had a minimal effect on the protein's secondary structure. Thus, further research is needed to confirm the allergenicity of polyphenol-PPH complex using animal models or clinical trials.

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Inhibition of Reducing Sugar Fructose Induced Severe Oxidative Stress by Caffeic Acid Phenethyl Ester in Pancreatic β-cells. F.I. Ghani*, B. Smith, A.H. Penn, K.N. Islam, Agriculture Research and Development Program, Central State University, Wilberforce, OH 45384.

Oxidative stress, resulting from an imbalance between pro-oxidants and antioxidants, damages cellular components and contributes to the onset and progression of diabetes and its complications. High sugar intake exacerbates oxidative stress, with metabolic syndromes linked to reducing sugars strongly associated with diabetes. Caffeic acid phenethyl ester (CAPE), a bioactive compound from honeybee propolis, possesses antioxidant, anti-inflammatory, and cytoprotective properties. This study examined whether CAPE could protect Chinese hamster pancreatic β-cells (HIT) from reducing sugar-induced oxidative damage. We observed that reducing sugar-induced oxidative stress was markedly reduced by CAPE in starved β-cells, as it was measured by thiobarbituric acid reactive substances (TBARS), a marker for oxidative stress. We also found another marker of oxidative stress; protein carbonyl formation was significantly decreased in reducing sugar-treated starved β-cells. We also observed that cotreatment of CAPE with reducing sugar antagonized the expression of antioxidant gene (GPx1 and catalase) in starved β-cells, as it was judged by qPCR analysis. In addition, CAPE was able to suppress HIF-1α/β, TNF-α, NF-κB signaling, and upregulate anti-apoptotic gene, Bcl-2, in reducing sugar-treated starved β-cells. Together, these findings indicate that CAPE protects β-cells from reducing sugar-induced oxidative stress and apoptosis, suggesting a potential therapeutic value in diabetes treatment.

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Perceptions of Functional Foods and Nutraceuticals Among Prospective Hospitality Students. I. B. Turnipseed*, R. R. Reese, R. Mangal, N. Al-Salam, K. Lerma, S. Whiteman, College of Agriculture, Virginia State University, Petersburg, VA 23806.

Understanding consumer awareness of functional foods and nutraceuticals is important to improving public health outcomes and guiding workforce preparation for hospitality professionals. This project examines familiarity, perceptions, and behavioral intentions related to these products among prospective hospitality students participating in a large recruitment and engagement event. Data were collected through a brief, voluntary, anonymous survey at the AHEAD Campus Takeover held at Howard University. Participants first tasted a sample of a functional food and then completed a five-item questionnaire assessing familiarity with terminology, conceptual understanding, taste perception, and inspiration to incorporate functional foods into daily diets. Given the very small convenience sample obtained during this initial event (n=6), this phase functioned as a pilot feasibility assessment focused on testing the event-based tasting plus micro-education workflow. Descriptive results indicated that 33% of respondents were unfamiliar with the term "nutraceutical," 17% with "functional food," 33% liked the sample, and 100% felt inspired to incorporate functional foods into their diets. Findings suggest low baseline familiarity yet favorable receptivity and motivation following exposure. A multi-site replication in early spring will strengthen precision and external validity. Results will inform recruitment messaging, curriculum updates, and experiential learning strategies within the Department of Hospitality Management at Virginia State University, while contributing to evidence-based approaches linking hospitality engagement with health promotion and workforce development.

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The One Health Landscape of Bacterial Antimicrobial Resistance in Virginia: 2007–2021. C. Kim*, E. Ndegwa**,** Agricultural Research Station, Virginia State University, Petersburg, VA 23806.

The rise of antimicrobial-resistant (AMR) bacteria is a significant global One Health concern, driven by the widespread use of antimicrobial agents in human and agricultural settings. Regional surveillance is crucial for awareness and mitigation efforts. This study examines AMR patterns in a total of 1,824 bacteria consisted of 99 *Campylobacter*, 1,485 *Escherichia coli, 121 Listeria, and 119 Salmonella* isolates collected from various sources in Virginia—including farm animals, wildlife, the environment, and food—between 2007 and 2021. Using the Kirby–Bauer disc diffusion method, susceptibility to antimicrobial agents across nine FDA-approved categories was assessed. Ampicillin resistance was most prevalent in *Campylobacter* (66.7%), while streptomycin resistance was highest in *E. coli* (39.1%). Nalidixic acid resistance was most frequently observed in *Listeria* (87.6%), and tetracycline resistance was most common in *Salmonella* (25.2%). Multidrug resistance (MDR) was identified in 50.5% of *Campylobacter*, 6.6% of *E. coli*, 30.6% of *Listeria*, and 10.9% of *Salmonella* isolates. No antimicrobial was consistently effective against all isolates from different sources. The study revealed heightened MDR and distinct AMR patterns in bacteria from food products compared to other sources. These findings underscore the need for targeted AMR mitigation strategies, promoting responsible antimicrobial use through a One Health approach.

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Integrative Metabolomics and Machine Learning Uncover Biochemical Markers for Predicting Quality Traits in Stored Blueberries. M. F. Mengist*, Agricultural Research Station, Virginia State University, Petersburg, VA 23806.

Blueberries are rich in health-promoting phytochemicals, particularly flavonoids, which contribute to their nutritional and functional value. Maintaining fruit quality during postharvest storage is critical for consumer satisfaction and marketability. Although cold storage is widely used to preserve freshness, the underlying metabolomic changes that occur during storage and their relationships to key quality traits remain poorly understood. In this study, we investigated the effects of storage duration and ploidy on both fruit quality and metabolite profiles in tetraploid and hexaploid blueberry cultivars. Samples were analyzed at harvest and after 3 and 6 weeks of storage at 4 °C. Fruit texture was strongly influenced by the interaction between genotype and storage time, indicating that postharvest texture changes are cultivar-dependent. Using widely targeted metabolomics, we detected over 1,600 metabolites across diverse biochemical classes. While minimal metabolomic alterations were observed after 3 weeks of storage, significant changes emerged by 6 weeks, including a marked decline in flavonoid levels. KEGG pathway enrichment analysis identified flavonoid biosynthesis as a key pathway responsive to storage. Multivariate modeling, including partial least squares regression and machine learning approaches, revealed that sugar content could be accurately predicted from metabolite profiles, whereas texture predictions were more variable and dependent on the modeling parameters. Several metabolites, particularly terpenoids, emerged as strong predictors of sugar-related traits. Collectively, these findings provide an integrative metabolomics framework for understanding postharvest changes in

blueberries and highlight specific biochemical markers that can be targeted to optimize fruit quality, enhance shelf life, and guide cultivar selection for storage resilience.

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Assessment of Nutritional, Bioactive Components, and Human Health Benefits of Green Leaves of *Chenopodium quinoa* Willd. M.U. Ijaz*, H. Li, M. Renfroe, J. Adu., S. Pathan, A. Dudley, Land Grant Program, College of Agriculture, Virginia State University, MT Carter Annex, Virginia State University, VA 23806.

Quinoa (*Chenopodium quinoa* Willd.) leaves are an emerging dietary source of bioactive phytochemicals with potential roles in promoting human health. Although quinoa grains are well established as a functional food, the nutritional and therapeutic properties of its green leaves remain underexplored. This study evaluated three germplasm lines i.e. Ames 13724 (U.S.), PI 614885 (Chile), and PI 665275 (Bolivia) to determine genotype-specific differences in biochemical composition, antioxidant capacity, and metabolic bioactivities. Young leaves were extracted with 80% ethanol and analyzed for total phenolics, flavonoids, and antioxidant activity (DPPH, ABTS), along with antinutritional factors such as saponins, oxalates, nitrates, and protease inhibition. Significant ($p \leq 0.05$) differences were observed among lines. PI 665275 exhibited the highest phenolic (≈42 mg GAE/g DW) and flavonoid levels, with strong ABTS radical-scavenging activity and low saponin and oxalate contents, identifying it as the antioxidant-forward line suitable for nutraceutical and cytoprotective applications. PI 614885 demonstrated the strongest trypsin and chymotrypsin inhibition, suggesting potential for digestive-enzyme modulation and glycemic control. Ames 13724 showed moderate antioxidant activity but significantly higher ($p \leq 0.05$) saponin and oxalate levels, representing a nutrient–antinutrient trade-off model relevant to palatability and processing optimization. Preliminary *in-vitro* assays revealed that ethanolic extracts from PI 665275 and Ames 13724 suppressed proliferation of Colon-26 colorectal cancer cells and demonstrated some antidiabetic activity in 3T3-L1 adipocyte models. Collectively, these findings position quinoa leaves as a novel functional food with genotype-specific bioactive signatures supporting antioxidant defense, metabolic regulation, and colorectal-cancer prevention.

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Adverse Childhood Experiences are Associated with Perceived and Actual Health Status Among Adults in Tennessee. T. Mbogori*, Department of Human Sciences, College of Agriculture, Tennessee State University, Nashville, TN 37209.

Adverse Childhood Experiences (ACEs), such as abuse, neglect, and household dysfunction, are common and have long-term consequences for both physical and mental health. Individuals with high ACE exposure (four or more) are at increased risk for chronic diseases such as obesity, diabetes, and cardiovascular diseases. Tennessee ranks among the top ten states in the U.S. for obesity prevalence, highlighting the need to explore psychosocial factors like ACEs that may contribute to this burden. This study analyzed data from 4,642 adults who participated in the 2023 Centers for Disease Control and Prevention Behavioral Risk Factor Surveillance System (BRFSS) in Tennessee. ACE exposure was measured using the validated BRFSS ACE module. Perceived health was assessed through self-rated general health, and actual health status was determined using body mass index (BMI) derived from self-reported height and weight. Almost 70% of respondents reported experiencing at least one ACE, and 23.4% reported four or more. ACE exposure was significantly associated with poorer perceived health status. Adults with no ACEs were more likely to rate their health as excellent, while those with four or more ACEs were more likely to report fair or poor health. Higher ACE exposure was also linked to an increased likelihood of being overweight and obese. These findings demonstrate a strong, graded association between ACE exposure and both perceived and actual health status among Tennessee adults. Interventions addressing early-life adversity and incorporating trauma-informed approaches may be critical in reducing obesity and chronic disease risk.

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Determination of Anti-Oxidative and Anti-Inflammatory Potential of using Adipocyte (3T3) Cells. N. Montgomery II*, R. Kaur, M. Verghese, Department of Food and Animal Sciences, Alabama A&M University, Normal, AL 35762.

Worldwide, coffee is one of the most consumed beverages due to its stimulating properties and its unique taste and aroma. In several studies, coffee has demonstrated its beneficial impact on human health as a potent antioxidant due to its polyphenolic content. Roasting conditions may alter polyphenols. The objective of this study was to evaluate two varieties of green coffee and roasted coffee bean's total phenolic content (TPC), total flavonoid content (TFC), and antioxidant assays. Trolox Equivalent Antioxidant (TEAC) Capacity, 2,2, diphenyl-1-picrylhydrazyl (DPPH), and Ferric Reducing Antioxidant Potential (FRAP) were conducted using standard protocols. Brazilian peaberry Arabica and India Robusta Cherry beans were obtained commercially. Green beans were roasted at 400 degrees for 12 minutes. Aqueous (AQ) and 80% ethanol (ET) extracts, of both, Arabica and Robusta, green coffee beans and medium roasted coffee were prepared. TPC, TFC, and antioxidant assays were conducted using standard protocols. Roasted Arabica (AQ) consistently contained higher levels of flavonoids and phenolics, with TFC reaching an average of 279.60 mg C.E./100g DW and TPC averaging 20.77 mg G.A.E./100g DW. Raw Arabica and Robusta extracts, AE and EE, inhibited the pro-inflammatory effect of H2O2 by decreasing IL-6 levels from 200.1 to 20.3 and 30.4 pg/mg total proteins, respectively. Concentration of thiobarbituric acid-reactive substances (TBARS) was significantly lower in cells treated Robusta, raw and roasted extracts, compared to H2O2 and Arabica raw and roasted. Results suggest that raw and roasted coffee exhibits antioxidant and anti-inflammatory potential.

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Abundance and Diversity of Mosquitoes in Somerset and Wicomico Counties, Maryland. M. Okulate*, K. Ramadhan, F. Taha, T. Ogbonna, D. Elnaiem, Department of Natural Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853; D. Schamberger, Maryland Department of Agriculture, Mosquito Control Office, Salisbury, MD 21801.

Mosquitoes pose a major threat to the health of humans and livestock in Maryland and other places in the US. The purpose of our study was to investigate the ecology of mosquito vectors of human and animal diseases, as a prelude to designing effective programs for their control. A field study was conducted in the summers of 2023 – 2025 to compare the abundance of different mosquito species in Somerset and Wicomico Counties, Maryland. Mosquitoes were collected by BG (Biogent) and CDC light traps operated simultaneously each week in 15 sites representing different microhabitats of the two counties. Mosquitoes captured in the traps were killed by deep freezing and identified using relevant taxonomic keys. The BG trap captured a significantly smaller number of female mosquitoes as compared to the CDC light trap. However, the heterogeneity of mosquitoes captured in the BG trap was much higher than in the CDC traps. Five genera and 29 species of mosquitoes were found in the area. The most prevalent mosquito genera in the area were *Aedes, Anopheles,* and *Culex* mosquitoes. The most abundant mosquito species in both trap types were *Ae. taeniorhychus, Ae. vexans, An. crucians*, and *Cx. Spp*. The most important mosquito captured in the study was *Aedes albopictus*, which is a major vector of several arboviruses, including Zika and dengue.

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Effects of Oviposition Media Types on Differential Attraction of Mosquitoes to Gravid Traps. D. Elnaiem*, L. Thomas, A. Khurram, D. Barri, J. Adams, M. Okulate, Department of Natural Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853; D. Schamberger, Maryland Department of Agriculture, Mosquito Control Office, Salisbury, MD 21801.

Reliable surveillance is essential for monitoring mosquito vector populations and implementing effective control measures against the diseases they transmit, particularly under shifting weather patterns that facilitate the spread of vector-borne diseases into previously non-endemic regions. Unfortunately, the sampling tools used in mosquito surveillance often vary in their efficacy for collecting different vector species. This study aimed to identify the mosquito fauna of Maryland's Lower Eastern Shore region and to compare the effectiveness of various trap types in sampling different vector species. The research was conducted in two experimental periods: July 9-August 16, 2024, and September 4-October 15, 2025. Eight trap types were evaluated: (1) BG Trap with BG Lure only, (2) BG Trap with BG Lure and CO_2, (3) BG Trap with CO_2 only, (4) BG Trap with octanol, (5) Gravid Trap with chicken manure and hay infusion, (6) CDC Light Trap with CO_2 only, (7) CDC Light Trap with light only, and (8) Dark CDC Light Trap with CO_2 only. Traps were deployed side by side at four locations in Salisbury (Wicomico County) and Princess Anne (Somerset County), Maryland, during both study periods. A large number of mosquitoes representing five genera and 22 species were collected across the different trap types. Statistical analysis revealed significant

variation in the abundance of mosquito species captured by different traps. Gravid traps and CO_2-baited traps showed the highest efficacy for sampling disease-vectoring *Culex* and *Aedes* species, respectively. Results are discussed in relation to improving mosquito vector surveillance and control strategies.

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Empowering Food Innovation, Sustainability and Entrepreneurship: The Role of Alabama A&M University's Food Product Innovation Center (FoodPIC). E. Baidoo*, J. Herring, Department of Food and Animal Sciences, Alabama A& M University, Normal, AL 35762; M. El-Dweik, J. Wells-Marshall, Alabama Cooperative and Extension Service, Alabama A& M University, Normal, AL 35762; L.T. Walker, L. Kassama, M. Verghese, Department of Food and Animal Sciences, Alabama A&M University, Normal, AL 35762.

The Food Process Innovation Center (FoodPIC**),** located at Alabama A&M University**,** was established to support small food businesses, entrepreneurs, and cottage processors. The Center promotes innovation in food product development, processing, and commercialization through access to technical expertise, laboratory resources, and pilot-scale equipment. FoodPIC features a commercial kitchen that will be open to the public upon completion of construction. This facility is designed to support culinary startups and enhance community engagement by offering dedicated space for food preparation, product testing, and scaling processes. The project began with renovating laboratory areas, installing specialized equipment, and organizing the space to support research and development. To increase outreach, a Facebook page was launched, and marketing materials, including placards and brochures, were developed to raise awareness of the Center's services. FoodPIC participated in the inaugural North Alabama Food Expo, building connections with local stakeholders. In partnership with the Alabama Cooperative Extension System (ACES), the team also developed a podcast series to promote the Center's mission and capabilities. During its first year, FoodPIC collaborated with 35 food establishments/partners. Services provided included product testing**,** nutritional analysis, shelf-life determination, and quality assessment for a variety of foods such as candy, confectionaries, sauces, dried products, beverages, muffins, and juices. The Center also assisted clients in creating nutrition labels for regulatory compliance. Through these initiatives, FoodPIC has positioned itself as a vital resource for food innovation and entrepreneurship in the region.

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Soil vs. Soilless Production: Impacts on Microbiomes and Phytonutrient Profiles of Outredgeous Lettuce (*Lactuca sativa*). S. Parveen*, A. Punchihewage Don, B. Min, F. Hashem, Department of Agriculture, Food, and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853; P. Millner, U.S. Department of Agriculture–ARS-Environmental Microbial and Food Safety Laboratory, Beltsville, MD 20705; C. Grim, U.S. Food and Drug Administration, College Park, MD 20742; J. Lee, A. Hossain, School of Engineering and Applied Sciences, University of the District of Columbia, Washington, DC 20008; J. Izursa, Department of Environmental Science and Technology, University of Maryland, College Park, MD 20742; N. Hasan, Arius Bioscience, Onley, MD 20830.

Soilless lettuce production in hydroponic and aquaponic controlled environment systems is expanding, although open-field production still dominates. The microbiome and phytonutrient profiles of produce in these alternative systems remain largely uncharacterized. The objectives of this study were to address this data gap. 'Outredgeous' lettuce was grown in three systems: hydroponics, organically-managed field soil, and aquaponics in a controlled-environment greenhouse. Aquaponic biofilter scavengers aided nutrient balance. Physico-chemical parameters and plant growth were recorded weekly. Aerobic Plate Counts (APC) ranged from log 2.32-8.26 CFU/g/mL in all systems, but greater levels occurred in soilless systems (log 8.26 g/ml) compared to soil-based systems (log 7.40 CFU/g). Root APCs were greater than (log 8.26 CFU/g) those in soil (log 7.40 CFU/g) or on leaves (log 3.05 CFU/g). Microbiomes were characterized using 16S rRNA sequencing. Phytonutrient profiles (phenolic acids, anthocyanins, flavonoids) of lettuce obtained at harvest were analyzed using standard methods. The soil supported the greatest microbial richness across all taxonomic levels compared to aquaponic/hydroponic systems. Soil microbiomes had a higher relative abundance of human foodborne pathogenic bacteria belonging to Enterobacteriaceae, Clostridiaceae, and Listeriaceae compared to aquaponic/hydroponic systems. Principal Coordinate Analysis revealed distinct clustering of microbial communities by production system, highlighting significant differences in community structures. The different types of biofilter scavengers had no effect on plant growth, physico-chemical parameters, or microbes. Phytonutrient contents were significantly greater ($p<0.05$) in

soilless systems than in soil-based systems. The results of this study provide unique comparative microbiomes from soilless and soil-based systems useful for food safety and quality evaluation.

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Assessment of the Nutritional Benefits of Underutilized Purslane (*Portulaca oleracea* L.) for the Development of Value-added Products. M.L. Reid-Fitten*, C.P. Cotton, B.R. Min, C.I. Nindo, Department of Agriculture, Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853.

Purslane (*Portulaca oleracea* L.), often referred to as a "power food" of the future, is rich in flavonoids, vitamins, minerals, and other nutraceutical compounds, enhancing both its nutritional and medicinal value. Despite its potential, purslane remains underutilized due to its extreme perishability and seasonal availability. This study evaluated the effects of thermal processing methods on the nutritional quality of purslane dried value-added products. Treatments included steam and hot water blanching, and a control (fresh), each followed by freeze drying, hot air drying, and infrared drying methods. Field-grown purslane was harvested twice per week and processed three times throughout the growing season. Methanolic extracts from each treatment were analyzed for moisture content, water activity, phytonutrients, ascorbic acid, β-carotene, and antioxidant activities. Results indicated that the infrared-dried control treatment exhibited significantly higher moisture content compared to the other treatments, while water activity did not differ significantly among treatments. Significant variations were observed among treatments and harvest times for total phenolic and flavonoid contents, as well as antioxidant properties, including 1,1-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging capacity and oxygen radical absorbance capacity (ORAC). The results varied depending on the treatment and the harvest time, with the majority of the treatments showing significantly higher levels in the second (56 DAT) and third (84 DAT) harvest. Notable differences in vitamin C content were observed across all treatments. No significant differences were observed in total β-carotene and total carotene. These findings highlight purslane's potential as a sustainable, nutrient-dense crop suitable for development into functional, shelf-stable food products**.**

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Computational Characterization of HIV-1 Envelope Dynamicomes Across Rare Subtypes. D. F. Indihar*, Department of Biological Sciences, Alabama A&M University, Normal, AL 35762; C. O. Barnes, Stanford Medicine, Stanford University, Stanford, CA 94305.

Human immunodeficiency virus type 1 (HIV-1) is classified into ten subtypes, which are distinct genetic lineages of the virus. Although five of these subtypes each account for less than 1% of global infections, they play critical roles in the evolution, recombination, and persistence of the virus worldwide. HIV-1 transmission is mediated by the viral envelope (Env) protein, which binds to host cell CD4 and a co-receptor to facilitate viral entry into target immune cells. Previous studies have demonstrated that the efficiency of viral entry can vary between subtypes, likely due to structural differences in Env. It has been hypothesized that these subtype-specific variations influence transmission efficiency and the establishment of clinical infection. However, the Env protein structures for the rare subtypes have not been solved, leaving a significant gap in our understanding of subtype-specific Env-mediated entry mechanisms. The goal of this project was to characterize the dynamicomes (the structure, function, and evolution) of Env proteins from the rare HIV-1 subtypes. Using publicly available genomic datasets and informatic tools, we generated hypothetical protein structures, analyzed structural homologies, reconstructed phylogenetic relationships, and modeled atomic-level dynamics over time. This comprehensive computational analysis revealed patterns of structural conservation and divergence that provide insight into the molecular determinants of viral entry across subtypes. By elucidating these subtype-specific features, this work advances our understanding of HIV-1 Env-mediated entry and lays the foundation for future experimental studies aimed at informing viral entry and evolutionary mechanisms.

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Free-and Bound-Form Terpenes in Sweet Potato Peel and Their Antifungal Activity Against *Aspergillus flavus*-Induced Tomato Spoilage. G. Rodriguez*, Southern University Agricultural Research and Extension Center, Baton Rouge, LA 70813; M. Thapaliya, D. Bui, School of Nutrition and Food Science, Louisiana State University, Baton Rouge, LA 70803; F. Malekian, Southern University Agricultural Research and Extension Center, Baton Rouge, LA 70813; A. Adhikari, Z. Xu, School of Nutrition and Food Science, Louisiana State University, Baton Rouge, LA 70803.

Natural preservatives are gaining attention as chemical-free solutions to extend produce shelf life and prevent microbial spoilage. Therefore, sweet potato peel (SPP) was investigated as a source of antifungal bioactive compounds in this study. We evaluated essential oils and, for the first time, a bound terpene (BT) concentrate extracted from SPP against *Aspergillus flavus*, using both in vitro and in vivo assays. Murasaki organic Japanese sweet potato (*Ipomoea batatas* L.) peels, *A. flavus* AF13, a highly aflatoxigenic fungus, and Creole tomato (*Solanum lycopersicum*) fruits were used in the study. Essential oils were extracted by hydrodistillation (HD) and vacuum distillation (VD), while the BT fraction was isolated and concentrated. HD and VD yielded 19 and 10 terpenes, respectively, with linalool and α-terpineol dominating and representing more than 50% of total terpenes in both distillates. The BT concentrate demonstrated significant inhibition of *A. flavus* growth at concentrations starting from 12.5 µL/mL. The strongest effect was observed at 100 µL/mL, with a inhibition zone and growth reduction. In contrast, HD and VD distillates showed no antifungal activity in either in vitro or in vivo assays. Consistently, the BT concentrate-treated tomatoes reduced fungal growth and spoilage, with lesion diameters less than 10 mm after 7 days of storage, while the HD and VD distillate treatments had diameters over 20 mm, and the untreated control had diameters over 60 mm. These findings highlight that SPP waste could be an economical and bio-based source for developing natural antifungal ingredients. The success is anticipated to offer a potential alternative to current synthetic fungicides in preventing fungi *A. flavus*-induced spoilage of nightshade vegetables.

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Food Scaping as a Tool for Regenerative Agriculture. D. Stoddart*, R. Griffin, L. Carson, R. Richardson, A. Gilliam**,** College of Agriculture, Food and Natural Resources, Department of Agriculture, Nutrition and Human Ecology, Prairie View A&M University, TX 77446.

Regenerative agriculture focuses on restoring soil health, biodiversity, and ecosystem resilience while ensuring sustainable food production. Food-scaping is a practice that integrates edible plants into ornamental landscaping. This has the potential to support regenerative agricultural principles by enhancing soil fertility, promoting biodiversity, and reducing environmental footprints. This study examines the effectiveness of food scaping as a regenerative agricultural strategy by evaluating its impact on soil health, biodiversity, economic feasibility, and community engagement. Using a mixed-methods approach, including field experiments, surveys, and economic analysis, this research aims to provide empirical data supporting food scaping as a viable tool for sustainable land management. The findings will contribute to the growing body of knowledge on regenerative agriculture and offer practical insights for farmers, urban planners, and policymakers.

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Developing a Micro-credentialing Nutrition Education Program for Small Restaurant Staff. K. Heckstall*, J. Robinson, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Small, independently owned restaurants play a critical role in community health, yet their staff often have limited access to professional development opportunities in nutrition and wellness. While food safety training programs such as ServSafe are widely adopted, no parallel credential exists to equip chefs, cooks and front-of-house staff with practical nutrition knowledge relevant to their daily work. To address this gap, we propose the development of an online micro-credentialing nutrition education program tailored specifically for staff in small restaurant businesses. This initiative aims to strengthen staff capacity to meet customer dietary needs, support healthier menu development, and enhance the professional credibility of small restaurants business. This presentation outlines the initial process of developing an online micro-credentialing nutrition education program by exploring needs assessment and stakeholder input from small restaurant owners and staff via surveys and interviews. By sharing the developmental pathway from initial concept through design, this session provides a roadmap for creating innovative, scalable training solutions that enhance workforce skills, support small business growth, and contribute to community health outcomes.

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Multifactorial Determinants and Integrated Management of Pediatric Obesity. M. Ravola*, Department of Human Sciences, Alcorn State University, Lorman, MS 39096; B. George, School of Business, Alcorn State University, Lorman, MS 39096.

Pediatric obesity is an escalating global health challenge, shaped by the dynamic interplay of biological, behavioral, environmental, and societal determinants. Children's obesity risk is significantly influenced by nutritional habits, which are shaped by individual choices, family dynamics, and pervasive food marketing strategies. Economic disparities further contribute to the complexity, as limited access to nutritious, affordable foods acts as a major barrier for healthy eating in populations. Family lifestyle factors—including irregular mealtimes, low physical activity, and frequent intake of energy-dense, processed foods—heighten susceptibility and persistence of obesity. Addressing pediatric obesity effectively requires an integrated, multidisciplinary approach. Nutrition counseling and educational initiatives empower children and caregivers, fostering informed dietary choices. Policy-driven regulation of unhealthy food marketing can mitigate environmental triggers for unhealthy eating. Expanding access to affordable, nutritious food in schools, communities, and households is vital to overcome accessibility barriers. Comprehensive behavioral and family interventions focusing on active living, consistent routines, and parental engagement lay the groundwork for sustainable habit change. This presentation highlights the necessity of addressing nutritional patterns, marketing exposure, food accessibility, and family behavior in tandem. Such coordinated, holistic strategies are fundamental to strengthening prevention and intervention programs, reshaping family and community environments, enhancing health literacy, and supporting lifelong well-being among children and adolescents. Empowering families through education, effective policies, and tailored interventions offers promise for reversing current pediatric obesity trends and promoting healthier futures.

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Towards an Emerging Public Health Paradigm: Agriculture and Food Production for Health. R. Wallace*, Foundation for Innovation in Healthy Food, Wilmington, DE 19806; G. Ozbay; Delaware State University, DE 19901; A. Parsaeimehr, South Dakota State University, Department of Biology and Microbiology, Brookings, SD 57007; P.S. Baenziger, University of Nebraska, Lincoln, NE 68583.

An emerging paradigm in public health focuses on enhancing nutrition in existing food staples to reduce chronic disease at population scale, rather than relying on individuals to change behavior. This paradigm leverages commodity breeding, production practices, and processing to enhance nutrition, whereby foods consumed by millions can be improved at low incremental cost. This perspective supports and expands this paradigm, illustrating the potential to improve diets by describing opportunities to increase the arabinoxylan fiber content of commodity wheat through classical plant breeding (a non-GMO technology). The approach described in this perspective links agricultural and food science with health-system implementation to deliver equitable access, healthcare cost savings, and improved community health. Based on published dose–response relationships, comparative-risk modeling indicates that modest fiber increases achieved by the commodity wheat breeding lead to reduced population-level risk reductions of 1-3% for cardiovascular disease, 3-4.5% for type 2 diabetes, and 1-3.5% for colorectal cancer. The perspective concludes by outlining actionable steps for evaluation and adoption of this paradigm at population scale.

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Designing Dairy Free Yogurt Analogs with Improved Health Benefits and Gastrointestinal (GI) survivability. A. Sarker, H. Kazemeini*, Agricultural and Environmental Research Station, West Virginia State University, Institute, WV 25112.

Coconut yogurt analogs were prepared as alternatives to dairy yogurts. Optimized coconut milk yogurt alternatives (CNM) were supplemented with ginger (*Zingiber officinale*) powder (GP, ginger harvested at week 30) to improve gastrointestinal health and mitigate obesity. Studies were carried out to optimize GP content in ginger supplemented yogurt analog (CNMG) for desirable physicochemical and probiotic properties as compared to CNM and traditional cow milk yogurt (CM). 0.5% GP was selected for CNMG preparation. The alternative yogurts, CNM and CNMG possessed significantly ($P < 0.05$) reduced textural properties such as firmness, stiffness, thickness and stickiness than those of CM. However, the probiotic viabilities of alternative yogurts and traditional yogurt were not significantly ($P > 0.05$) different as reflected to the non-significant ($P > 0.05$) pH difference at the end of the 21 days of storage period. Moreover, CNM and CNMG exhibited reduced ($P < 0.05$) whey syneresis (%) throughout the storage as compared to

the traditional one. Simulated gastrointestinal (GI) test with alternative yogurts further demonstrated the survivability (%) of probiotics under GI stress. This study will be extended to fortifying CNM with baby ginger powder (BGP, harvested at week 15) to be served as a "proof-of-concept" to our previous studies revealing BGP's remarkable anti-obesity effect in vitro. Similar to traditional yogurt, plant-based yogurt alternatives will be beneficial for maintaining a healthy gut microbiome. Owing to the presence of medium-chain fatty acids (MCFAs), coconut milk has been linked to supporting the growth of beneficial gut microbiota and therefore, helping mitigate obesity.

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Physical and Biochemical Modulation of Buckwheat Protein Matrix for Improved Film Properties. V.A.N. Nicholas-Okpara*, Agricultural and Environmental Research Station, West Virginia State University Institute, WV 25112; I. Israelsen, K. Matak, J. Jaczynski, Division of Animal and Nutritional Science, West Virginia University, Morgantown, WV 26506; A. Sarker, Agricultural and Environmental Research Station, West Virginia State University Institute, WV 25112.

Buckwheat protein (BWP) based films were treated with heat, rutin, and transglutaminase (TGase). This study investigated the effects of the treatments on the functional and microstructural properties of BWP cast films. Isoelectric precipitated BWP was used for the film production and conditioned using 50% relative humidity (RH) at 25°C. Standard methods were used for evaluating water vapor permeability (WVP), mechanical, microstructural, physical and physiochemical properties. Formation of hydrophobic barriers through matrix reorganization, enzymatic crosslinking and protein-phenolic interactions were indication of reduced WVP by 1.09% - 43.92% and increased tensile strength (TS) ($P<0.05$) in the treated films. The heated group showed the strongest effect in TS (57.88% increase, 7.23 MPa). The treated films' lightness and yellowness were improved, while thermal treatment notably reduced opacity. The 1% TGase showed the highest time-dependent uptake in moisture sorption. The rutin and TGase BWP films' antioxidant potentials were enhanced by increase of 9.17% - 15.34% trolox antioxidant equivalents. At higher concentration of TGase, the ninhydrin assay indicated reduced crosslinking suggesting saturation but optimal at 1% TGase. The structural integrity and compactness of the heated, rutin, and TGase-treated BWP treated films were progressively improved. The 2% rutin and 1% TGase films showed the most cohesive and homogeneous matrices correlating with reduced WVP and enhanced TS. FTIR analysis revealed that heat, rutin, and TGase treatments altered hydrogen bonding and protein conformation, enhancing molecular stability and improving the biofunctional, mechanical and barrier properties of BWP films for sustainable food products packaging use.

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Hyperspectral - Artificial Intelligence (AI) Pipeline to Predict Yogurt Quality Attributes Made from Different Milk Sources. A. Sarker*, Agricultural and Environmental Research Station, West Virginia State University, Institute, WV 25112; K.V.R Jammuladinne, A. Maiti, Department of Mathematics, Engineering and Computer Science, West Virginia State University, Institute, WV 25314.

This study presents an automated pipeline for predicting yogurt properties from hyperspectral images. The dataset includes over 60 samples from cow milk and coconut milk yogurt. Samples were imaged using a visible near-infrared hyperspectral imaging (VNIR-HSI) camera, Specim IQ, with a 400–1000 nm spectral range. The images contained background artifacts, uneven lighting, and surface reflections. These factors often introduce noise, and developing a pipeline that provides reasonable prediction accuracy is a challenging task. Furthermore, the properties of hyperspectral images vary depending on the source of milk used in the yogurt. In this study, an automated pipeline was developed for predicting quality attributes including pH, titratable acidity, viscosity, and color. The pipeline used a stepwise segmentation method to select the yogurt region which was then divided into fixed-size spectral patches. Each patch contained pixels from only the yogurt region. A convolutional neural network (CNN) was designed and trained using the patches along with temporal information. The CNN includes a shared encoder and separate prediction heads for the two different milk sources. The evaluation showed high test-set R^2 values (above 0.85) for pH and color attributes (L*, a*, b*), and moderate values for titratable acidity (0.43) and viscosity (0.68). Overall, non-invasive hyperspectral imaging provides reliable prediction for key quality attributes, especially when combined with temporal information. Results show consistent prediction accuracy, even under significant noise. The pipeline handles spectral and spatial variation across samples without requiring manual preprocessing. It provides a reliable method for yogurt quality prediction from raw hyperspectral data.

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Not So Hidden Hunger: Understanding Food Insecurity Among Students at Prairie View A&M University. B., Copeland*, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Food insecurity continues to be a major global and national issue, affecting millions of individuals each year. In the United States, college students represent a particularly vulnerable population due to rising costs of attendance and limited financial resources. Students attending Historically Black Colleges and Universities (HBCUs) face additional barriers that increase their risk of food insecurity. This study examines the prevalence and impact of food insecurity among students at Prairie View A&M University. The objective was to document the scope of food insecurity, assess its influence on student well-being and academic outcomes, and identify key contributing factors within this population. A cross-sectional descriptive survey was distributed electronically to the entire student body, with 1,658 respondents. Regression analysis was used to examine the relationship between food insecurity and different variables. In general, results indicated that a substantial portion of students experienced food insecurity, which was linked to challenges in housing and utility affordability, mental health, and access to academic resources. Students reporting greater financial and emotional strain were more likely to experience food insecurity, and academic performance appeared to be negatively affected. Findings underscore the persistent and complex nature of food insecurity within HBCU settings. Addressing these disparities requires coordinated institutional efforts to improve access to basic needs, enhance academic support systems, and expand mental health and financial resources for students.

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Qualitative Analysis of Challenges to Food Access in Rural Texas. Y.O. Olawuyi*, J.J. Quinlan, Food Security Research Center, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Rural regions of Texas continue to face persistent barriers to healthy food access, where structural and geographic constraints limit the availability of nutritious options. Understanding these challenges from both retailer and consumer perspectives will be critical to informing interventions that improve nutrition equity and strengthen local food systems. This study aims to qualitatively analyze the barriers and facilitators to food access in rural Texas by examining the operational realities of small food retailers and the lived experiences of rural consumers. A mixed-method, cross-sectional design will be used to integrate qualitative interviews with small food retailer owners/managers (n=30) and quantitative surveys with rural residents (n=500–750). Rural counties will be selected using the USDA Food Access Research Atlas to capture variation in local retail environments. Retailers will be purposively sampled across store types (corner stores, gas marts, dollar stores), while consumers will be recruited through community channels and online platforms. Interview data, guided by the Retail Food Environment framework, will explore themes related to supply chains, perishability, healthy food demand, and Supplemental Nutrition Assistance Program (SNAP) participation. Consumer surveys will incorporate validated measures of food security (USDA 6-item), perceived access (NEMS-P), purchasing patterns, and dietary behaviors. Data collection will begin in November 2025. Findings will provide contextualized insights into how structural, economic, and social factors shape rural food access, informing future policy and community-based strategies to enhance nutrition security in Texas communities.

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Investigation of Polycyclic Aromatic Hydrocarbons (PAHs) in Agricultural Soil in South Carolina. C. Thomas*, T. Reed, W. Webb, 1890 Research and Extension, South Carolina State University, Orangeburg, SC 29117.

Polycyclic aromatic hydrocarbons (PAHs) are toxic, persistent environmental pollutants of concern due to their carcinogenic and mutagenic properties. The U.S. Environmental Protection Agency (EPA) has designated 16 PAHs as priority pollutants based on their persistence, toxicity, and potential for human exposure. Agriculture is one of South Carolina's leading industries, making soil quality and contamination monitoring vital to environmental and public health. This study evaluates agricultural soils collected 25 years apart to assess temporal changes in PAH contamination across multiple land regions of South Carolina. Over this period, PAH contamination remained relatively consistent, with low percent changes observed, reflecting their long-term persistence in the environment. Soil samples were analyzed for texture, type, and total organic carbon (TOC) content to evaluate their influence on

PAH accumulation. Analytical techniques included Gas Chromatography Mass Spectrometry (GCMS) for quantification and fluorescence microscopy for complementary detection and characterization of PAHs. Results showed variation in PAH contamination by crop, soil texture, and region. Corn, grown in sandy soil, exhibited low TOC (4.8%) content and a smaller PAH change over the 25-year period (6%), suggesting limited organic matter retention and contaminant binding. In contrast, okra, cultivated in silty soil, displayed higher TOC (17.3%) content and a greater PAH change (8%), indicating enhanced carbon accumulation and pollutant retention in finer-textured soils. These finding demonstrate that soil texture and organic carbon content modulate long-term PAH dynamics and provide valuable data to inform soil management and remediation strategies aimed at reducing PAH persistence and preventing their entry into the food chain.

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A Comparative Analysis of Phytochemicals, Antioxidants and Antibacterial Activities of Sweet Potato Varieties Grown in South Carolina. N. Mohammed*, J.B. Stukes, G. Wright, 1890 Research and Extension, and The Department of Biological and Physical Sciences, South Carolina State University, Orangeburg, SC 29117.

Sweet potato (*Ipomoea batatas*) is a dicotyledonous plant that belongs to the family *Convolvulaceae* which has higher contents of phytochemicals, carbohydrates, various vitamins, and minerals. It is main South Carolina vegetable with 2,000 acres harvested annually and has been rediscovered as a functional food containing high levels of flavonoids, phenolics, and anthocyanins which might have various health beneficial effects on incidences of prevention of cancers and chronic diseases, including cardiovascular disease, type II diabetes, and impaired cognitive function. There has been an increasing demand for novel antimicrobial agents sourced from nature for preservation of food, and these antimicrobial agents with potential benefits over synthetic antimicrobials are said to inhibit the growth of other microorganisms. This study was therefore conducted to screen the phytochemical composition and antimicrobial activity of South Carolina varieties of sweet potato on selected foodborne pathogens. Furthermore, the antioxidant properties were examined to establish which variety of sweet potatoes exhibited the highest level. Information about sweet potato quality will be shared with the farmers and concerns about whether sweet potatoes are good or not for health will be shared with the consumer. Moreover, a better understanding of treatment methods to inhibit foodborne pathogens by phenolic compounds could lead to establishing a protocol for food safety that does not involve the use of antibiotics. Among the four varieties of sweet potato cultivars (Purple, Burgundy, Beaureguard and Porto Rico) grown in South Carolina were tested, purple sweet potato showed highest antioxidant, polyphenol and antibacterial activities.

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A Novel MXene-Based Two-Dimensional VOC-Sensing Membrane for Rapid Detection of Foodborne Pathogens. Q. Yang*, S. Mahdi, X. Jones, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101; M. Esmaeelpour, B. Zhang, Department of Electrical Engineering, Missouri University of Science and Technology, Rolla, MO 65409; V. Mochalin, Department of Chemistry, Missouri University of Science and Technology, Rolla, MO 65409.

The growing demand for high-nutrient and preservative-free foods has heightened the risk of foodborne pathogen outbreaks. Conventional microbial and PCR-based detection methods are time-consuming and unsuitable for real-time monitoring, especially when pathogens exist in the viable but non-culturable (VBNC) state. This project develops a rapid on-site detection platform by integrating two-dimensional MXene membrane materials for enhanced sensing of volatile organic compounds (VOCs) secreted by foodborne pathogens. Through VOC profiling, the system mimics mammalian olfaction to achieve high-sensitivity and high-precision identification of spoilage markers in complex food matrices. Complementary UHPLC-MS/MS and GC-MS/MS analyses provide validation and feedback to refine detection accuracy. Upon optimization, the MXene-based sensing membrane will be coupled with time-stretched spectroscopy, offering superior spectral resolution and acquisition speed. The resulting portable, cost-effective, and intelligent sensing tool will support real-time food safety monitoring and improve the efficiency and sustainability of agricultural production and processing systems. Additional experimental progress and results will be reported at the ARD Annual Meeting.

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Effect of Overstory Density and Herbicide on Growth and Survival of Planted Shortleaf Pine (*Pinus echinata*): First Growing Season Results. S. Hossain*, K. Naka, W. Briggs, Department of Natural Resources and Environmental Sciences, Alabama A&M University, Normal, AL 35762.

Shortleaf pine (*Pinus echinata*), an iconic southern pine species, has undergone a significant population decline throughout its natural range over the last half-century. This decline has threatened the species' long-term viability, leading to the loss of local biodiversity associated with shortleaf pine ecosystems. We examined the effect of overstory density and herbicide on the growth and survival of shortleaf pine seedlings planted in a north Alabama site. Overstory densities represented three basal area classes: 0 (open), 50-100 (partial), and >100 (closed) $ft^2\ ac^{-1}$. Before planting, herbicides (e.g., triclopyr-garlon 4) diluted by diesel were applied to competing hardwood vegetation in a split-plot design, where one split-plot received treatment while the other was untreated. In the first growing season after planting, the herbicide appeared to have a positive effect on root collar diameter and seedling height under all overstory densities. While seedling survival was 97%, 80%, and 78% in the open, partial, and closed overstory, respectively, plots that received herbicide had higher survivorship than those that were not treated with herbicide. This study provides valuable insights into shortleaf pine restoration, offering guidance for silvicultural techniques, such as herbicide application and thinning, to enhance its growth and survival.

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Urban Expansion and the Erosion of Natural Resilience: Assessing Disaster Risk and Agricultural Losses in U.S. Peri-Urban Counties. H. Grover*, Department of Community and Regional Planning, Alabama A&M University, Normal, AL 35762.

This research investigates how the conversion of natural resource areas in peri-urban counties near metropolitan regions influences disaster vulnerability and ecological impacts. Drawing on data from the Spatial Hazard Events and Losses Database for the United States (SHELDUS) at Arizona State University, the study examines how urban expansion erodes natural resilience by reducing forests, wetlands, cropland, and grasslands that traditionally mitigate hazard impacts. This loss heightens disaster risk—particularly from floods and wildfires—by diminishing ecological buffers and increasing exposure. Statistical analyses compare peri-urban counties with varying degrees of natural resource depletion to assess relationships between urban expansion, hazard impacts, and agricultural losses. Findings indicate that counties experiencing greater erosion of natural resilience face disproportionately greater hazard exposure, and higher disaster-driven crop losses, underscoring the consequences of unsustainable urban expansion into natural resource rich regions. The research highlights the need for ensuring that urban expansion policies preserve critical natural assets to support ecological sustainability. By analyzing ecological consequences through the lens of urban expansion and the erosion of natural resilience, this work informs strategies to enhance resilience and protect agricultural economies in high-pressure peri-urban zones.

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Analysis of Urban Heat Island Effects: A Case Study from Three Major Cities of Alabama, USA Using Remotely Sensed Data. S. Chatterjee*, R. Kulawardhana, M. Lotsah, R. Rathnayake, Department of Natural Resources and Environmental Sciences, Alabama A&M University, Normal, AL 35762.

The Urban heat island (UHI) effects and their consequences on the urban environments, society, and economies continue to grow as anthropogenic activities intensify, while urban populations continue to grow. Using Moderate Resolution Imaging Spectroradiometer's (MODIS) MOD11A2 land surface temperature (LST) and land-use/ land-cover (LULC) products from National Land Cover Database (NLCD), this research investigated UHI developments and their temporal dynamics over the past two decades (2000 – 2024) focusing three major cities of the state, namely Huntsville, Birmingham, and Mobile. The highest rate of urban expansion over the two decades observed for the Madison and Limestone Counties that host Huntsville City area with 7.5% of the land area mapped as newly developed areas, followed by Jefferson and Mobile counties. Maximum UHI intensities were highest over the Jefferson County area and can be attributed to the highly intensified urban developments characterized by nearly 1/3rd of the land extent (30%) occupied by developed LULCs. UHI intensities over the Mobile County remained relatively lower which can be attributed to its location in the coastal region. Average temperatures over the urbanized areas were consistently higher than that of non-developed areas during summer day-and night-times across all study areas and among all years within the study period indicating impacts of developed areas on UHI developments. These findings indicate MODIS

LST products as capable of mapping and quantifying UHI effects at local to regional scale studies and are capable as surrogates for field measurements.

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Greenhouse and Field Evaluations of Microbial Extracellular Polymeric Substances to Enhance Agricultural Production. J. Metuge*. Z. Senwo**,** Department of Natural Resources and Environmental Sciences, Alabama A&M University, Normal, AL 35762.

Extracellular polymeric substances (EPS) produced by microorganisms have been shown to improve soil physical properties and are applied in soil erosion control. Because of their ability to enhance plant nutrient uptake, it was hypothesized that they could be a valuable natural resource to boost agricultural productivity. In both greenhouse and field studies, we examined the effects of *Rhizobium tropici*-derived EPS on various soil properties, as well as the growth and yield of black-eyed peas (BEPs) (*Vigna unguiculata*) in monoculture and sweet corn in a crop rotation experiment. Results showed that adding *R. tropici* EPS to soils significantly increased basal soil respiration, CO_2 flux, microbial biomass, active carbon, available phosphorus, total soil nitrogen, and potentially mineralizable nitrogen (PMN) compared to the non-amended soils. Soil microbial populations initially shifted towards Gram-negative bacteria in the early stages of application and BEP growth, then shifted towards Gram-positive bacteria in the amended soils. The microbial EPS notably improved root nodulation, plant biomass, and seed yield of BEPs. Additionally, the total seed yield and quality of sweet corn grown on EPS-amended plots previously planted with BEPs increased significantly. This study provides information on the short-term response patterns of soil properties and the growth of BEPs and sweet corn after fortifications with microbial EPS.

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Assessment of Urban Heat Islands (UHIs) using Remote Sensing. R. Kulawardhana*, S. Chatterjee, M. Lotsah, R. Rathnayaka Department of Natural Resources and Environmental Sciences, Alabama A&M University, Normal, AL 35762.

Urban Heat Island (UHI) effects are known to alter micro-climates of urban areas increasingly threatening operation and habitability of rapidly developing cities. Development of UHIs and their impacts are known to be highly localized and variable over time with intensified effects during extreme weather events and or seasons. Using remotely sensed data and spatial analyses, this study evaluated spatial patterns and trends in UHI developments over 3 major cities of Alabama, USA: Huntsville, Birmingham and Mobile. Spatial expansion of developed areas and magnitude and trends of UHI developments were mapped and quantified using LULC data from National Land Cover Database (NLCD) and MODIS derived LST products, respectively. Our findings reveal continuation of urban expansion over all three study areas but at varying rates and patterns. Isodata clustering approach using time series of MODIS derived LSTs were able to map UHIs as distinguished clusters of significantly ($p=0.01$) warmer surface temperatures as compared to their surroundings. The magnitudes of UHI intensities were significantly different ($p=0.05$) among the three study areas, and during both seasons (summer and winter). Interestingly, spatial distributions of the UHI clusters closely resembled spatial distributions of developed areas mapped using NLCD data. Our findings indicate the potential of satellite derived LST estimates to spatially map and quantify UHI effects in terms of surface warming. These findings also provide detailed insights into understanding impacts of urban developments on alterations of urban microclimates and can help in future urban planning efforts for mitigating UHI effects.

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How to increase the production of ethanol by *Saccharomyces cerevisiae*. M. Piva*, Department of Biological Sciences, Alcorn State University,Lorman, MS 39096; I. Mayo, Department of Biological Sciences, Alcorn State University,Lorman, MS 39096; J. Chambers, Department of Biological Sciences, Alcorn State University,Lorman, MS 39096; and J.I. Moreno, Department of Biological Sciences, Alcorn State University, Lorman, MS 39096.

Gas emissions from burning fossil fuels have caused a significant risein global temperatures over recent decades, increasing the risk of heatwaves and wildfires. Ethanol is a sustainable biofuel that can help slow the planet's rapid warming because it producesfewer gases than fossil fuels. It is also a renewable resource derived from plant-based fermentation substrates. However, opposition persists because diverting agricultural resources toward biofuel

production could threaten food supplies. One potential solution to this complex issue is to increase ethanol production yield by removing the source of oxidative radicals in thefermentative microbe. We tested this idea by comparing the rate of carbon dioxide production between *CCM1* deletion mutants, which lack mitochondrial function, and their wild-type counterparts at the start of fermentation, before ethanol accumulates to toxic levels. These *S.cerevisiae* mutants overexpress two key fermentation genes, *TDH3* and *ADH1*, and have an NADH/NAD^+ imbalance that favors NADH, creating a more reduced cytoplasmic environment that stimulates ethanol production. As a result, these mutants nearly double their fermentation rate per cell compared to wild-type strains. Thus, altering a genetic trait that decreases oxidationenhances the production of a product enriched in reduction equivalents— a characteristic of all fuels. This work was supported by the Mississippi INBRE, funded by an Institutional Development Award from the National Institute of General Medical Sciences of the National Institutes of Health, grant number P20GM103476, and by the US Department of Education, TitleIII, grant number P382G230011.

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Evaluating Drought Stress Impacts and Supplemental Irrigation Potential for Rainfed Maize and Soybean Systems in Ohio Using Machine Learning. R. Dhillon*, Agricultural Research Development Program, Central State University, Wilberforce, OH 45384; S. Das, Department of Agricultural & Biological Engineering, University of Florida, Gainesville, FL 32611; V.S. Shedekar, Department of Food, Agricultural and Biological Engineering, The Ohio State University, Columbus, OH 43210; and V. Sharma, Department of Agricultural & Biological Engineering, University of Florida, Gainesville, FL 32611.

This study evaluates how monthly precipitation, temperature, soil water deficit (SWD), and supplemental irrigation influence the spatio-temporal variability of county-level maize and soybean yields across Ohio. A soil water balance approach was combined with machine learning to identify key climatic and hydrological variables affecting yield response to irrigation. The Random Forest model performed best, with an RMSE of 0.60 Mt/ha and R^2 of 0.77 for maize, and an RMSE of 0.21 Mt/ha and R^2 of 0.64 for soybean yields. Maize yields were most influenced by July SWD, September maximum temperature, and August precipitation, while soybean yields were primarily affected by May and August precipitation. Supplemental irrigation of 50.8 mm/month during summer improved maize yields more than soybean yields, producing an average maize increase of 598 kg/ha (~0.6 Mt/ha) relative to rainfed conditions. Inter-annual yield variability decreased significantly for both crops under all irrigation treatments, but irrigation beyond 50.8 mm/month did not produce additional gains. Yield improvements varied by year, with greater benefits in dry years—especially for maize—and in years with cooler September temperatures. Spatially, Southwest Ohio showed the highest average maize yield gain from 1991–2022, with increases up to 22.6% (1224 kg/ha, ~1.2 Mt/ha). For soybeans, yield increases reached up to 9.2% (207.5 kg/ha, ~0.21 Mt/ha), with counties showing higher yield responses distributed across multiple regions of Ohio. Overall, the results demonstrate that moderate supplemental irrigation can enhance yields and reduce variability, particularly for maize and in drier growing seasons.

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HydroThrive: A Web Application for Sustainable Water Management in a Drought-Prone Region. R. Kandiah*, Department of Engineering and Technology, Central State University, Wilberforce, OH 45384.

Water management is essential in agricultural and civil engineering projects, spanning irrigation systems, potable water supply, and water reclamation. In drought-prone regions, effective management requires strategies that support sustainability, resilience, and adaptive capacity in alignment with the United Nations Sustainable Development Goals (SDGs) and the ENVISION v3 framework. These emphasize environmental stewardship, resource efficiency, and fairness in planning and infrastructure development. HydroThrive is a web-based application that uses Artificial Intelligence (AI) models to support the design and implementation of context-specific water management strategies. The application helps engineers, planners, and policymakers develop tailored strategies, action plans, and success indicators addressing water needs across sectors such as agriculture, industry, and domestic use. Its objectives include improving water conservation, promoting reuse and recycling, strengthening water infrastructure, and enhancing resilience to ecological variability. HydroThrive integrates user-provided data, such as customer requirements or needs assessments, with information gathered through public Application Programming Interfaces (APIs). These APIs supply real-time weather, soil, hydrological, and water quality data, along with relevant SDG and ENVISION framework information. Using these inputs, HydroThrive produces structured action plans that include procedural steps, targeted activities, and performance metrics for evaluation and monitoring. A prototype model has been

demonstrated using a hypothetical scenario in California's Central Valley to validate its framework. Future enhancements will expand decision-making capabilities by incorporating economic cost modeling, lifecycle assessment, and project timeline optimization, positioning HydroThrive as a comprehensive tool for sustainable and resilient water management.

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Introduction to 1890 Soil Health Education and Training Programs. M. Guo*, S. Elavarthi, Department of Agriculture and Natural Resources, Delaware State University, Dover, DE 19901; R. Ogutu, A. Wetherill, Cooperative Extension, Delaware State University, Dover, DE 19901.

Healthy soil is the foundation of sustainable agriculture. With support from US Department of Agriculture, peer institutions, and local farms, the Soil Health and Sustainable Agriculture Education team consisting of scientists, cooperative extension specialists, and small farm educators at Delaware State University have been developing, implementing, and enhancing the 1890 soil health education and training programs over the past decade, aiming to prepare competent agricultural professionals with the fundamental science of soil health and its sustainable management. Diverse soil health education materials, training modules, and experiential learning projects were developed. The programs have been implemented through curriculum integration, experiential learning projects, internship opportunities, training workshops, outreach events, thematic conferences, and farm tours. The training outputs cover the focal topics including the importance of soil health, general soil health properties and indicators, soil health assessment methods, soil health management practices, agriculture, sustainable agriculture, agrivoltaics, agricultural cooperative extension skills, and leadership cultivation. In the past three years more than two thousand students, gardeners, and farmers received the essential soil health education and training via classroom teaching, summer workshops, small farm conferences, and other outreach activities. In addition, a dedicated website 890soilhealtorg was created to disseminate the program information and distribute the soil health education and training materials to the 1890 land-grant communities.

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Agrobacterium-Mediated Transformation of *Chlorella* sp. (UTEX B 3198) and Assessment of Amino Acid Profile Changes. A. Parsaeimehr [*]; Department of Biology & Microbiology, College of Natural Sciences, South Dakota State University, Brookings, SD, 57007, USA; G. Ozbay, Department of Agriculture and Natural Resources, Delaware State University, Dover, DE, 19901, USA.
We established an *Agrobacterium*-mediated transformation platform for the unicellular microalga *Chlorella* sp. (UTEX B 3198). The microalga was cultivated in BG11 and Modified Bold 3N media, with total biomass, relative growth rate, and amino acid content monitored to optimize downstream processes. We also examined changes in the amino acid profile following cultivation and transformation. Transformation was performed using *Agrobacterium tumefaciens* LBA4404 carrying the pCAMBIA1305.1 plasmid (Addgene #64401), expressing GFP and GUS reporter genes under a 35S promoter. Key factors influencing transformation efficiency, including IPTG concentration, selection antibiotics, microalga-to-Agrobacterium ratios, and medium composition were systematically optimized, enabling reproducible integration of foreign genes. The dual GFP and GUS reporters provided complementary validation, allowing real-time visualization and enzymatic confirmation of gene expression. PCR amplification of GFP and GUS further confirmed successful transformation. This platform demonstrates a robust and efficient method for genetic engineering in Chlorella, with the added ability to monitor amino acid profile changes, supporting applications in biofuel production, environmental monitoring.

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Heavy Metals in Silver Lake, Dover, DE: Environmental Insights from Water and Sediments for Fish and Ecosystem Health K Jahan*, N. Boukari, L. Roberts, One Health Lab, College of Agriculture, Science & Technology, Delaware State University, Dover, DE 19901; D. Austin, K. Milligan, Y. Yue, Department of Chemistry, College of Agriculture, Science & Technology, Delaware State University, Dover, DE 19901; G. Ozbay, One Health Lab, College of Agriculture, Science & Technology, Delaware State University, Dover, DE 19901.

Urban freshwater systems are increasingly impacted by heavy metal contamination, which can accumulate in sediments and enter aquatic food webs, posing long-term risks to fish, ecosystem function, and fisheries sustainability. Silver Lake, located within the St. Jones watershed in Dover, Delaware, is currently under a fish consumption advisory limiting residents to two 8-ounce fish meals per year due to potential bioaccumulation of metals in fish. Despite this advisory, the specific environmental sources and pathways contributing to contamination remain poorly understood. To address this gap, water and sediment samples were collected from six representative sites across the lake. Dissolved metals (Pb, Cd, Cr, Cu, Zn, Hg, As) in water were quantified using inductively coupled plasma mass spectrometry (ICP-MS) following EPA Method 200.8. Preliminary results indicate that all target metals are present in the water column, but concentrations remain below federal guidelines, suggesting that water alone is not the primary pathway for metal exposure to aquatic organisms. Sediment analysis is ongoing to determine long-term metal reservoirs and spatial hotspots that may contribute to bioavailability and ecological risk. By integrating water and sediment data, this study aims to elucidate the environmental distribution of heavy metals in Silver Lake, identify areas of concern for ecosystem and fish health, and provide actionable insights for urban freshwater management. The findings will support evidence-based decision-making for fishery management, protect aquatic life, and inform strategies for sustainable fisheries and aquaculture practices in contaminated freshwater environments.

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Biochar Soil Amendment Influences Nutrient Dynamics and Carbon Thermal Stability in Hemp Production in Florida Sandy Soils. L. Ngatia*, W. Zhou, K. Oduor, W. Marechal, G. Bugna and T. Sarker, Center for Water Resources, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32307.

Biochar soil amendment improves soil fertility and enhances nutrient retention in agricultural systems. However, little is known about the influence of biochar and cover crops on nutrient dynamics and carbon (C) thermal stability in in situ hemp cultivation. This study examined the impact of biochar and cover crop on nutrient and C thermal stability under hemp production at Florida A&M University, Florida. Treatments included 0%, 2%, 4%, and 8% biochar. Soil samples were composited in triplicate at six depth intervals (0–5, 5–10, 10–20, 20–30, 30–40, and 40–50 cm). Samples were analyzed for total, available nutrient concentrations, and C thermal stability. Biochar application and soil depth significantly influenced soil carbon (C), phosphorus (P), and potassium (K) concentrations ($P < 0.0001$). Significant treatment × depth interactions were observed for C, P, and K, indicating that nutrient responses varied along the soil profile depending on biochar rate. Nitrogen was affected by both treatment ($P = 0.027$) and depth ($P< 0.0001$), but no significant interaction occurred between the two factors. Data showed a relative increase in Low Thermal Stable C compared to High Thermal Stable C in the topsoil with increased biochar percentage, as indicated by an increasing R400 Index, which ranged from 0.34 to 0.54. Higher biochar rates enhanced nutrient accumulation and C thermal lability in surface layers. Therefore, biochar soil amendment improves nutrient status and carbon (C) lability, suggesting its potential to enhance nutrient retention, fertility, and C thermal lability in hemp production systems.

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In Situ Short-term Effects of Biochar and Cover Crop on Soil Nutrient Dynamics Under Collard Green Cultivation. K. Oduor*, L. Ngatia, A. Bolques, W. Marechal, G. Bugna and G. Orji-Nwoke, Center for Water Resources, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32307.

Biochar is a promising soil amendment for enhancing fertility, improving nutrient retention, and promoting carbon sequestration. However, its effects in combination with cover crop on soil nutrient and carbon (C) thermal dynamics under vegetable production remain poorly understood, limiting its optimal application in intensive horticultural systems. The study was conducted at the Florida A&M University (FAMU) Research and Extension Center in Quincy, Florida, to assess the effects of biochar application and cover crop (Fagopyrum *esculentum)* on soil nutrient and C thermal stability under collard green (*Brassica oleracea* L.) cultivation. Treatments included a control, a cover crop, and biochar rates of 1%, 2.5%, and 5%. Soil samples were collected along three transects per treatment at six depth intervals (0–5, 5–10, 10–20, 20–30, 30–40, and 40–50 cm). Two cores were composited by depth and analyzed for total and available nutrient concentrations using the ashing and Mehlich 1 extraction methods, respectively. Carbon thermal stability was determined using MESTA technology. Biochar application and soil depth significantly influenced the distribution of soil nutrients ($P < 0.05$). Depth had a strong effect on carbon, nitrogen, phosphorus, potassium, and magnesium concentrations ($P < 0.0001$). There was a significant interaction between treatment and depth for magnesium ($P = 0.013$), indicating that magnesium availability varied with depth. The R400 index exhibited values

above 0.5 across treatments (0.5-0.7), indicating dominance of thermally labile C. The study is ongoing to assess the long-term effects of biochar on soil nutrients and crop productivity.

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Do Forest Wood Debris Management Practices Influence Soil Particle Size? Consequences on Carbon Thermal Stability and Nutrient Dynamics. L. Ngatia*, W. Marechal and A. Adonuja, Center for Water Resources, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32307; and J. M. Grace III, USDA-Forest Service, Southern Research Station, Tallahassee, FL 32303.

Hurricane Michael deposited massive wood debris on the forest floor at Chipola Experimental Forest. The wood debris was managed through drum chopping and prescribed fire. However, it remains unclear how these management practices influence soil particle size, carbon (C) thermal stability, and nutrient availability. Therefore, this study investigated the impact of wood debris drum chopping and prescribed fire on carbon concentration and soil C thermal stability, examining both bulk and fractionated soil samples. The soil was fractionated according to particle size, which included <250 µm, 250-500 µm, and 500-2000µm. Carbon thermal stability was determined by MESTA technology. Carbon was determined by a CN analyzer, nutrients were analyzed by the ashing method, and the Mehlich 1 method. The bulk soil C concentration decreased significantly along the soil profile ($P < 0.0001$). However, the 0-2 cm depth (topsoil) exhibited a significantly higher C concentration after fire ($P=0.0031$). After fire, the C concentration increased by 300% within the 0-2 cm depth. R400 index decreased with increasing soil depth. Soil particles <250 µm exhibited the highest R400 index in the topsoil compared to other particle sizes in all treatments. Nitrate was positively related to the R400 index ($r = 0.55$; $P = 0.0006$). For particles of 250-500µm, the R400 index decreased from 0.68 in the baseline to 0.45 after drum chopping and fire, suggesting an increase in soil C stability. Therefore, debris management practices, with the potential to alter soil particle size, may influence the lability of C and nutrient availability.

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Woody Debris Management Alters Soil Nutrient Dynamics Across Particle Size Fractions in the Chipola Experimental Forest, Florida. K. Oduor*, L. Ngatia, A. Adonuja and W. Marechal, Center for Water Resources, College of Agriculture & Food Sciences, Florida A&M University, Tallahassee, FL 32307; and J. M. Grace III, USDA-Forest Service, Southern Research Station, Center for Forest Watershed Research-Center for Forest Assessment and Synthesis, Tallahassee, FL 32303.

Downed woody debris (DWD) enhances nutrient cycling and soil fertility in forests. Post-hurricane management through drum-chopping and prescribed burning promotes recovery, though their impacts on soil particle size and soil nutrient dynamics remain poorly understood. Soil nutrient dynamics were evaluated at the Chipola Experimental Research Forest, FL, under three woody debris management statuses (baseline, drum-chop, and fire). Soil samples were collected along four transects, with four cores per transect to 40 cm depth, subdivided into six depth intervals (0–2, 3–5, 6–10, 10–20, 20–30, and 30–40 cm). Composited samples from each depth were fractionated by particle size (<250, 250–500, and 500–2000 µm) and analyzed for total and available nutrients using the ashing and Mehlich 1 methods, respectively. Significant effects ($P < 0.05$) of status, depth, and their interaction were observed for total C, N, P, and K. Particle size also influenced nutrient concentrations, with significant depth × particle size interactions across all nutrients. Significant effects ($P < 0.05$) of status, depth, and their interaction were also observed for the available nutrients P, K, NH_4-N, and NO_3-N. Particle size significantly affected P and NO_3-N, with notable depth × particle size interactions for P and K. A three-way interaction ($P<0.0001$) occurred only for P, indicating its higher sensitivity to the combined effects of status, depth, and particle size. These findings highlight that post-disturbance management alters soil particle size and soil nutrient distribution, underscoring its role in maintaining soil fertility and ecosystem recovery.

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Long Leaf Pine Litter Decomposition: Carbon Composition and Thermal Stability in Chipola Experimental Forest. L. Ngatia*, K. Oduor, W. Marechal, G. Orji-Nwoke and G. Bugna, Center for Water Resources, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32307, USA; I. Nadhirah, Soil & Fertilizer Research Centre, MARDI, 43400 Serdang, Selangor, Malaysia; J. M. Grace III, USDA-Forest Service, Southern

Research Station, Tallahassee, FL 32303, USA; and S. Holmes, National High Magnetic Field Laboratory, Florida State University, Tallahassee, FL 32310, USA.

Extreme weather conditions, such as hurricanes, result in massive litter deposition on the forest floor, but little is known about the carbon (C) composition and thermal stability of this litter. This study investigated the long-leaf Pine litter C composition and thermal stability along the decomposition gradient. The litter samples were collected and air-dried to constant weight. Approximately 7g of litter samples were weighed into a 25 cm x 25 cm mesh bag with 1 cm x 1 cm holes, redeployed in the field. The litter bags were retrieved from the field sequentially after 0, 1, 2, 4, 6, 8, 10, and 12 months had passed. The samples were analyzed using ^{13}C Nuclear Magnetic Resonance and MESTA technology. The results indicated a significant increase in alkyl and alkyl:O alkyl ratio along the decomposition continuum, indicating an increase in decomposed and stable form of C. The low-thermal-stable C exhibited an increase, while the high-thermal C exhibited a decrease as the decomposition progressed. This pattern was further supported by an increase in the R400 index, ranging from 0.53 to 0.64, indicating increased thermal lability as the decomposition progressed, which contrasted with the expectation that thermal lability would decrease as decomposition progressed.

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Integration of GEDI Lidar and satellite observation for monitoring forest structural dynamics. D. Oli*, B. Gyawali, M. Parajuli, College of Agriculture, Health and Natural Resources, Kentucky State University, Frankfort, KY, 40601; D. Zourarakis, Martin-Gatton College of Agriculture, Food and Environment, University of Kentucky, Lexington, KY, 40506

Continuous monitoring of forest structure is necessary for understanding forest carbon dynamics, forest degradation and to support the sustainable management of forest resources. Spatially explicit and high-quality information is crucial to monitoring terrestrial ecosystems and making informed decisions in diversity conservation and environmental stewardship. Despite its significant implications for forest monitoring, a gap remains in high-quality 3D structural data of forest structure. The Global Ecosystem Dynamics Investigation (GEDI) Light Detection and Ranging (lidar) sensor is continuously providing sampling of forest structural attributes. We explored the integration of GEDI lidar and Sentinel data to produce spatially explicit and high-quality maps of forest canopy height, canopy fraction cover, plant area index, and foliage height density, key attributes of forest structure, for eastern Kentucky. Random forest regression models were used to train and predict these attributes. The maps were validated using a separate subset of GEDI data. Validation was done using the coefficient of determination (R^2), root mean square error (RMSE) and mean absolute error (MAE). Preliminary results showed robustness of Sentinel data to extrapolate GEDI measurements to get key forest structure attributes. Therefore, this approach can further enhance the efforts of forest conservation and allows for multi-year monitoring of forests using consistent satellite observations.

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Modeling the Trajectory and Drivers of Above-Ground Biomass Accumulation in Reclaimed Mine Lands. K. Paudel*, B. Gyawali, D. Zourarakis, M. Parajuli, J. Sandifer, College of Agriculture, Health and Natural Resources, Kentucky State University

Reclaimed surface mine lands serve as critical sites for studying ecological restoration and Above-Ground Biomass (AGB) accumulation, which is highly contingent upon localized soil and microclimatic variability. This study aims to develop a spatiotemporal modeling framework to monitor and forecast temporal trajectory and spatial heterogeneity of AGB *growth* using lidar, multispectral imagery, and environmental covariates in reforested plots within a reclaimed coal mine in Martin County, Eastern Kentucky. High-density UAV lidar and imagery collected across two consecutive growing seasons (2024 and 2025) were processed to generate Canopy Height Models and delineate Individual Tree Crowns (ITCs). Structural metrics, including tree height, crown diameter, and canopy volume, were derived for both years. and annual AGB growth rate for each plot was calculated using the 2024-2025 difference. This AGB growth rate was then modeled as a function of initial structural metrics and key site variables (soil properties, topographic indices, and initial vegetation density) using supervised machine learning algorithms. Feature importance analysis was used to rank the key drivers contributing to biomass accumulation rate, specifically identifying which soil or topographic factors most influence the acceleration or deceleration of recovery. Our findings generate a high-resolution Growth Trajectory Map, revealing areas of rapid versus stunted AGB recovery. Areas of rapid recovery are further examined to assess whether accelerated growth may be linked to invasive species. The results inform managers

by identifying specific site conditions that limit or promote rapid growth, thus informing targeted intervention strategies and enhancing the long-term carbon sequestration potential of Appalachian reclaimed lands.

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Integrated Farming for Sustainable Catfish and Leafy Green Production in Aquaponics System: Implications for the Commercial Producers. K. Gosh*; T. Ivey; S. Moreno; J. Jones; H. Fontenet; J. Price; and K. Thames. Sherman Lewis School of Agriculture and Applied Sciences, Department of Agriculture and Natural Resources, Langston University, Langston, OK 73050.

Aquaponics combines fish culture with soilless plant production in which fish waste supplies nutrients for plants, while nitrifying bacteria convert ammonia into plant-available nitrates. This study evaluated growth performance and feed utilization of channel catfish (*Ictalurus punctatus*) under two stocking densities (12 vs. 24 fish per tank) and assessed their potential effects on Romaine lettuce (*Lactuca sativa*) growth in a nutrient film technique system. Catfish were fed daily at 3% of body weight, and water quality parameters were monitored regularly to optimize nutrient balance. Descriptive analyses revealed that low-density tanks supported higher individual growth, whereas high-density tanks produced more uniform but slower growth trajectories. Final biomass gains ranged from 568.68 g to 2,535.30 g, with percentage weight gain spanning 52.07% to 157.28%. Notably, Tank 3 (high density) achieved the highest relative growth (%WG = 157.28%, SGR = 1.027) with a favorable FCR (1.57), whereas Tank 1 (high density) exhibited the lowest performance (%WG = 53.15%, SGR = 0.463, FCR = 3.29). Among low-density tanks, Tank 4 displayed strong relative growth (%WG = 121.37%, SGR = 0.863) with acceptable FCR (1.83), while Tanks 5 and 6 had higher FCRs (3.15 and 3.34). Although t-tests indicated no statistically significant differences (Weight Gain: $p = 0.133$; %WG: $p = 0.418$; SGR: $p = 0.435$; FCR: $p = 0.487$), descriptive trends suggest biologically meaningful effects, likely reflecting high within-density variability. This study demonstrates that integrated aquaponics systems can enhance the yields of both catfish and leafy greens, supporting small-scale food production.

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Carbon sequestration dynamics in aquaculture ponds: influences of fish species selection, pond age, and farming practices. K. Gosh*, M. McCallum, T. Ivey; A. Compere; S. Moreno; I. Williams; J. Jones; H. Fontenet; J. Price; and K. Thames. Sherman Lewis School of Agriculture and Applied Sciences, Department of Agriculture and Natural Resources. Langston University, Langston, OK 73050.

Aquaculture ponds, often overlooked in national carbon budgets, present a valuable opportunity for carbon storage. This study explores the carbon absorption rate of pond sediments in relation to fish species selection, pond age, and fish farming management. We employed a standardized soil sampling protocol, using a hand core sediment sampler to collect 200g-300g soil samples from approximately 20 cm depth (methodology adapted from the previously published research papers). All samples were collected by the same individual to ensure consistency. Soil analyses were performed at the Oklahoma State University Soil Testing Lab. Channel Catfish (n=4), koi (n=2), and bluegill (n=2) fish-pond soils were sampled. Additionally, a questionnaire captured data on physical and chemical parameters and fish farming management practices. Our results indicated that carbon absorption rates varied significantly among fish species selections. Bluegill fishponds exhibited the highest organic matter (%) and total carbon (%) content in both dry and wet conditions, followed by catfish and koi ponds (Figure 1). Furthermore, carbon absorption rates were assessed in relation to pond age and various management factors (stocking rate, feed, total production). Once again, bluegill fish-ponds showed the highest carbon absorption rates, followed by catfish and koi ponds. This study underscores the potential for optimizing carbon storage in aquaculture ponds and highlights the importance of considering fish species selection, pond age, and fish farming management practices in carbon sequestration strategies. These findings contribute to our understanding of carbon dynamics in aquaculture systems and their relevance in addressing the challenges posed by changing environmental patterns.

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Weather Variability and Its Influence on Corn Yields in Missouri's Corn Belt. G. Singh*, B. Valliyodan, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101; S. Bardhan, Department of Agricultural and Environmental Sciences, College of Agriculture, Tennessee State

University, Nashville, TN 37209; S. Chakraborty, Department of Statistics, University of Missouri, Columbia, MO 65202.

Weather variability poses a significant threat to corn production in Missouri (MO). This study employs Autoregressive Distributed Lag (ARDL) model to investigate impact of changing environmental conditions for corn in MO over the past 53 years (1970–2023). Climate data, including monthly maximum and minimum temperatures and precipitation, we analyze trends in minimum temperature (Tmin), maximum temperature (Tmax), precipitation (PP), diurnal temperature range (DTR) and carbon dioxide emissions (CO_2) and their impacts on yield variability. The results reveal a warming signal depicted by an increase in minimum temperature at a rate of 0.208 °C per decade and the maximum temperature at 0.093 °C per decade. Simultaneously, cumulative PP increased by 8.104 mm per decade, atmospheric CO_2 increased at the rate of 6.139 Mt per decade, while the DTR exhibited a declining trend of –0.113 °C per decade. The warming trend in Missouri was driven by Tmin, contributing to 68.83%, while Tmax accounted for about 31.17% of the total observed long-term warming effect based on the ARDL model. With a 1 °C increase in maximum temperature, corn yield decreased by 1.09% in the short run and by 0.64% eventually in the long term, indicating significant negative impact. These results highlight the sensitivity of corn to elevated temperature conditions. These findings underline the urgent need for targeted adaptation strategies including early sowing dates, cultivar change, increasing root density through genetic adaptation and planting short duration varieties to enhance agricultural resilience in the Midwest for maximum yields.

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Influence of Soil Properties on Stand Density in Declining White Oaks (*Quercus alba* L.) Forests. S. Khadka* and J. Yang. College of Agriculture, Environment and Human Science (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101.

Management of white oak (*Quercus alba* L.) stands is a critical concern in forest ecosystems due to its impact on biodiversity and ecosystem functions. Understanding the role of soil properties in shaping stand density is essential for effective oak forest management. This study examined whether stand density of declining white oaks differs significantly across soil property classes. Multicycle Forest Inventory and Analysis data were compiled to capture white oaks across the eastern United States. Stand density was quantified across plot systems using number of trees per unit area. Soil variables such as texture, organic matter and total available water were analyzed to assess soil properties. Analysis of variance was used to test difference across the means of soil property classes, followed by Tukey's HSD for pairwise comparisons. Results demonstrated that stand density of declining white differs significantly across various soil classes ($p \leq 0.05$). These findings highlight the pivotal role of soil conditions in regulating white oak stand density. Incorporating soil attributes into forest management and restoration planning may improve strategies for sustaining declining white oak populations. Future research should expand to include interactions between soil, climatic stressors, and biotic factors to better inform adaptive management across diverse forested landscapes.

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Soil health comparison of annual versus perennial cover crops in alleyways between vegetable production beds during organic transition. P. Karki*, T. Hurisso, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101; T. Reinbott, University of Missouri, Columbia, MO 65201.

Vegetable production farms that are being converted from conventional to organic management lack adequate soil organic matter (SOM), which often leads to growers facing low yields during the transition period. Some growers take land out of cash crop production every other year or more to grow cover crops to rapidly build soil health; however, the practice is yet to be adopted widely. In this 3-year study, perennial and annual grass/legume cover crop bi-cultures that tolerate frequent mowing were established in alleyways between vegetable production beds with tilled no-cover alleyway as a control. We found that perennial cover crops (especially perennial ryegrass/white clover mix) and an annual cover crop mixture of sorghum sudangrass/sweet white clover) consistently increased several of the soil health indicators evaluated. On average, soil organic C (SOC), total N, active C (POXC), β-glucosidase (BG), and β-glucosaminidase (NAG) under perennial and annual cover crop systems were up to 34%, 26%, 29%, 88%, and 78% greater, respectively, than those under the tilled no-cover control. Overall, our findings highlight the utility of both perennial and annual grass/legume cover crop bi-cultures as a sustainable strategy to boost soil health and potentially

suppress weeds in vegetable-based rotation during organic transition without having to take land out of cash crop production.

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A Multi-Scale Framework for Forest Inventory and Structural Assessment Using Airborne and UAS LiDAR in Missouri's Ozark Forests. X. Zhang*, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University, Jefferson City, MO 65101; B. Graham, Missouri Department of Conservation, West Plains, MO 65775.

Accurate forest inventory is essential for managing forests sustainably and tracking carbon stocks. Traditional ground-based methods provide high precision but are limited in spatial scale. To overcome this limitation, we developed a multi-scale LiDAR framework that integrates airborne and unmanned aircraft system (UAS) LiDAR data to quantify forest structure and condition across Missouri's Ozark forests. The framework has three core components. The first involves airborne LiDAR-based regional modeling that uses Quality Level 1 (QL1) data and >400 field plots collected by the Missouri Department of Conservation in 2022 to estimate forest attributes such as diameter at breast height (DBH), basal area, and tree density. The second component conducts UAS LiDAR-based fine-scale assessment over Missouri Ozark Forest Ecosystem Project (MOFEP) plots during leaf-on (2025) and leaf-off (2026) conditions to characterize canopy height, crown density, and understory structure. The final stage focuses on integration and validation, combining metrics from both platforms with machine learning models to improve cross-scale prediction accuracy. This integrated framework links high-resolution UAS data with broad-scale airborne observations, offering an efficient, scalable, and transferable approach for studying forest dynamics, management effects, and carbon storage across diverse landscapes.

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Emerging Contaminants and Water Quality Dynamics in Freshwater Aquaculture. J.K. Maiyo*, V.A. Kazibwe and M. Matuha, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101.

Aquaculture is the fastest-growing food production sector globally, yet in the United States, domestic production remains limited, contributing to an ongoing seafood trade deficit. Missouri is positioned for aquaculture expansion due to its abundant freshwater resources, central market access, and prevalence of small-scale systems that support rural economies. However, sustainable aquaculture growth depends on understanding and mitigating water quality risks, including those posed by Contaminants of Emerging Concern (CECs). These pollutants, such as antibiotics, per- and polyfluoroalkyl substances (PFAS), microplastics, and algal toxins, are increasingly detected in aquatic environments and may impair fish health, disrupt biological treatment processes, reduce system productivity, and compromise food safety. Despite growing global concern, limited data exist on the occurrence, sources, and fate of CECs in U.S. freshwater aquaculture. This study investigates the prevalence, transport pathways, and persistence of selected CECs in representative aquaculture systems in Missouri. Water and sediment samples will be collected from recirculating, flow-through, and pond-based systems and analyzed using advanced analytical techniques, including solid-phase extraction with LC-MS/MS and spectroscopic characterization for microplastics. Temporal variability will be assessed to evaluate the system processes that influence CEC behavior. The study also includes preliminary toxicological risk screening to assess potential impacts on aquatic species and human exposure via aquaculture products. Outcomes of this research are integral to sustainable aquaculture development and enhancing fish health and product safety in Missouri and beyond.

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Sustainable Aviation Fuel in the Heartland: Comparing Corn, Soy, and Emerging Oilseed Pathways for Missouri's Bioeconomy. C. Sanchez*, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101; S. Fenwick, Clean Fuels Alliance America, Jefferson City, MO 65101; J. Knaebel, Missouri Corn Growers Association, Jefferson City, MO 65101; and M. Amick, Missouri Soybean Association, Jefferson City, MO 65101.

Missouri, a leading agricultural state and major producer of biodiesel, is strategically located to serve as a key hub for Sustainable Aviation Fuel (SAF) production. This research examines the most promising SAF conversion pathways, Hydroprocessed Esters and Fatty Acids (HEFA) and Alcohol-to-Jet (AtJ), based on Missouri's primary crops: corn and soybeans, along with innovative, emerging oilseed cover crops. The HEFA pathway is highly relevant, utilizing oils from soybeans and specialized cover crops like winter camelina and pennycress. As the most commercially advanced technology, HEFA supports blend limits up to 50%. A key advantage of emergent oilseeds is their ability to grow during the fallow winter season, which avoids competition with food production, improves soil health, and may lower the fuel's lifecycle Carbon Intensity (CI) score. Conversely, the AtJ pathway transforms corn-based ethanol into SAF. This process produces more SAF per acre than oil crops, requiring fewer total acres to generate the same amount of fuel. However, reducing life-cycle gas (GHG) emissions often involves using advanced techniques, such as Carbon Capture and Sequestration (CCS), and implementing sustainable farming practices like cover cropping and no-till farming to qualify for federal tax credits. A strategic comparison demonstrates that HEFA offers an immediate, scalable option by utilizing dual-purpose feedstock and existing oil processing capacity, including a planned Missouri facility using HEFA-compatible technology. Meanwhile, AtJ provides a high-yield choice that relies on carbon mitigation and new conversion infrastructure. Strategic investment in both pathways is essential to unlock Missouri's potential in the expanding SAF market.

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Linking soil chemistry to soil carbon sequestration in agricultural farmlands. M. C. Enebe*, R. W. Griffin, J. Barouei, R. L. Ray, CAFNR Research, College of Agriculture, Food and Natural Resources Research, Prairie View A&M University, Prairie View 77446, TX

The global quest for environmental sustainability necessitate the adoption of ecofriendly approaches for carbon storage in the soil. Soil samples derived from three different agricultural farmlands were analyzed for mineral and carbon compositions. The farmlands under continuous tillage system were each divided into 30 subplots and soil samples were taken from each of these subplots at a depth of 6 and 12 inches respectively. The aim is to understand the spatial variations of nutrients and how they affect soil organic carbon sequestration. Hence, this study evaluated the impact of soil chemistry on carbon sequestration. The result showed that the mineral compositions such as Al, Ca, Cu and Mn increased with depth. While Fe, K, Mg, P, Zn and B decreased with soil depth. A comparison across the 3 farmlands here referred to as plots 1, 2 and 3 (representing farmland 1, 2 and 3) showed that plot 1 (farmland 1) has the highest Al, Fe, and Ca at the top and subsoils. The distributions of these soil minerals correlated with soil total organic carbon (TOC). Within plot 1 topsoil Al and Ca correlated positively with TOC. While Mg negatively correlate with organic carbon. Fe, on the other hand, correlated positively with TOC with an even distribution. At the subsoil increase in Al, and Ca did not result with increase in TOC. Interestingly, Fe correlated positively with TOC at subsoil. In plot 2 topsoil, Fe and Mg correlated positively with TOC but did not change with increase in Al, Ca, Na, Mg and K concentration at the subsoils. In plot 3, increase in Ca, K, Na correlated positively with increase in TOC. But within the subsoil Al, Ca and Na correlated positively with TOC. The study showed the variability in mineral stocks with soil depth across the different farmlands; Al, Fe and Ca facilitate soil carbon sequestration through complexation reactions.

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Hydrological Regime Characterization of U.S. River Basins Using the Budyko Framework. B. G. Tikuye*, R. L. Ray, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

The Budyko framework is a simple yet effective tool for estimating watershed water balance. Accurate estimation of the watershed characteristic parameter (Pw) is critical for reliable water balance simulations using the Budyko framework. Thus, this study is designed to characterize the hydrological regime of U.S. River Basins using the Budyko framework. The TerraClimate dataset of primary climate variables, i.e., precipitation and derived variables (viz., potential and actual evapotranspiration), spanning six decades plus, was applied to calculate the dryness index (DI), aridity index (AI), and evaporative index. Then, the Budyko framework was applied to characterize watersheds and identify water- and energy-limited river basins. Results reveal strong regional contrasts in water and energy limitations. The Colorado River Basin (DI = 3.91, AI = 0.27, Budyko ratio = 0.80) exhibits a semi-arid climate and a water-limited hydrological regime, where evapotranspiration is highly constrained by water availability. Furthermore, the Columbia

River Basin (DI = 1.21, AI = 0.84) and the Mississippi River basin (DI = 1.38, AI = 1.24) are displaying water-limited regimes influenced by water constraints. The South Atlantic Gulf Basin (DI = 0.87, AI = 1.17, Budyko ratio = 0.74) and Great Lake Basin (DI = 0.82, AI = 1.24, Budyko ratio = 0.70) exhibit a humid and energy limited regime, whereas the Texas Gulf Basin (DI= 2.74, AI = 0.38, Budyko ratio = 0.92) displays a semi-arid, water-limited environment. Overall, humid basins tend toward transitional to energy-limited regimes, whereas semi-arid basins display mixed transitional and water-limited behavior.

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Evaluating agricultural drought across Texas with SMAP-derived soil moisture indices. G. Tefera*, R. L. Ray, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Drought is one of the most pressing climatic hazards, with profound impacts on agriculture, water resources, and ecosystem sustainability. This study analyzed agricultural drought conditions in Texas using soil moisture-based indicators. Soil Moisture Active Passive (SMAP) satellite soil moisture data (from 2015 to 2024) were analyzed for drought indices, the Soil Water Deficit Index (SWDI), and the Standardized Soil Moisture Drought Index (SSI) for quantifying the incidence of drought across diverse climatic zones in Texas. The methodological framework integrated soil moisture anomalies, percentile-based thresholds, and spatial mapping to capture both seasonal variability and interannual drought trends. We compared precipitation anomalies, drought indices, and evapotranspiration patterns with the U.S. Drought Monitor (USDM) classifications. Results revealed that central and western Texas exhibited the highest frequency and severity of soil moisture deficits, particularly during the 2018 and 2022 drought episodes, while eastern Texas showed comparatively lower agricultural drought. The SSI captured prolonged drought signals, whereas SWDI was more sensitive to short-term agricultural stress. These findings demonstrate the complementary utility of multiple soil moisture indices for robust drought monitoring. We recommend that stakeholders incorporate soil moisture-based indices, particularly in conjunction with SMAP data, into existing drought early warning systems to improve preparedness and enhance agricultural drought resilience in Texas.

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Spatio-Temporal Dynamics of Vegetation Health and Drought Conditions across Brazos River basin. N. Kumar* and R. L. Ray, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

The monitoring of agricultural drought is crucial for analyzing vegetation stress and promoting sustainable land and water management. This study utilizes Moderate Resolution Imaging Spectroradiometer (MODIS) datasets within the Google Earth Engine (GEE) platform to evaluate drought dynamics in the Brazos River basin from 2016 to 2019. The Vegetation Condition Index (VCI), Temperature Condition Index (TCI), and Vegetation Health Index (VHI) were calculated using MODIS NDVI (MOD13A1) and land surface temperature (MOD11A2) datasets. These indices were calculated, spatially averaged, and categorized to reflect different levels of drought severity. The mean values for VCI (44.93), TCI (47.14), and VHI (46.04) were examined to assess vegetation health and temperature stress patterns across the study region. Vegetation response fluctuated across different times and locations in the Brazos River basin. VHI values ranged from 28.72 to 44.53, indicating moderate drought possibly during dry periods in the upstream area, while values from 48.83 to 67.86 reflected adequate moisture conditions in the downstream portion. The study establishes the effectiveness of GEE for large-scale drought monitoring and presents a replicable methodology for ongoing agricultural drought assessment utilizing freely accessible satellite data.

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Sustainability, Mitigation, and Adaptation in Texas: Bridging the Gap Between Policy Intent and Practical Implementation. B. Mengistie*, R. L. Ray; CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Despite robust international frameworks and national policies aimed at sustainability, mitigation, and adaptation, a persistent gap remains between what is proposed in policy and what is implemented in practice. While the United States has made ambitious sustainability commitments, such as net-zero targets and adaptation strategies, there

remains a significant gap between these policy goals and actual implementation. Texas has a massive energy and industrial footprint and is highly exposed to extreme weather and water stress, as shown by the 2021 power crisis during severe cold, the Central Texas floods in July 2025, and recurring droughts. Despite growing concerns about sustainability, local responses often fall short of policy expectations. This study critically examines local sustainability, mitigation, and adaptation efforts in Texas by comparing stated policy goals with actual practices on the ground, employing a multidisciplinary approach and developing action plans that integrate resilience and environmental policy indicators. The analysis reveals a persistent gap between policy and practical implementation informed by insights from practitioners, scientists, and policymakers. Key challenges include continued fossil fuel dependence, lack of detailed and enforceable plans, insufficient funding and resources, fragmented governance and coordination across federal, state, and local levels, limited local capacity and data, environmental burdens, and lack of community engagement, among others. To bridge the policy-practice divide, this review calls for context-sensitive strategies, stronger stakeholder engagement, and actionable policy tools that empower local governments to implement sustainable policies effectively.

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Quantifying the carbon sequestration potential of Sorghum at watershed scale in Texas High Plains, United States. T.G Tarkegn*, R.L Ray and G.W Tefera, College of Agriculture, Food and Natural Resources Research (CAFNR Research), Prairie View A&M University, Prairie View 77446, TX.

Understanding and quantifying the carbon sequestration potential of major crops is critical for developing effective land management strategies. This study aims to quantify the carbon sequestration potential of Sorghum at the watershed scale in the Texas High Plains, United States. Quantifications of the carbon sequestration of Sorghum were made through integrating the SWAT2012, and Soil and Water Assessment Tool-Carbon (SWAT-C) models. Thus, the SWAT2012 was initially set up using spatial and temporal data, which includes, the Digital Elevation Model (DEM), soil, land use, and weather data. Then, after, the SWAT-C model was set up using outputs from SWAT2012. Calibration and validations of the SWAT-C model were made using streamflow, crop yield, and Soil Organic Carbon (SOC) data in R-SWAT software. The performance of the model was evaluated using KGE, NSE, R, and PBAIS. The calibrated and validated SWAT-C model was used for assessing the carbon sequestration potential of Sorghum. The findings of this study provide valuable insights into the role of Sorghum-based cropping systems in enhancing carbon storage, and guiding sustainable agricultural and land management practices.

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Prediction of Corn Biomass and Grain Yield Using Vegetation Indices from Multispectral Imagery and Field Spectroradiometer Data. R. Awal*, A. Veettil, A. Nta-Akare, K.D. Hall, A. Fares, B. Thapa, A. Elhassan, A. Adem, and A. Rahman, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Unmanned Aerial System (UAS)-based multispectral imagery and field spectroradiometer measurements provide robust tools for early stress detection, precision resource management, and data-driven yield forecasting in agricultural systems. This study investigated the potential of vegetation indices derived from both aerial imagery and ground-based spectral reflectance to predict corn biomass and grain yield under varying organic amendment treatments. A factorial field experiment was conducted at the Prairie View A&M University Research Farm, incorporating two biochar application rates (2,268 and 4,536 kg ha^{-1}) and three nitrogen-equivalent rates of dairy and chicken manure (0, 224, and 448 kg N ha^{-1}). Multispectral data were collected throughout the growing season using a Sentera 6X thermal sensor mounted on a UAS, while in-situ spectral reflectance measurements were obtained with a PSR+ spectroradiometer. Multiple vegetation indices related to plant nutrient status, water stress, and biomass were derived and evaluated for their predictive strength. Results demonstrated that vegetation indices from both UAS-based and field measurements exhibited strong correlations with corn biomass and grain yield, highlighting their potential for enhancing yield estimation and precision management in sustainable cropping systems.

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Hindrances to Adoption of Cover Crop Practice in South Carolina. W. Atakora*, L. Drammeh, T. Nyatta, B. Huber, J. Idassi, E. Agbodjan, F. Anoruo, Public Service and Agriculture 1890 Research & Extension, South Carolina State University, Orangeburg, 29117.

In this report we examine the challenges and adoption of cover cropping in South Carolina, identifying it as a sustainable agricultural practice that enhances soil health, reduces weed pressure, and improves water retention. Soil erosion, exacerbated by historical deforestation, poses significant challenges in the region. Cover cropping presents potential solutions to address these issues while promoting environmental stewardship. Initiatives such as the $70 million regenerative agriculture project, funded by U. S. Department of Agriculture and implemented by SC State University in strategic partnership with Clemson University, aim to support cover cropping practices. 182 small farmers and ranchers were purposefully selected state-wide in this survey to explore perceptions, awareness of benefits, and available resources, revealing key barriers such as knowledge gaps, financial constraints, limited access to no-till equipment in the adoption of cover cropping. The researchers found that cover crops contribute to agricultural sustainability by reducing dependency on chemical inputs and pesticides, lowering costs through weed suppression, nitrogen replenishment, and disease mitigation. They also decrease water usage via a natural mulch effect that lessens groundwater and surface water demand. Despite the benefits of cover crops uncovered, its adoption in South Carolina remains low. The report recommends several strategies to enhance cover crop adoption, including educational outreach, policy formulation through public awareness campaigns, financial assistance, infrastructure development. It emphasizes the need for organized collaboration between small farmers and ranchers, researchers, policymakers, and community stakeholders to advance the adoption of cover cropping as well as foster innovation in the agriculture sector.

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Effects of *Quercus virginiana* Tree Canopies on Reduction of Solar UVA/B Radiation in the Urban Environment. E. El Dakkak, Y. Qi*, V. Ferchaud, Department of Urban Forestry, Environment and Natural Resources, Southern University and A&M College, Baton Rouge, LA 70813; K.L. Chin, D. Kambiranda, and J. Obuya. Southern University Agricultural Research & Extension Center, Baton Rouge, LA 70813.

Ozone layer depletion increases solar ultraviolet radiation on the Earth's surface, which can cause negative impacts on agriculture, ecosystems, animals, and humans. While tree canopies are known to influence UV exposure, few studies have compared the UV levels above and below the tree canopy. This study investigates how tree canopies affect total, diffuse, and direct UVA and UVB in the urban environment using a shadow-band radiometer, which provides continuous measurements at seven wavelengths (300,305,311,317,325,332, 368 nm) for total, diffuse, and direct irradiance. Three large mature isolated live oak (Quercus virginiana) trees on the Southern University campus, Baton Rouge, Louisiana, were selected for the study. Each tree canopy was divided into four quadrants for under-canopy data collection using a mobile UVB monitoring station, streamlined with the USDA-UV Monitoring Network. The simultaneous above-canopy measurements were obtained from a permanent USDA-UV monitoring station 10 miles away from the SUBR campus. Results show that tree canopies can substantially reduce solar UV irradiance. Live oak tree canopy reduced daily total UVA and UVB by 80–86%, nearly all direct UV radiation (≈100%), and 59–75% of diffuse UV radiation. The canopy UV reduction power varied with leaf area index, time of day, and sky conditions. The results demonstrate the ecological role of urban tree canopies in reducing harmful solar UV exposure at the ground level. The results have implications for strategic planning and management of urban forests to increase urban tree canopy coverage and provide effective sun protection for the public.

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Monitoring the Response of Herpetofauna and Snake Fungal Disease (*Ophidiomyces ophiodiicola*) to Longleaf Pine Restoration. W.B. Sutton[1*], S.M. Robinson[1], D.A. Walker[2], R. Brubaker[1], and J.A. Cochran[3]; [1]Wildlife Ecology Laboratory, Department of Environmental Sciences, Tennessee State University, Nashville, TN 37209; [2]Department of Biology, Middle Tennessee State University, Murfreesboro, TN 37132; and [3]William B. Bankhead National Forest, U.S. Forest Service, Double Springs, AL 35553.

The combination of habitat loss and disease has dramatically reduced wildlife populations globally. Given this challenge, widespread habitat restoration and monitoring are needed to conserve vulnerable populations. In recent decades, there have been efforts to restore longleaf pine (*Pinus palustris*) forests across their historic range.

Simultaneously, a fungal pathogen known to infect snakes, Snake Fungal Disease (SFD), has been detected throughout the eastern U.S. In this study, we investigated how herpetofauna in the William B. Bankhead National Forest responded to longleaf pine restoration while monitoring for the presence of SFD across a gradient of habitat types, species, and individual characteristics. From 2021-2024, we used drift-fence trap arrays across a chronosequence of longleaf pine restoration to detect 52 species of herpetofauna. Reptile communities, in particular snake assemblages, demonstrated significant responses to restoration. For rare species like Northern Pinesnakes, restoration practices such as prescribed burning were positively associated with predicted abundance. From 2023-2024 we detected SFD among all habitat types and among most snake species sampled using skin swabs. The prevalence of SFD differed between species and was positively correlated with body size. Furthermore, we uncovered a significant positive association between the average maximum humidity of a sampling stand and the prevalence of SFD, suggesting that humid environments may provide a conducive setting for SFD to persist. This work provides practical insight into the effects of longleaf pine restoration on herpetofaunal communities. It also revealed connections between SFD and environmental conditions. Used in conjunction, these findings may help conserve threatened herpetofaunal populations.

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Detecting Forest Gaps and Regeneration Potential from Ultra-High-Resolution LiDAR and RGBI Data in the Land Between the Lakes. X. Xu*, A. KC, and B. Pokharel, Department of Environmental Sciences, College of Agriculture, Tennessee State University, Nashville, TN 37209.

Detecting forest gaps is essential for evaluating regeneration, biodiversity, and ecosystem resilience. This study integrates high-density airborne LiDAR and ultra-high-resolution RGBI imagery to identify canopy gaps and assess regeneration potential across the Land Between the Lakes (LBL) National Recreation Area forests in western Kentucky and Tennessee. Digital Terrain Models (DTM) and Canopy Height Models (CHM) were generated at 1 m spatial resolution to characterize fine-scale forest structure. Canopy gaps were delineated where CHM values were below 2 m within contiguous areas larger than 5 m². For each gap, spatial and structural attributes, such as size, shape complexity, and surrounding canopy height, were quantified and linked with spectral indices derived from RGBI imagery to evaluate potential vegetation recovery. The fusion of LiDAR-based structural metrics with RGBI-derived spectral indicators provides a powerful means to detect forest gaps and infer regeneration potential at sub-meter resolution. This integrated approach enables detailed characterization of forest heterogeneity and early successional conditions within a densely forested landscape. The results from this study will contribute to a deeper understanding of fine-scale forest structures and offer a scalable framework for forest monitoring, management, and resilience assessment in complex mixed species uneven-aged forest ecosystems.

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Divergent Responses of Crop Yield and Soil Nitrous Oxide Emissions to Precipitation Changes. D. Hui[1,*], J. Christian[1,2], A. Chauvin[1], F. Hayat[1], A. Ray[1], R. Thapa[2], Y. Chen[2], N. Girkin[3], D.M. Ricciuto[4], M.A Mayes[4], H. Tian[5,6], [1]Department of Biological Sciences, Tennessee State University, Nashville, TN 37209; [2]Department of Environmental Sciences, Tennessee State University, Nashville, TN 37209; [3]School of Biosciences, University of Nottingham, LE12 5RD, UK; [4]Environmental Sciences Division and Climate Change Science Institute, Oak Ridge National Laboratory, Oak Ridge, TN 37830; [5]Center for Earth System Science and Global Sustainability, Schiller Institute for Integrated Science and Society, Boston College, Chestnut Hill, MA 02467; [6]Department of Earth and Environmental Sciences, Boston College, Chestnut Hill, MA 02467.

With global food demand projected to rise by 50-60% between 2019 and 2050, understanding how crop yield and soil health respond to weather variability, particularly drought, is essential. In this study, we coupled a long-term climate dataset (1981-2020) with the biogeochemical model DNDC to simulate corn yield and soil nitrous oxide (N_2O) emissions under 20 precipitation scenarios/treatments, ranging from severe drought (-90% precipitation reduction) to extreme wet conditions (+100% precipitation addition). We quantified the interannual variability (IAV) and precipitation sensitivity of both responses. Both corn yield and soil N_2O emissions exhibited substantial IAV, but with distinct patterns: yield variability peaked under moderate drought conditions (-30% to -50% precipitation reduction), whereas variability in soil N_2O emissions intensified with increasing precipitation. Corn yield increased linearly from severe drought to ambient precipitation but plateaued when precipitation exceeded ambient levels. In contrast, soil N_2O emissions rose continuously across nearly all precipitation treatments. Under majority precipitation treatments, corn yield increased linearly with precipitation, while soil N_2O emissions only significantly changed with precipitation under drought conditions (-30% to -70%). We further identified a precipitation threshold for maximum yield and an

optimal precipitation range where precipitation enhanced yield more strongly than soil N_2O emissions. Overall, our findings reveal nonlinear and asymmetric responses of crop productivity and soil N_2O emissions to precipitation changes, underscoring the need for adaptive management strategies under increasing weather variability.

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How Do Students Think About Urban Forestry at HBCUs? Y. Chen*, D. Young, A. McElroy, and R. Archer, Department of Environmental Sciences, College of Agriculture, Tennessee State University, Nashville, TN 37209; D. Padgett, Department of History, Geography, Political Science, and Africana Studies, Tennessee State University, Nashville, TN 37209; and A. Thompson, Association of 1890 Research Directors, Greensboro, NC 27411.

As an emerging profession, urban forestry is receiving increasing interest and attention globally. Yet urban forestry student numbers and student awareness of the field as a prospective career remain low. Little is known about undergraduate students' career goals and perceptions of urban forestry at Historically Black Colleges and Universities (HBCUs). To address this gap, a 39-question online survey was developed and distributed via email to undergraduate students majoring in agriculture, environmental science, and natural resource management at all 19 land-grant HBCUs. We received 81 survey responses and found that although students valued urban forests, most (66.7%) were either only slightly knowledgeable or not knowledgeable at all about urban forestry. Most students (72.9%) were aware of urban forestry as a profession, and their awareness was related to current nature-based outdoor activities ($p=0.0298$). However, only 22% of respondents considered becoming an urban forester in the future, a result that was affected by their household income levels ($p=0.0453$). Interest in urban forestry was notably high (93%); however, only 32.1% of respondents had actively sought to learn more about the topic. Their primary sources of information included the internet, classes, consultations with professors or experts/specialists, books, and participation in conferences or meetings. Additionally, only a few respondents (26.8%) reported that their universities offer urban forestry-related courses, but 53.7% of respondents were interested in taking courses if available in the future. These findings imply the need for urban forestry program development, curriculum design, and student career support at HBCUs.

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Baseline Soil Sampling and Spatial Assessment of Vetiver Phytoremediation Using Remote Sensing and GIS Near Tennessee State University. R.S. Archer*, C. Apraku, and Z. Love, Department of Environmental Sciences, Tennessee State University, Nashville, TN 37209.

Contamination of soil and groundwater by hydrocarbons and heavy metals from large-scale fuel and additive facilities presents a significant environmental challenge, particularly near Tennessee State University's main campus farm. Addressing this issue, our project investigates the potential of vetiver grass (*Chrysopogon zizanioides*) as a cost-effective and eco-friendly phytoremediator. Preliminary soil analyses reveal elevated concentrations of iron, aluminum, calcium, manganese, and magnesium. Leveraging remote sensing and GIS technologies, we aim to quantify vetiver's phytoremediation capacity for hydrocarbon derivatives across varied spatial patterns. To establish a robust baseline, 50 soil samples were systematically collected by student researchers, with detailed records of sample coordinates, weather conditions, soil temperature, and wind speed. GIS mapping delineated agricultural plot boundaries. The experimental design includes five rows of vetiver plantings at distinct densities (two and four plants per hole) with control plots, facilitating assessment of spatial remediation effects. The project integrates medium-to-high resolution drone imagery and periodic soil health analyses to monitor remediation progress. This research will not only provide new insights into the spatial dynamics of vetiver phytoremediation but will also support broader adoption of nature-based solutions for environmental management. It highlights accessible methods for soil restoration that can be implemented by small organizations, community groups, and individual property owners. Next steps include vetiver planting and longitudinal field measurements over the coming year, with consideration for seasonal temperature variations. The study's outcomes will inform future strategies for sustainable land management and remediation.

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Unveiling Biochar properties: A dual approach with SEM and FTIR techniques. D. Baah*[1], M. Irfan[2], and K. Kpomblekou-A[2], [1]College of Art and Sciences, [2]College of Agriculture, Environment and Nutrition Sciences, Tuskegee University, Tuskegee, AL 36088, USA

Biochar is a pyrogenic carbon produced from woody biomass in the absence of oxygen at high temperatures. Biomass-derived biochar production has been demonstrated as a potentially viable strategy for developing negative carbon emission technologies as a material for effective remediation of harmful contaminants in soils and to improve soil physical and chemical properties. Seeds of a customer blend certified organic Taproot Radish (*Raphanus sativus*), Crimson Clover (*Trifolium incarnatum*) Raw, Cowpeas (*Vigna unguiculata* [L.] Walp.), Hairy Vetch (*Vigna unguiculata* [L.] Walp.) Raw, Buckwheat (*Fagopyrum esculentum* Moench), Black Oats (*Avena strigose*), Winter Barley (*Hordeum vulgare* L.), Cereal Rye (*Secale cereale*), and Oats (*Avena sativa* L.) cover crops were planted on Marvyn sandy loam soil (certified organic farm, Tuskegee University). At harvest, the mixture was cut above ground and air-dried to produce the biochar at three pyrolysis temperatures of 400°C, 500°C, and 600°C using TF1 12/60/300 Carbonite Gero furnace (Carbonite Gero Ltd, Hope Valley, England). Surface morphological properties of the biochar produced were characterized by using scanning electron microscopy and Fourier transform infrared spectroscopy to assess changes in its surface structure and functional groups. The SEM surface characterization of the samples showed presence of nanopores and entrapment channels that could enhance the ability of the biochar to retain water and nutrients as well as providing a habitat for microorganisms. By measuring how biochar absorbed infrared light, FTIR provided a spectral fingerprint that reveals presence of aromatic (**C = C**), carbonyl (**C = O**), and hydroxyl (**O-H**) bonds.

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Weather-Based Irrigation Scheduling and Comparison of Water Productivity of Soybeans under Furrow and Subsurface Drip Irrigation (SDI). A. K. Saha*, K. Rhodes, S. Susmita, Department of Agriculture, University of Arkansas at Pine Bluff, AR 71601.

Arkansas is ranked 3rd for irrigated acres in the nation. The most irrigated methods are gravity flow, which usually incur about 50% of water loss. While the Mississippi River Basin is a source of irrigation for Arkansas, the primary source is groundwater from the Mississippi River Valley Alluvial Aquifer (MRVAA). MRVAA face challenges due to the over-pumping and water levels declining that is huge concerns about the aquifer's sustainability. This study investigates the feasibility and water productivity of weather-based irrigation scheduling for normal-pressurized Subsurface drip irrigation, SDI (install ¾" diameter pipe at 5" depth from the soil surface) over conventional furrow. Soybean crop has been cultivated (plots size 20 ft X 83 ft) in late summer 2025 at UAPB campus farm (in Pine Bluff, AR) having soil type Grenada Silt loam (slopes 1 to 3%). Three irrigation systems (SDI, furrow and rainfed) were investigated in three plots. The irrigation schedule developed from historical data and applied (with adjustment) by utilizing FAO developed AquaCrop model and weather data (collected from Air & Water database, USDA NRCS). Sentek soil moisture sensors were used to monitor the variation of water content. During growing season, the soil moisture fluctuation after irrigation application, assure the feasible the normal pressurized SDI method to irrigate the soybean within, without clogging. During mid-November, the soybean will be harvested and the crop water productivity, grain and biomass yield, crop water use efficiency will be tested to identify best water saving irrigation technique.

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Impact of Pollinators in Cultivated Farmland, and Unmanaged Site with the Different Floral Plants. Y. I. Park*, Department of Agriculture, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601.

Native or solitary bees are great pollinators in nature. They don't produce honey, but they do rarely sting, unlikely honeybees. They are vital pollinators of wildflowers, garden flowers, farmlands, and generally everywhere. However, they are well-known pollinators, foraging in the area near their nests. Even though their habitats tend to be limited to a narrow range, they can serve as vital pollinators of small gardens and orchards. This research focuses on comparing cultivated land and uncultivated land (the nearest site within 10 kilometers) and how artificial impacts on land influence other factors that affect the population and diversity of pollinators in each site. I chose a farmland that either grows blueberries and blackberries, or naturally occurring varieties of both floral and non-floral plants.

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Tracking the Impact of Cover Crops on Runoff in Arkansas Agriculture. T. White*, E. Buckner, and M. Daniels. University of Arkansas at Pine Bluff, 1200 North University Drive, Pine Bluff, Arkansas 71601.

The excess nitrogen and phosphorus in surface water runoff are among the most substantial water quality concerns in Arkansas. The National Resources Conservation Service (NRCS) has developed the Mississippi River Basin Initiative (MRBI), including Arkansas as one of 13 participating states. USDA NRCS developed MRBI to address water quality concerns in the Gulf of America due to agricultural practices and activities in the Mississippi River Basin. Our lab and others are working together to implement conservation practices encouraged by NRCS to promote better water quality and quantity, enhance wildlife habitats, and restore wetlands while sustaining agricultural productivity in Arkansas. Our focus is edge-of-field monitoring with ISCO 6712 automatic samplers at a privately owned farm site in Jefferson County within the Bayou Bartholomew watershed to analyze the sediment in runoff from agricultural fields during rain and irrigation events. The first year of cover crop treatment did not show any significant difference in Nitrate + Nitrite, Orthophosphate, total nitrogen, total phosphorus, and total suspended solids concentrations in 2016. However, in 2017, there were no significant differences in loads of Nitrate + Nitrite, Orthophosphate, total nitrogen, total phosphorus, and total suspended solids. Still, total suspended solids showed a slight reduction in loads at the treatment site compared to the control site. The calculated p-value was .0759. Our research suggests that long-term usage of cover crops will help reduce the discharge of loads in the runoff.

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Spatial Variability of Atmospheric Ammonia Near Poultry Operations and Its Linkage to Water Quality in Maryland's Lower Eastern Shore and Chesapeake Bay. M. Xia*, D. G. Sauder, S. Sreenivasan, A. Khairullah, B. Bediako, B. Sahoo, H. Liu, J. Cumming, Department of Natural Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853.

The Lower Eastern Shore of Maryland is one of the nation's most concentrated poultry production regions, with broiler production rising to 36 million confined birds in 2022. Motivated by citizen concerns regarding the atmospheric ammonia concentrations near poultry operations on the Lower Eastern Shore of Maryland, a collaborative air quality monitoring initiative was launched in April 2020. This study examined fine-scale variability in atmospheric ammonia using three air quality monitoring stations established in April 2020 across distinct land-use settings. Continuous measurements of ammonia, PM2.5, PM10, and meteorological variables revealed strong differences among sites: Pocomoke, near poultry operations, had the highest average ammonia (10-12 ppb); Harmony, in a mixed agricultural–residential area, showed moderate levels; and Princess Anne, in an agricultural area, recorded the lowest. These differences reflected not only proximity to poultry houses but also agricultural farms, residential proximity, and wind conditions. The study also developed an integrated modeling system linking EPA's CMAQ atmospheric chemistry model with coastal models FVCOM and CE-QUAL-ICM to assess interactions between atmospheric deposition and aquatic systems. The atmospheric model demonstrates the spatial distribution of ammonia from various sources and its conversion to ammonium through multiphase chemical processes, strongly affecting local PM2.5 air pollution and nitrogen deposition. The ongoing water quality simulations incorporating local and remote atmospheric loading only indicate a very slight increase in ammonium concentrations, which contributes to minor oxygen depletion and seasonal hypoxia in the Chesapeake Bay, accounting for less than 5% of total summer hypoxia.

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The Cost of Persistence: Physiological Mechanisms of Resilience and Decline in Delmarva's Coastal Forests. S. Stotts*, Department of Agriculture, Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853.

The Mid-Atlantic is a global hotspot for salinity intrusion, with tidal water levels increasing 4.18-6.85 mm yr^{-1}, double the global average. This environmental forcing significantly impacts the Delmarva Peninsula, driving forest retreat at an average rate of 3.4 m yr^{-1} (reaching up to 30-50 m yr^{-1} in some areas) and leaving 'ghost forests' as a visual indicator of dramatic ecosystem change. Soil salinization and inundation trigger cascading ecological feedbacks, yet the associated long-term physiological mechanisms are not fully understood. Our interdisciplinary research utilizes standard dendrochronology, resistograph analysis (wood density), and cellular analysis to investigate these mechanisms in affected forests. The results indicate that trees on the Delmarva Peninsula exhibit remarkable resilience, often persisting in salinizing conditions for over 75 years. However, this longevity comes at a cost: salt exposure induces significantly reduced radial growth, lower wood density, and measurable cellular changes. Furthermore, it

appears that changes in weather patterns typically considered negative, such as increased atmospheric carbon dioxide and a shift toward extreme precipitation, may enhance tree survival in salinizing systems. These findings have critical implications for both the economic value of timber resources and the long-term ecological stability of coastal forest dynamics.

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Utilize Sea Level Rise Projection Model to Simulate Multiple Sea Level Rise Scenarios. Y. N. Chi*, T. J. Bishop, and C. Ngo, Department of Agriculture, Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853.

The Manokin Watershed, located in Somerset County on Maryland's Eastern Shore, comprises a diverse array of ecosystems, including agricultural lands, coastal zones, wetlands, and upland forests. These habitats are essential for maintaining regional ecosystems , supporting wildlife populations, and providing critical ecosystem services such as water purification, flood control, and carbon storage. They also underpin the economic and cultural livelihoods of local communities through agriculture, fisheries, and recreation. However, the accelerating impacts of sea level rise (SLR) pose significant threats to the ecological integrity of this watershed. This study utilizes NOAA's Sea Level Rise Viewer to model potential ecological changes under various SLR scenarios. Through geospatial analysis, the research identifies vulnerable areas, predicts marsh migration pathways, and assesses the resilience of existing habitats. The findings provide a foundation for adaptive management strategies aimed at conserving wide array of ecosystems, enhancing habitat connectivity, and guiding sustainable land-use planning. By proactively addressing the challenges posed by SLR, this research supports long-term efforts to protect the Manokin Watershed's natural resources and ensure ecological and community resilience in the face of environmental stressors.

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Using Generative AI to Create Culturally Responsive Teaching Artifacts. L. K. Rutto*, M. Comer, Department of Agriculture, Virginia State University, VA 23806.

Generative artificial intelligence (GenAI) continues to impact teaching and learning at all levels including tertiary education. As GenAI tools have evolved, the initial impulse by teachers to limit student access and penalize usage, has been overtaken by the realization that the rapidly increasing sophistication of GenAI coupled with easy access left educators with no choice but to embrace and integrate artificial intelligence into the classroom of the future. At the same time, a segment of educators has started to explore the potential of GenAI platforms to support culturally responsive education. Culturally responsive teaching (CRT) is a model that takes learner identity, background, and lived experiences into consideration during curriculum development and content delivery. Most of published research on CRT report findings on access, inclusivity, and teacher/learner competence in utilizing GenAI resources. However, our interest is in the opportunities that GenAI provide for teachers to quickly and easily generate culturally responsive image, audiovisual and animated teaching artifacts. We will report results from our work to explore fitness, and ease of use of different AI audiovisual and graphic generators (e.g. Adobe firefly, SORA, VEO, Luma, Minimax etc.) as tools for developing culturally responsive teaching aids for interactive instruction in the plant and soil sciences.

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Winter Cover Crops and Potential for Forage and as Alternative N source for Grains. M. K. Kering*[1], S. S. Narina[1], V. W. Temu[1, 1] Virginia State University, [1]Agricultural Research Station, Petersburg, VA 23803.
In the Eastern US including the Commonwealth of Virginia, fall and spring receives appreciable amount of precipitation. And for the sand textured soils found in the coastal plains of the Commonwealth of Virginia, there exist greater potential for nutrient losses in leaching during this period. Nutrients leached out of cropland can have serious consequences on the environmental quality of the Chesapeake watershed and may negatively impact marine life. Planting cool season cover crops in the fall, could help mitigate leaching losses, and allows biomass produced to be put to other economic uses. In this study, a randomized complete block design (RCBD) experiment was designed at the Virginia State University, Research and Demonstration farm. Winter rye, crimson clover, red clover and Austrian winter pea were planted in the fall. In late spring, subsamples were obtained for biomass determination, elemental composition, and forage quality attributes and crop terminated by tilling-in. Biomass yield, elemental composition and forage attributes differed among crop species. Austrian winter pea gave the greatest biomass (6.6 Mg ha^{-1}) of all

species. Legume species mean, N, P, K, ADF, and NDF were 26.7, 2.9, 22.0, 309 and 421 g kg^{-1} compared to 12.8, 2.6, 16.6, 386, and 722 g kg^{-1} found in winter rye. Because of huge biomass, Austrian pea has potential for greatest N nutrient release upon mineralization. Therefore, while cover crops in the winter months reduce leaching losses, an appropriately chosen cover crop can be managed to offer supplemental forage and/or alternative N source for incoming grain crop.

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From Toxic Waters to Barren Lands: Biotechnological Innovations in Plant Adaptation and Bioenergy Production under Heavy Metal Stress. S. Sanjaya*, Department of Biology, Agriculture Experimental Research Station, Energy and Environmental Science Institute, West Virginia State University, Institute, WV 25112; and B. Muthan, Agriculture Experimental Research Station, Energy and Environmental Science Institute, West Virginia State University, Institute, WV 25112.

Heavy metal contamination from industrial and mining activities poses severe challenges to both ecosystem health and agricultural productivity. This study integrates molecular and agronomic approaches to enhance plant resilience and productivity in contaminated environments using two model systems: the aquatic plant *Spirodela polyrhiza* (duckweed) and the bioenergy crop *Camelina sativa*. In *S. polyrhiza*, exposure to flue gas desulfurization (FGD) wastewater significantly reduced chlorophyll content and growth while stimulating lipid degradation and triacylglycerol (TAG) accumulation. Transcriptome analysis revealed upregulation of genes associated with fatty acid biosynthesis, β-oxidation, and lipid remodeling. Notably, the transcription factor WRINKLED3 (SpWRI3) was strongly induced, and its ectopic expression in *Arabidopsis thaliana* enhanced tolerance to heavy metal stress through increased glutathione levels and reduced oxidative damage. Complementary studies in *C. sativa* demonstrated that FGD gypsum, a byproduct of coal-fired power plants, served as an effective soil amendment for reclaiming degraded mine soils. FGD gypsum improved soil quality, enhanced biomass and seed yield, and enriched fatty acid composition favorable for biodiesel production. The sulfur component of FGD gypsum stimulated antioxidant and metal-chelating pathways, contributing to improved stress tolerance and seed quality. Together, these findings provide new insights into molecular and physiological adaptations to heavy metal stress and present sustainable biotechnological strategies for environmental remediation and bioenergy crop production on marginal and contaminated lands.

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Use of Biochar to Improve Soil Productivity and Resiliency. A. Hass*; West Virginia State University Land Grant Program, Agriculture and Environmental Experimental Station, Institute, WV 25112.

Conventional agronomic practices lead to depletion in soil organic matter and overall decline in inherent soil fertility and health. The problem is even more acute in reclaimed mine lands due to limited inputs during the reclamation process. Use of biochar, a charcoal-like material as soil amendment can improve soil productivity. In this field study we evaluate the impact of different biochar application rates (0 to 96 Mt ha^{-1}) on fertility and health of five different soils (three reclaimed mine sites soils, one pasture on Gilpin soil series, and one agronomic rotational farmland on Lakin soil series). Mixed hardwood biochar was applied and sites were tilled and sawn with pasture mix and winter wheat during the fall of 2024. Sites were instrumented with a weather station and selected treatments and plots were instrumented at depth of 10 cm with soil sensors monitoring moisture/temperature/salinity on 15 min intervals. Additionally, sites were harvested and soil sampled from all plots at the end of the growing season and tested for fertility attributes. Field monitoring results show significant increase in soil moisture, with a wide stepwise difference between low application rates (<12 Mt ha^{-1}) vs high application rates (> 48 Mt ha^{-1}), suggesting wide room for optimization. Biochar application did not affect yield nor adversely affect soil temperature. Yet, high application rates did let to elevated salinity. While fitting biochar type and application rates to soil type and land use needs further optimization, the practice seemed to have an overall positive impact on soil properties.

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Does Meiotic Recombination Differ across Lineages and Sexes? - Genetic and Epigenetic Regulation of Crossover Dynamics in Maize. G. Lee*, Department of Biology, West Virginia State University, Institute, WV 25112;

B. Wosti, Department of Biology, West Virginia State University, Institute, WV 25112; E. Ojo, Department of Biology, West Virginia State University, Institute, WV 25112; Meixia Zhao, Department of Microbiology and Cell Science, University of Florida, Gainesville, FL 32611.

Meiotic recombination is a fundamental biological process that generates crossovers (COs) during meiosis, contributing to genetic diversity in offspring. While several mechanisms underlying CO formation in plants have been characterized, a comprehensive understanding of CO patterns and their regulation, particularly across sexes and lineages, remains to be elucidated. In this study, we investigated variation and regulatory factors influencing meiotic recombination dynamics using male and female maize lines derived from distinct climate zones. Through analyses of CO landscapes based on multiple genome sequencing datasets of hybrid crosses, we found that recombination patterns differ significantly between tropical and temperate lines in males, while remaining relatively stable in females. Transcriptomic profiling revealed that synapsis-related genes and heat shock proteins exhibit differential expression between temperate and tropical maize lines during male meiosis, suggesting pivotal roles for CO interference and stress-response pathways in shaping meiotic recombination dynamics. Additionally, through epigenetic analysis, we observed that standing variation in DNA methylation, particularly CHH methylation, may influence recombination variability in female meiocytes across lineages. These findings, together with further investigations into genetic and epigenetic factors, deepen our understanding of sex-dependent meiotic recombination as shaped by genetic background and cultivar origin, advancing strategies for crop breeding and genetic diversification.

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Determinants of Marketing Channel Choices Among Small Ruminant Producers in the Midwest of United States. M. Ansah* and Ye Su, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101.

This study examines factors influencing marketing choices for small ruminant producers in the U.S. Midwest, using survey data from 270 sheep and 105 goat farmers. The analysis explores how economic, profitability, production systems, and market access shape marketing behavior across auction yards, direct on-farm sales, and online platforms. Results show that auction yards are the most common outlet, used by 83 percent of sheep producers and 71 percent of goat producers, followed by direct on-farm sales (43 and 41 percent, respectively). Only about 7 to 10 percent of producers use online or social media marketing. Profitability and proximity are the main factors affecting marketing choices, with 42 percent of sheep and 34 percent of goat producers citing these as their primary reasons for channel selection. Approximately half of sheep producers report earning profits compared to 26 percent of goat producers, although many remain dissatisfied with their returns. Production systems are predominantly semi-intensive, with over 90 percent combining grazing and feeding. Most producers operate on less than 50 acres, and feed is the largest production expense, reported by 95 percent of sheep and 90 percent of goat producers, followed by fencing and veterinary services. More than 90 percent rely on family labor, while hired labor is limited to about one-third of sheep and one-tenth of goat farms. Overall, small ruminant marketing in the United States remains concentrated in traditional systems, suggesting opportunities to expand access to cooperative, digital, and value-added markets.

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Does farming social capital among Missouri Latino farmers influence access and use of USDA Programs, which facilitate the adoption of sustainable practices in an adverse weather era? E. Gonzalez*, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101.

This research focuses on the extent to which the Latino farming community's levels of social capital facilitate the adoption of sustainable and regenerative farming practices. Accessing USDA farming support among non-traditional farmers, such as Latino, Black, and other farmers with limited resources to grow food, has been a historical and ongoing challenge within these communities (Gonzalez, 2017; Horts et al., 2023). We employed a mixed-methods approach to assessing the level of social capital among fifty Latino farmers when interacting with community formal and informal networks, which can lead to either dense or poor social capital levels. Data collected from face-to-face surveys of fifty Latino producers and open-ended focus group interviews were gathered and analyzed to evaluate the levels of social and inhome interactions that related to farming duties among family members, neighbors, other farmers, friends, coworkers, community members, USDA government representatives, and religious leaders. Levels of formal and informal interactions led to different social capital in the neighborhoods where they socialize, observing

significantly strong, dense networks among bonding relations, like trust and solidarity, among networks that they frequently use. Poor bonding relations with formal community networks that lead to USDA support programs were frequently observed. Significantly low levels of social capital in the form of trust and solidarity might keep farmers from adopting sustainable farming and regenerative production practices that aim to increase their resilience to adverse weather environments.

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Growing Beyond Barriers: The UMES Alternative Agriculture Model for Farmer Success. *N.M. Burton**, Extension Department, University of Maryland Eastern Shore, Princess Anne, MD 21853.

The University of Maryland Eastern Shore (UMES) launched the Alternative Agricultural Tract in 2018 to support small farmers interested in producing ethnic crops; foods with cultural significance for immigrant, and diaspora communities, including callaloo, bitter melon, cassava and hibiscus. Although farmer interest was high, many were hesitant to capitalize on these opportunities. Between 2018 and 2021, the program trained over 2,000 farmers, yet only 10% diversified their crops, underscoring the need for more firsthand support. To increase impact, UMES partnered with small farmers to establish the Around the Bay Farmers' Alliance, Inc. (ATBFA), a farmer-led network focused on shared learning, aggregation, and market access. Building on this model, UMES introduced the Alternative Crops Class in 2023, offering intensive, applied training. The first cohort of 18 farmers produced 158,000 pounds of ethnic crops and achieved a 100% retention rate, a major improvement from earlier years. ATBFA membership grew from 10 to 65 farmers, with 15 active members now marketing over 250 tons of produce annually, up from 20,000 pounds in the program's first year. Through this integrated approach, ATBFA secured over $350,000 in grants, grew indoor production space from 3,000 to 40,000 square feet, and added over $200,000 in assets such as refrigerated trucks, coolers, forklifts, and a pavilion supporting cold chain and training. This model of education, research, and farmer collaboration demonstrates how targeted technical assistance and continuous learning can enhance resilience, profitability, and sustainability among farmers across Maryland's Eastern Shore and beyond.

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The Economic Contribution and Structural Linkages of Oklahoma's Goat Industry. B.A. Atilola*; Whittaker Wesley; Nirodha De Silva; Nyairo Newton; James Arati; Shannon Giscombe, Langston University, Langston, OK 73050

The goat industry plays an increasingly visible role in Oklahoma's livestock economy, yet its broader economic significance has not been systematically evaluated. This study provides the first integrated assessment of the industry's upstream production activities and downstream processing and distribution functions within the state economy. Using regional input–output modeling and industry-level spending patterns, we quantify the overall economic importance of goat production and processing, emphasizing the structure of linkages that connect primary producers to manufacturing, transportation, food service, and other supporting sectors. The analysis reveals clear patterns in how the industry's direct activities translate into secondary contributions across the wider economy. Upstream production exhibits a concentrated footprint with limited spillover activity beyond agriculture, while downstream transformation shows more diverse connections to non-agricultural industries. These patterns highlight a structural contrast between production-focused and transformation-driven segments of the value chain. Overall results indicate that the goat industry offers measurable economic contributions and presents opportunities for expansion through enhanced local linkages, value-added processing, and supply-chain development. By characterizing the industry's role within Oklahoma's economic system, this study provides a foundation for future research and evidence-based policymaking aimed at strengthening regional livestock diversification and rural economic development.

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Does Consumer Care Low-carbon Technologies? Evidence from Willingness to Pay for Low-Carbon Cherry Tomatoes Across Technologies and Retail Outlets. R. Chen*, Dept. of Ag. and Envi. Sciences, Tuskegee University, Tuskegee, AL 36088, A. Xu, Dept. of Agriculture, Fort Hayes State University, Hays, KS 67601.

Sustainable food production in controlled environment agriculture (CEA) requires minimizing environmental impacts while ensuring economic viability. Low-carbon technologies, including energy efficiency, plant trait enhancements,

and water conservation, play a crucial role in improving the environmental performance of CEA. However, a limited understanding of consumer responses to carbon reduction and low-carbon technologies hinders low-carbon market expansion. Using a nationally representative discrete choice experiment on greenhouse cherry tomatoes, we estimate the willingness to pay (WTP) for incremental carbon reductions (10–30%) and for seven low-carbon technologies—seasonal production, AI optimization, bioenergy heating, pathogen-free wastewater irrigation, and GMOs—across food retail outlets. Consumers are willing to pay about 17–39% more for products with 10–30% carbon reduction, with evidence of substitution with USDA Organic certification. Preferred technologies include seasonal production, AI optimization, bioenergy heating, and pathogen-free wastewater irrigation, whereas GMO technology is widely disfavored. Consumer responses to low-carbon food technologies vary by retail channel. Specialty-store shoppers are more receptive to microorganism-based methods but expressed concern about the use of AI in food production; discount-store shoppers responded negatively to microorganism applications; farmers' market placed a high value on seasonality; warehouse-club shoppers showed a clear aversion to seasonality and bioenergy. The findings suggest that low-carbon certification and tailored marketing strategies can enhance marketability in CEA. This study provides actionable insights, emphasizing the potential for the low-carbon market and the importance of aligning technology development and food retail outlets with consumer preferences to maximize environmental and economic benefits.

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A Bayesian Triple-Hurdle Model of Maize Market Participation in Zambia. W. J. Burke*, Department of Agriculture, Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853; J. N. Ng'ombe*, North Carolina A&T State University, A. Bwalya, University of Zambia, R. N. Kiwanuka-Lubinda, University of Zambia, K. N. Addai, Griffith University, and J. Han, University of Arkansas.

Smallholder participation in agricultural markets is vital for rural livelihoods and economic transformation in sub-Saharan Africa, yet many farmers remain partially or fully excluded from market opportunities. This study applies a novel Bayesian triple-hurdle model to analyze maize market participation among 7,932 smallholder households in Zambia, examining three decisions: whether to produce maize, whether to sell, and how much to sell. The Bayesian framework provides an alternative to conventional frequentist estimation, allowing incorporation of prior information and probabilistic interpretation of uncertainty, which helps stabilize estimation in data-intensive models such as the triple-hurdle, particularly when sample sizes diminish across stages. Results show that while 90% of rural households grow maize, only about half engage in market sales. Key determinants of participation and sales include household characteristics (age, gender, education), institutional factors (access to extension services, farmer organization membership), and agro-ecological conditions. Findings suggest that broadening market participation requires targeted interventions, including tailored training for youth and women, improved extension delivery models, and enhanced access to irrigation and market information. The Bayesian approach demonstrates strong potential for advancing evidence-based policy design in agricultural systems and community development.

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Drivers and Barriers to Cowpea Farming Adoption in Ghana. N. Pattanaik*, M. Ibrahim, B. Cornish, Fort Valley State University, Fort Valley, GA; J. Bukenya, Alabama A & M University, Huntsville, AL; A. Y. Seini, University for Development Studies, Tamale, Ghana.

Cowpea (*Vigna unguiculata*) is a protein-rich legume widely cultivated in West Africa, including Ghana, where the bulk of production is concentrated in the Upper West, Upper East, Northern, and Brong Ahafo regions. As the most economically important indigenous legume crop, expanded cowpea production offers opportunities for smallholder farmers. This study investigated farmer motivations and challenges in adopting and expanding cowpea as a cash crop through surveys of 593 producers across four districts: East Gonja, Savelugu, West Mamprusi, and Yendi. Farmers were asked about economic, agronomic, and environmental factors influencing cowpea production. Results showed that market incentives strongly influenced adoption; when presented with a scenario where cowpea prices were higher than maize, one-third of farmers indicated willingness to shift all maize acreage to cowpea cultivation. Farmers reported Tumagli (35%), Apagba alla (28%), and Padi Tuya (25%) as the most commonly grown varieties. Access to credit and farmer demographics were identified as key factors supporting the expansion of cowpea farming. These findings highlight both the economic potential and structural challenges of scaling up cowpea production in Ghana, offering insights for policies that promote legume-based agricultural sustainability.

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Cultivating Career Awareness in Food, Nutrition and Agriculture; An Immersive Professional Development Program for High School STEM Teachers and Counselors. J.J. Quinlan*, Food Security Research Center, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Workforce development programs with an emphasis on careers in food science, nutrition and agriculture are lacking. This project aimed to develop, implement, and assess a 4-week professional development program for high school STEM teachers and counselors focusing on food science, urban agriculture and nutrition. The Summer Food, Urban Agriculture, and Nutrition (FUN) Program allowed teachers and counselors to learn from university faculty and industry professionals about careers and resources in food science, nutrition, and agriculture. It used a combination of immersive laboratory, farm, and kitchen activities, field trips, lectures, guest speakers, and group projects. It helped educators to advance their knowledge about skills and degrees needed for entry level roles within these disciplines. The program successfully recruited three cohorts of teachers and counselors in the Summers of 2023, 2024 and 2025 for a total of 63 participants. Analysis of the first 2 cohorts found that educators reported a significant increase in overall understanding of food, nutrition, and agriculture careers (pretest mean: 3.5, posttest mean: 4.3, $p < 0.05$) and a highly significant increase in confidence promoting these careers (pretest mean: 1, posttest mean: 4, $p < 0.001$). Given the average teacher class size (20) and counselor workload (394) in Philadelphia, where the program was run, up to 13,000 students stand to indirectly benefit from knowledge gained through this program. This program serves as a model with great potential to be adapted to rural areas in Texas and elsewhere with a focus on animal and food production, nutrition and agriculture.

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Mobilizing Against Threats to Community Health- MATCH^3. N. M. Estwick*, S. Glover, M. Eley, K. Davis, F. Stribling III, H. English, R. Farid-Tilghman, M. Robinson, C. Bradley, G. Sorola, A. Igwenagu. Prairie View A&M University, Prairie View, CAFNR Research, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446, University of South Carolina, North Carolina A&T State University, Florida A&M University, Tennessee State University, University of Arkansas Pine Bluff, Tuskegee University, Fort Valley State University.

There is need for a better understanding of strategies that enlarge the extent to which farming communities are aware of and prepare for disasters. In 2017, the 1890-Extension Disaster Education Network (EDEN) Advisory Group (AG) was created to fully engage 1890-Land Grant Universities (LGUs) into EDEN and its resources. The 1890- EDEN AG mission is to strengthen the capacity of 1890 institutions to provide education and training related to the newest NIFA Knowledge Area (KA 807). Community Based Participatory Research (CBPR) informs this work, in that CBPR is the ideal methodology for working with communities. The study revealed the need to increase disaster awareness and education programs in the producer communities 1890 institutions serve. The research and extension 1890 partnership spearheading this study is well positioned to help producers mitigate loss of quality products they produce and maintain operations in times of disaster. In addition, working with the various local, state and Federal agencies, and private sector partners has generated new insights and/or perspectives on how to provide relevant information on disaster management practices for 1890 network clientele.

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Which Educational Experiences Attract More Visits to Agritourism Operations in the US? Evidence from a National Survey of Agritourism and On-Farm Direct Sales. P. B. Bhandari*, Lila Karki, E. N. Escobar, and Moses T. Kairo. UMES Extension, University of Maryland Eastern Shore, Princess Anne, MD 21853.

Agritourism operations offer various attractions to attract visitors and enhance profitability. They offer education, recreation, entertainment, farm stays, and direct sales to increase the number of visitors. Among educational experiences are classes, farm tours, hands-on work experiences, tastings, and demonstrations to attract visitors, which are important from an Extension perspective. Evidence from our previous studies shows that number of offerings, including on-farm direct sales, attracted significantly more visitors to a farm and increased profitability. However, which specific types of educational experiences attract more visits to agritourism operations is yet to be answered. To

our knowledge, existing agritourism literature lacks this evidence. Using the nationally representative data from a U.S. national survey of operators collected in 2020, we address this gap. Of 1,834 agritourism operations that were reported in the survey, 53% (n=963) provided educational experiences to visitors. These operators offered farm tours (79%), visits to students (60%), classes (41%), and demonstrations (40.6%). Others were, respectively, tastings, farm or ranch work experience, petting areas, camps, and more. The number of visits to a farm varied by the types of educational experiences offered. The adjusted results from multivariate analyses (OLS regression) revealed that while more educational attractions significantly ($p<.01$) increased the number of visits to a farm, specifically, tasting ($p<.05$), petting zoo ($p<.01$), and farm demonstrations ($p<01$) significantly increased the number of visits, implying that some educational activities are more important in attracting visitors than others. This evidence is important for farmers, policymakers, and Extension educators engaged in developing or promoting agritourism.

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Content analysis and review of agricultural literature for children and families to support food science, nutrition education, and health through books. C.M. Sewer*, Department of Human Ecology, University of Maryland Eastern Shore, Princess Anne, Maryland, 21853.

Gianferrari and Mikai (2023) use an educational book on agriculture, specifically representing the farming of food, and also sharing healthy habits from seed to soil for children. In this content analysis, many children's books have been found to support the definition of "agricultural literature" for children from PreK to 12th grade. Agricultural literature is defined as literature on agricultural sciences and farming, picture books, and reading materials that define the science of agriculture, nutrition education, and ways to decrease obesity through healthy foods grown through farming. Using nutrition education to increase healthy lives through agricultural literature at home, school, and in the community is the beginning of innovative approaches to increasing best practices for a healthy future for everyone. Agricultural literature about the science of agriculture from seed to soil, maintaining healthy habits, nutritional value of foods harvested, and plants used for healing, i.e., fruits and vegetables necessary for children's healthy growth and development. Using search engines to locate and exhaust searches using the search term, "agricultural literature", and located and created a database specifically for children from PreK to 12th grade. This content analysis resulted in a database of agricultural literature based on grade level, organized into categories: agricultural science and nutrition education. This content analysis also resulted in the agricultural literature database being categorized and grouped into four developmental domains based on children's development: physical, intellectual, emotional, and social, called P.I.E.S., a framework for learning (Sewer, 2018). Microsoft 365 Excel will store the agricultural literature database.

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Leveraging Partnerships among 1890 Institutions to Enhance Students' Experiential Learning and Food Security in the U.S. and Globally through Faculty Engagements. C.I. Nindo*, S.L. Tubene, S.A. Zebelo, S.A. Dhekney, Department of Agriculture, Food, and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, Maryland 21853; J. Obuya, Southern University Agricultural Research and Extension Center, P.O. Box 10010, Baton Rouge, LA 70813; F.O. Aila, Department of Business Administration, Maseno University, Kenya; E. Okoth, Department of Food Science and Technology, Jomo Kenyatta University of Agriculture and Technology, P.O. Box 62000 – 00200 Nairobi, Kenya.

Economic growth and stability in some of the fastest-growing African countries—despite the abundant human and agricultural resources—are threatened by stressors such as unpredictable weather patterns, the emergence of new crop pests and diseases, and downward trends in agricultural productivity These challenges exacerbate food insecurity in those countries and negatively impact U.S. agricultural trade. The Center of Excellence for Global Food Security and Defense (CEGFSD) has been at the forefront in providing experiential learning opportunities for students and spearheading faculty research activities by leveraging the partnerships it has created among the "19-Strong" 1890 Institutions and their respective international networks. The goal of the Eastern Africa Cluster within the CEGFSD is to strengthen agricultural development and address new and emerging animal/plant pests and diseases both in the U.S., Kenya, the Democratic Republic of Congo (DRC), and in the broader region. Those efforts that started before global COVID-19 pandemic were slowed down somewhat, but the lessons learned and the evolving policy landscapes informed strategic adjustments to address food insecurity and training of students to better address the eight interlinked Center priorities, namely, agricultural productivity, reduction of global poverty, enhancement of global food supply chains, improving food safety, impacts of trade on food availability, access, use, and stability, advancement of the

long-term prosperity of the U.S. through global food security and defense initiatives, global ecological change, and emerging technologies. This presentation highlights some of the efforts to strengthen collaborative partnerships, faculty engagements, and student experiences in Kenya and the DRC.

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Fair Treatment and Superfund Remediation: the Perception of the Environmental, Economic, and Energy Academy Cohorts. O. Ojarikre *, Land Grant Program, Department of Integrative Public Policy and Development. College of Agriculture, Environment & Nutrition Sciences (CAENS), Tuskegee University, 1200 W. Montgomery Rd, Tuskegee, AL 36088.

Fair treatment and Superfund remediation are two significant topics often discussed for their impact on many communities. Fir treatment regardless of race and ethnicity became a focus through an executive order by President Bill Clinton in 1994, aiming to provide fairness for low-income populations and who have been disproportionately affected by environmental changes. The Superfund law, enacted by Congress in 1980, was established to address the cleanup of sites contaminated by such activities and hold responsible parties accountable. Both programs seek to improve environmental and public health. A survey conducted as part of a research project, evaluating the perceptions of participants in the Environmental, Economic, and Energy Academy—a community leadership training program organized by Tuskegee University for the Southeast region—found that most respondents either slightly disagreed or had neutral opinions regarding the effectiveness of both programs.

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Establishing and Evaluating an Interdisciplinary Volunteer Income Tax Assistance (VITA) Program at North Carolina A&T State University. D. Dixon*, V. L. Giddings, M. Williams-Wheeler, Department of Family and Consumer Sciences, North Carolina Agricultural and Technical State University, Greensboro, NC 27411; S. Johnson, Center of Excellence for Entrepreneurship & Innovation, North Carolina Agricultural and Technical State University, Greensboro, NC 27411; W. Golden, Charles Schwab Financial Planning Center, University of Georgia, Athens, GA 30602; E. Acquah, Department of Nutrition, University of North Carolina- Greensboro, Greensboro, NC 27412.

The Volunteer Income Tax Assistance (VITA) program, established by the Internal Revenue Service to support financial literacy and community engagement, provides free tax preparation services to low- and moderate-income individuals while offering applied learning experiences for volunteers. North Carolina Agricultural and Technical State University (N.C. A&T) has launched a sustainable, interdisciplinary VITA initiative supported by a Higher Education Challenge Grant in partnership with the University of Georgia. This program unites faculty and students across disciplines, including accounting, family and consumer sciences, engineering, and food science, to enhance both workforce readiness and community impact. This project explores the implementation process and evaluates students' motivations, perceptions, and reflections on their participation in the VITA program. Early findings indicate that participants were motivated by the opportunity to strengthen professional skills while contributing meaningful service to local communities. Students reported enhanced confidence, communication, and problem-solving skills, along with a deeper understanding of financial and civic responsibility. The interdisciplinary design encourages collaboration and experiential learning, integrating academic theory with practical application. Although logistical and resource challenges emerged during the program's first year, outcomes demonstrate substantial benefits for student learning and community engagement. The initiative serves as a replicable model for expanding service-learning programs that promote economic empowerment, leadership development, and social responsibility among student populations.

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Does Cellphone Banking Change Lives? Fintech and Poverty in Kenya. D.T. Adu*, Department of Agriculture, Alcorn State University, Lorman, MS 39096; and V. Hartarska, Department of Agricultural Economics and Rural Sociology, Auburn University, Auburn, AL 36849.

Fintech is transforming financial markets globally by expanding access to financial services, par-ticularly for individuals with limited access to traditional banking. While some scholars remain skeptical about its potential, others liken its impact to that of the Industrial Revolution. How- ever, there is limited empirical evidence establishing a causal relationship between Fintech and economic outcomes. This study estimates the causal impact of Fintech on

poverty in Kenya usingdata from 2000 to 2017. Employing the synthetic control method alongside multiple robustness checks, we assess the introduction of *M-Shwari*—a mobile-based digital credit and savings plat- form developed by the Commercial Bank of Africa and Safaricom Plc and targeting poor clients excluded from the formal financial system. Our findings indicate that this innovation has significantly reduced poverty: the per capita poverty rate below US$1.90 and US$3.20 decreased by10% and 4%, respectively. Additionally, using the national poverty rate as a robustness check, wefind a sustained decline of approximately 4%, further supporting our main results. These findings provide robust evidence of Fintech's role in poverty alleviation.

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Unintended Consequences of Monetary Policy: Impacts of Inflation and Interest Rates on Rural Business and Household Resilience in Post-Pandemic Missouri. D. Giwa-Daramola* and Y. Su, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101; S. Mukembo, Division of Applied Social Sciences, University of Missouri, Columbia, MO 65201.

The COVID-19 pandemic triggered significant macroeconomic disruptions, including high inflation and interest rates, which disproportionately affected rural communities across Missouri. This research evaluates the impacts of these inflationary and monetary shocks on Missouri rural households and businesses in the post-pandemic period and their ability to adapt and stay resilience, which is the ability to deal with the shocks to maintain their status. Using secondary data from the Bureau of Labor Statistics and the Missouri Department of Revenue, the study identifies key vulnerabilities and adaptive strategies within Missouri's rural economy. The empirical analysis focuses on how rising input costs, unemployment rate, and weakened consumer purchasing power have impacted rural households and businesses differently from their urban counterparts. The analysis will also find how rural residents and businesses cope with these unintended consequences and stay resilient. These findings will advance understanding of the impact of unintended consequences, such as inflation arising from monetary policies aimed at mitigating the economic impact of the pandemic and provide evidence-based guidance for policymakers and stakeholders seeking to strengthen rural economic recovery and promote rural resilience.

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Expanding Academic and Workforce Pathways Through Undergraduate Study Away Experiences: The Case of the National Student Exchange (NSE) Program. L. Asare-Baah* and O. Bolden-Tiller, Tuskegee University, Tuskegee, AL 36088.

Undergraduate study away programs such as the National Student Exchange (NSE) provide students with unique opportunities to advance academic goals, gain workforce-ready skills, and engage across diverse cultural and institutional settings. These experiences are particularly valuable for students seeking to access courses, faculty expertise, or research opportunities unavailable at their home institutions. By temporarily relocating to a partner campus for a semester or academic year, students enhance their academic flexibility, explore new disciplines, and build professional networks that support long-term career development. This study examines the impact of the NSE program through a case study approach focused on student workforce development and graduate/professional school readiness. A qualitative method was employed, including structured surveys and semi-structured interviews with outbound students from Tuskegee University who completed study away experiences at other NSE member institutions. Survey items assessed academic growth, networking access, and perceived readiness for workforce and post-graduate opportunities. Interview data were thematically analyzed to capture students' reflections on academic enhancement, cultural exposure, and career confidence. Preliminary findings suggest that NSE participation significantly supports outbound students' success by expanding educational access, improving self-efficacy, and fostering professional preparedness. The results highlight the role of mobility-based programs in shaping student outcomes and building stronger pathways to graduate or professional education and workforce preparedness, especially for students from resource-limited institutions. Outbound students chose out-of-state campuses such as Iowa State University, Michigan Technological University, and Oklahoma State University, among others. These insights offer valuable direction for institutions aiming to increase equity.

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Trusted Messengers as Health Information Griots in Rural Communities: An Exploratory Study F.H. Jackson*, Department of Agricultural and Environmental Sciences, Tuskegee University, Tuskegee, AL 36088 and L.B. Hall, Tuskegee Area Diabetes Support Group, Tuskegee, AL 36088

Rural communities in Alabama's Black Belt experience a disproportionate incidence of chronic disease and multimorbidity. Statewide, six in 10 adults have at least one chronic condition and four in ten have two or more, with even higher rates in Black Belt counties. Hypertension, diabetes, and cardiovascular diseases contribute to persistent disparities in premature mortality and preventable hospitalizations. Physical access to care is limited – with some counties, including Lowndes, Perry, and Pickens, lacking any hospital facility. Rural Alabama residents live an average of 10.5 miles from a hospital, compared to 4.4 miles for urban residents; some Black Belt residents report traveling over an hour to receive care. Insurance and health promotion access further complicate the health and wellness landscape. In the 12 core Black Belt counties, 43% of residents are Medicaid-eligible. Near 10% of Alabama adults are uninsured, and 11% report cost-related barriers to care. The relative scarcity of privately insured populations limits preventive health programs in these areas. Within this constrained system, culturally congruent health communication emerges as a vital strategy. This presentation amplifies one grassroots health education support group and offers a framework to describe a scalable health education translation model for rural communities. In these settings, trusted community agents-faith leaders, elders, and lay health workers-act as "griots," translating health information into locally resonant forms. The proposed mixed-methods study explores how chronic disease patterns, access gaps, and communication disparities intersect, and how trusted messengers can help strengthen rural health resilience and advance health equity.

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Shifting Grounds: Structural Dependence and Economic Transition in West Virginia's Coal Mining Counties. S. Bandara*; Department of Economics, Finance and Marketing, West Virginia State University, Institute, WV, USA

Coal mining has historically shaped West Virginia's economy, yet its decline has produced uneven economic outcomes across counties. This study examines county-level dependence on coal mining and patterns of sectoral diversification using employment data from 2001 to 2020. Key metrics include Mining Employment Share (MES), Herfindahl–Hirschman Index (HHI), and Location Quotient (LQ), capturing absolute dependence, economic concentration, and relative specialization. Counties are classified into high, moderate, and low dependence groups to highlight potential vulnerabilities and resilience. Regression analysis explores associations between these measures and outcomes such as household income, poverty, and employment in non-mining sectors. This framework provides insights into structural economic transitions in post-coal Appalachia and informs strategies for targeted regional development and diversification.

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Impact of Ethnicity of Extension Officers on Small Farmers' Reception and Adoption of Innovations in the United States of America: A Review. D.K. Agyare* and E. Gonzalez, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101.

This review paper examines how the ethnicity of extension officers affects small farmers' acceptance and adoption of innovations in the USA. It focuses on the effectiveness of extension services and highlights the measurable outcomes aimed at addressing the inconsistencies in extension services provided to ethnically diverse farmers. The objective of the review was to evaluate the impact of extension officers' ethnicity on communication effectiveness, to identify tangible outcomes. A systematic analysis of qualitative, quantitative, and mixed-methods studies on Black American, Latino, and immigrant farmers across several U.S. states was conducted. The review highlights a strong link between ethnic congruence—where extension officers share the same ethnic background as farmers—and increased trust and communication. This is enhanced by cultural competency training for extension officers, which helps them navigate cultural nuances. Bilingual resources are essential for effective communication and understanding. While culturally tailored interventions and network support enhance innovation adoption, challenges like language barriers and institutional distrust remain. Farmers express greater contentment with extension services that are responsive to their ethnic and cultural backgrounds, which is linked to benefits such as higher income, improved market access, and strengthened community empowerment. However, research is constrained by limited sample sizes, a lack of longitudinal studies, and insufficient representation of diverse ethnic groups beyond Black Americans and Latinos.

These results highlight the importance of incorporating ethnic alignment and cultural understanding into extension programs to enhance inclusivity and effectiveness, guiding policy and practice directed at equitable dissemination of innovations among small-scale farmers.

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Bridging Science, Education, and Community: The UAPB Discovery Farm Approach.I. Young*, T. White. UAPB Discovery Farm Educational Center, University of Arkansas at Pine Bluff, Pine Bluff, Arkansas 71601.

The University of Arkansas at Pine Bluff (UAPB), a proud 1890 Land-Grant institution, is advancing a new model for agricultural education and community engagement through the Discovery Farm Educational Center. Anchored in UAPB's School of Agriculture, Fisheries, and Human Sciences, this initiative addresses critical challenges in sustainable agriculture, water quality, and environmental conservation—while actively inspiring the next generation of agricultural professionals. The Center offers experiential learning through on-farm demonstration plots, mobile labs, and K–12 programs including 4-H clubs, summer camps, and Junior MANRRS chapters. Strategic initiatives like the Conyer's Discovery Farm and the Farm to School program use real-world settings to teach best management practices, promote healthy eating, and foster environmental stewardship. In partnership with USDA-NRCS and the Mississippi River Basin Initiative, UAPB is also conducting edge-of-field monitoring to generate actionable data on runoff, water use, and habitat conservation. This presentation will highlight how UAPB is leveraging its land-grant mission, partnerships, and field-based education to create scalable, community-driven solutions that support sustainable agriculture in the Delta and beyond.

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Take What You Have to Make What You Need: Can Small-Scale African American Farmers Help Alleviate Food Insecurity in the Alabama Black Belt Counties. F. O. Adalumo-Ntam *, The College of Agriculture, Environment and Nutrition Sciences (CAENS), Tuskegee University, AL 36088.

Food insecurity continues to affect millions of Americans across all demographics. The Alabama Black Belt Counties (ABBCs) experience particularly high levels of food inaccessibility. This study examines the role of small-scale African American farmers in addressing food insecurity within the ABBCs. It also explores the involvement of the United States Department of Agriculture (USDA) in supporting small farmers' productivity and improving food access. The study applies statistical and spatial analysis to map food insecurity and food access indices in the region. Geographic Information Systems (GIS) and U.S. Census data were used to assess the distribution of African American farms and food access levels. Overall findings indicate that western Black Belt counties show higher vulnerability compared to eastern counties. A second component of the study evaluates the willingness of local food producers to use food hubs to enhance distribution and access. Responses from farmers were collected through an online survey. General results suggest that land ownership, gender, and education influence willingness to participate in USDA-supported food hub programs. The research emphasizes that empowering African American farmers can strengthen local food systems. It concludes that targeted education and USDA-backed initiatives can improve farmers' productivity and expand food access across the Black Belt region.

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Revenge Travel and the Impact on Tourism. S. Goldmon*, School of Agriculture, Fisheries and Human Sciences University of Arkansas at Pine Bluff, 1200 North University Dr., Pine Bluff, AR 71601.

The tourism industry has seen remarkable growth in recent years, especially after the global COVID-19 pandemic. This revival, often referred to as "revenge travel," reflects the widespread desire among individuals to explore the world after enduring prolonged lockdowns and restrictions. Today, many travelers are in search of meaningful experiences that include visits to historical landmarks, engagement with local cultures, and opportunities to indulge in exotic cuisines and breathtaking destinations. This shift has accelerated the growth of cultural tourism, fostering economic recovery in various regions and increasing the demand for skilled professionals in the sector. This study seeks to investigate the underlying motivations driving revenge travel and to evaluate its wider implications for the tourism industry. It considers whether tourism management academic programs should modify their curriculum to align with the evolving demands of the industry. The research employs a combination of quantitative and qualitative methods to capture traveler motivations, behavioral trends, and the insight of educators and industry professionals.

The literature suggests a strong desire among travelers to reconnect with the world and prioritize personal fulfillment through experiential travel. The study anticipates that continued post-pandemic growth in tourism will lead to academic institutions reassessing their educational frameworks, ensuring that future professionals are equipped to address emerging trends in a rapidly changing global tourism environment.

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Integrative Genomic and qPCR-Based Expression Analysis of Protein Phosphatase Gene Families in Sweet Potato (*Ipomoea batatas* L.) for Enhanced Stress Resilience and Sustainable Agriculture.
M. Azad*, N. Ibnat, S.S. Chowdhury, and S. Islam**,** Department of Agriculture/Agricultural Regulations, University of Arkansas at Pine Bluff, 1200 North University Dr., Pine Bluff, AR 71601; M. Rabbi, and A. Ghosh, Department of Biochemistry and Molecular Biology, Shahjalal University of Science and Technology, Sylhet, 3114, Bangladesh.

Protein phosphatases, particularly members of the PP2C (Protein Phosphatase 2C) family, play crucial roles in regulating cellular signaling by catalyzing the removal of phosphate groups from target proteins. Numerous biological processes, such as hormone signaling, reactions to heat and drought stress, and abiotic stress tolerance, are impacted by this dephosphorylation process. This study presents comprehensive genomic analysis, evolutionary assessment and transcript profiling of the PP2C gene family in sweet potato, a crop of major agricultural and nutritional importance. A total of 74 type 2C protein phosphatases (PP2C) genes have been identified in sweet potato. Among them, 7 gene pairs were identified as segmental duplication while 5 pairs as tandem duplications. Phylogenetic analysis grouped them into distinct clusters, indicating potential functional divergence and evolutionary relationships among *M. truncatula*, *O. sativa*, *S. lycopersicum*, *A. thaliana*, and sweet potato. Gene structure analysis provided insights into the arrangement of coding and non-coding regions. Motif and domain analysis highlighted conserved protein sequences aiding functional predictions. Synteny analysis compared genomic regions across species identifying homologous genes and tracing genome evolution. The study of cis-regulatory elements in promoters helped map gene regulations. Gene expression analysis by qPCR showed that among eight randomly selected PP2C genes, IbPP2C13 had the highest induction under salt stress. The findings establish a basis for validation of PP2C gene functions in sweet potato and aid in the advancement of innovative, sustainable, and resilient agriculture techniques by enhancing the understanding of the molecular pathways involved in biotic and abiotic stress adaptation in sweet potato.

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Building Digital Capacity in Agriculture: Lessons from Tuskegee University's AI Workshop Series. L. Lunsford*, K. Woods, B. Grant, D. Miller, M. Braxton, and R. Shange, Carver Integrative Sustainability Center – Tuskegee University Cooperative Extension, Tuskegee University, Tuskegee, AL 36088.

As emerging technologies continue to transform agricultural systems, access to artificial intelligence (AI) tools and digital literacy training remains limited in many rural and Black Belt communities. To address this gap, the Carver Integrative Sustainability Center (CISC) and Tuskegee University Cooperative Extension launched the 2025 AI Workshop Series, a three-part program designed to increase understanding, confidence, and practical use of AI among farmers, practitioners, and community members. The workshops—AI for Grant Writing, AI for Professional Development, and AI for Everyday Use—combined demonstration, guided practice, and peer collaboration to explore how AI can enhance productivity, communication, and funding success. Survey results indicated substantial gains in participants' confidence and intention to use AI tools in their professional and personal work. Participants also reported improvements in teamwork, adaptability, and collaboration, with all respondents expressing interest in continued training. Insights from the workshop series directly informed the development of a Train-the-Trainer model and the creation of an AI for Extension Agents curriculum, aimed at expanding digital literacy across Alabama's agricultural education network. This initiative demonstrates how community-based technology education can bridge digital divides and strengthen workforce development through the practical application of AI across agricultural and community contexts.

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Artificial Intelligence Application in Nonpoint Source Pollution Management: A Status Update. R. Nedd*, A. Morain, A. Anandhi, K. Poole, L. Hawkins, M. Jones, and B. Washington, School of Agriculture, Fisheries and Human

Sciences, The University of Arkansas at Pine Bluff, Pine Bluff, AR 71601. Biological Systems Engineering, Florida Agricultural and Mechanical University, Tallahassee, FL 32307.

Artificial intelligence (AI) has the potential to significantly advance the management of nonpoint source pollution (NPSP), a critical environmental issue characterized by diffuse sources and complex transport mechanisms. This study systematically examines current AI applications addressing NPSP through bibliometric and systematic analyses. A total of 124 studies were included after rigorous identification, screening, and eligibility assessments based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework. Key findings from the bibliometric analysis include publication trends, regional research contributions, author and journal contributions, and core concepts in NPSP. The systematic analysis further provided: (a) a comprehensive synthesis of NPSP characterization, covering pollution sources, key drivers, pollutants, transport pathways, and environmental impacts; (b) identification of emerging AI technologies such as the Internet of Things, unmanned aerial vehicles, and geographic information systems, and their potential applications in NPSP contexts; (c) a detailed classification of AI models used in NPSP assessment, highlighting predictors, predictands, and performance metrics specifically in water quality prediction and monitoring, groundwater vulnerability mapping, and pollutant-specific modeling; and (d) a critical assessment of knowledge gaps categorized into AI model development and validation, data constraints, governance and policy challenges, and system integration, alongside proposed targeted future research directions emphasizing adaptive governance, transparent AI modeling, and interdisciplinary collaboration. The findings from this study provide essential insights for researchers, policymakers, environmental managers, and communities aiming to implement AI-driven strategies to mitigate NPSP.

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Artificial Intelligence (AI) Adoption in Rural Fashion SMEs: Challenges, Opportunities, and a Contextualized Model for Sustainable Entrepreneurship. J. Opiri*, Department of Human Sciences, University of Arkansas Pine Bluff, AR 71601.

The global fashion industry is undergoing a digital transformation, with Artificial Intelligence (AI) emerging as a major driver of innovation in trend forecasting, design, production, and supply chain management. However, the feasibility and impact of AI adoption in rural fashion Small and Medium-sized Enterprises (SMEs) remain underexplored. The purpose of this study is to examine the unique challenges and opportunities associated with AI adoption among rural fashion SMEs and to propose a contextualized framework for sustainable digital entrepreneurship. A mixed-methods approach is being used to collect data. The first phase involves qualitative case studies of rural fashion SMEs both successful and struggling to explore experiences with AI-enabled tools and digital transition barriers. The second phase will use a quantitative survey to assess the relationships among AI adoption, rural-specific constraints, innovation capacity, and business performance. Preliminary findings suggest that while rural SMEs face challenges and AI integration offers many opportunities. The implications underscore the need for context-sensitive AI strategies that align with rural realities. The study aims to contribute a practical adoption model to guide rural entrepreneurs, policymakers, and technology developers in bridging the digital divide. By equipping rural fashion SMEs with scalable and accessible AI solutions, the research supports inclusive innovation and sustainable economic growth in underserved regions.

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Integrative Computational Intelligence for Predictive Research: The Triad 3M Model of Meta-Analysis, Monte Carlo Simulation, and Machine Learning. A. Abouzeid and S.M. Abousaad*, College of Agriculture and Environmental Sciences, North Carolina Agricultural and Technical State University, Greensboro, NC 27411.

Conventional statistical approaches are limited in their capacity to manage the complexity of big data, integrate heterogeneous datasets, capture nonlinear interactions and uncertainty, or achieve predictive accuracy across complex systems. These limitations hinder the generation of precise predictive insights for early intervention, resulting in fragmented interpretations, propagation of analytical errors, low reproducibility, limited generalization, missed timely interventions, and failure to support proactive, evidence-based decision-making. To address these challenges, we developed a next-generation big data computational framework, the triad 3M Model, integrating the statistical precision of Meta-Analysis, the probabilistic depth of Monte Carlo Simulation, and the predictive intelligence of Machine Learning algorithms. The objectives were to design an intelligent model that merges the analytical triad of

statistical rigor, probabilistic forecasting, and artificial intelligence, and to ensure its flexibility for application in various fields—including biological, agricultural, environmental, medical, and health sciences—creating an algorithmic system that enhances reproducibility, precision, scalability and economic sustainability in high-dimensional datasets. The triad 3M Model integrates three analytical pillars: a) *Meta-analysis* to establish evidence-based trends and quantify effects; b) *Monte Carlo simulations* to model variability and uncertainty for probabilistic forecasting; and (c) *Machine learning algorithms* to predict outcomes with high precision. The framework revealed consistent predictive patterns, improved model reliability, and strengthened decision-making capacity. Implementation of the triad 3M Model demonstrated its powerful, flexible, algorithm-driven capacity to provide a scalable, intelligent foundation for next-generation big data analytics, predictive research, and sustainable system optimization, with exceptional potential in early detection, timely intervention, and proactive data-driven decision optimization.

575

State-Level Total Factor Productivity Dynamics in U.S. Agriculture: Evidence from an Output–Input Systems Approach. K. Jefferson-Moore, and A. M. Abouzeid*, Department of Agribusiness, Applied Economics and Agriscience Education, North Carolina Agricultural and Technical State University, Greensboro, NC 27411.

Over the past five decades, U.S. agriculture has experienced major technological and structural transitions that reshaped the efficiency of production systems across states. Total Factor Productivity (TFP) serves as a comprehensive measure of how effectively agricultural inputs—labor, capital, and intermediate goods—are converted into output, integrating the effects of technology, management, and innovation. Using state-level data from 1970 to 2024, this study estimated a Cobb–Douglas production function to quantify elasticities, technological change, and the relative contributions of each input to agricultural output. Ordinary least squares regression using USDA and BEA datasets revealed a strong model, confirming the robustness of the production relationships. Results showed that intermediate inputs accounted for over 95% of total output growth nationally, whereas labor and capital elasticities were small and, in several states, negative—indicating diminishing marginal productivity. States such as Iowa, Illinois, and Nebraska demonstrated innovation-driven productivity gains linked to technological adoption and resource efficiency, while others, including Mississippi, Louisiana, and West Virginia, exhibited stagnation or negative TFP growth. Overall, the findings highlight that U.S. agricultural expansion remains heavily input-intensive, with limited efficiency improvement from technological progress. Strengthening innovation diffusion, capital efficiency, and sustainable input management is therefore essential to restore long-term productivity growth and regional equity in agricultural performance.

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Emission Trends from Selected Small Ruminant Farms in East-Central Alabama: Proposed Solutions for Improving Livestock Productivity. H. Ismael*, B. Min, M. Hilaire, S. Chaudhary, V. Kanyi, and H. Abdo. Department of Agricultural and Environmental Sciences, Tuskegee University, Tuskegee, Alabama.

The study aimed to monitor GHG emissions trends in eleven meat goat production systems in East-Central Alabama over a year, identify trends and hotspots, and propose solutions to enhance livestock productivity. To achieve these objectives, the advanced closed chamber technique was used to measure the emissions of CH_4, CO_2, N_2O, and H_2O by LI-COR LI-7810 and LI-7820 trace gas analyzers. The field experiments were conducted from June 2024 to September 2025, with two treatments, *Cynodon dactylon* (bermudagrass) and *Crotalaria juncea* (sunn hemp). The study showed that farms in Pick Road, Phenix, Seale, and Selma, where Blackbelt Prairie soils are prevalent, had the highest GHG emissions, with average CH_4, CO_2, and N_2O levels above 2050 ppb, 500 ppm, and 450 ppb, respectively. The lowest emissions were found in Piedmont Plateau soils around Tuskegee, Notasulga, and Shorter. The Coastal Plain soil formation had medium to low emissions. The results also showed a significant difference after applying the two treatments; in sunn hemp plots, CH_4 emissions (ppb) tended to significantly decrease by 12 to 15% compared to the control plots ($p < 0.135$). As for CO_2 emissions (ppm), they tend to decrease substantially by 17–20% compared to the control plots in all farms under investigation. Similarly, in bermudagrass plots, CH_4 emissions (ppb) tended to significantly decrease by 21-24% compared to the control plots ($p < 0.120$). Similarly, CO_2 emissions (ppm) tended to decline substantially by 25–30% compared to the control plots on all farms under investigation.

577

Differences in Hydroflurocarbons, Soil Moisture, and Soil Temperature between Southern-Pine Silvopasture and Open Pasture. U. Karki*, A. Acharya, S, Acharya, M. Dumre, and A. Kumi College of Agriculture, Environment & Nutrition Sciences (CAENS), Tuskegee University, 1200 W. Montgomery Rd, Tuskegee, AL 36088.

Silvopasture offers several environmental benefits over open-pasture system. However, studies are limited in exploring its potential in curtailing the emissions of hydroflurocarbons and soil parameters. The study hypothesized that hydroflurocarbon emission and soil temperature would be less and soil moisture greater in silvopasture than in open pasture. The study objective was to determine hydroflurocarbon emission and concentration, and soil temperature and soil moisture in silvopasture and open pasture. Hydroflurocarbons such as CH_4, CO_2, N_2O) emissions and concentration as well as soil temperature and soil moisture were measured in open-pasture and southern-pine silvopasture, located around one mile apart, from May to September 2025 every two weeks using the LI-7810 and LI-7820. Concomitantly, soil moisture (3.5 cm depth) and soil temperature (11.5 cm depth) were measured at both sites. Data were analyzed in SAS 9.4 using the GLM Procedure. Correlation among measured variables were also assessed. CH_4, emission was negative in both systems with silvopasture serving as a better sink vs. open pasture. CH4 concentration was less in silvopasture vs. open pasture. Similarly, both CO_2 emissions and concentration were less in silvopasture vs. open pasture. However, N_2O emission was greater in silvopasture although its concentration was lower vs. open pasture. Soil moisture was higher, and soil temperature was lower in silvopasture vs. open pasture. Measured variables showed various levels of correlations with one another. Results suggest that southern-pine silvopasture is a better system in minimizing hydrofluflorocarbons emission, conserving soil moisture, and creating milder soil temperatures vs. open pasture.

578

Evaluation of Biochar-Blended Organic and Inorganic Media as Potential Greenhouse Potting Mixes. L. Githinji* and M. Blakey. College of Agriculture, Virginia State University, Petersburg, VA 23806

Biochar-compost (BC) and biochar-vermiculite (BV) blends were evaluated for their physical and hydraulic properties and their impact on growth characteristics of Kale (*Brassica oleracea* var. *acephala*). The experiments were set up as a CRD with 5 treatments for BC and 6 treatments for BV, each replicated 4 times. The bulk density (BD), gravimetric water content (GWC), and matric potential were determined using standard methods. In addition, selected plant growth parameters were measured weekly. For BC experiment, the results revealed that GWC decreased linearly ($R^2 = 0.94$) with biochar increase. There was a linear decrease ($R^2 = 0.53$) in plant height with addition of biochar. Similarly, the leaf length decreased linearly ($R^2 = 0.82$) with biochar rate. For the BV experiment, the GWC increased ($R^2 = 0.81$) with biochar application rate. However, the plant height decreased ($R^2 = 0.70$) with biochar application rate. Similarly, the leaf length decreased ($R^2 = 0.62$) with biochar application rate. For these experiments, we found no apparent benefit of blending compost or vermiculite with biochar. Therefore, we concluded that either of unblended vermiculite or compost were a better medium for plant growth relative to biochar. In addition, it was apparent that compost supplied more essential nutrients to the plants while providing benefits similar to, or better than those provided by biochar.

579

Collaborative Network for Monitoring Emerging Plant and Animal Disease for Food Security in the Americas. J. Epple-Farmer*, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University, Jefferson City, MO 65101.

This is a summary of several day long symposiums that were funded as a part of the Center of Excellence for Global Food Security and Defense (CEGFSD). They were designed to foster international partnerships to strengthen agricultural integrity in developing countries, engage international researchers in addressing new and emerging animal and plant pests and diseases, and develop our current agricultural workforce to become more globally competent. With the growing importance of trade as a component of the U.S. economy, the animal and plant pests and diseases that affect our regional trading partners are of interest to the U.S. This means in our globally integrated world the growth and stability of our partners have significant impact on U.S.'s national food security and to the global food system as a whole. It is for this reason that we must stress the importance of a more globally conscious workforce. We share with our Latin American partners the important cultivation of forest trees, fruit & vegetable

plants as well as the management of poultry, sheep, goats and cattle. It is this commonality of shared food where our symposiums addresses global food security and defense.

580

Tree-Level Yield Prediction in Almond Orchards through UAV-Based Bloom Mapping. M. Chakraborty*, Department of Natural Resources and Environmental Design, North Carolina Agricultural and Technical State University, Greensboro, NC 27411; A. Pourreza, H. Jafarbiglu, Department of Biological and Agricultural Engineering, University of California, Davis, CA 95616; X. Zhang, School of Environmental, Civil, Agricultural and Mechanical Engineering, The University of Georgia, Athens, GA 30602; K. A. Shackel, and T. DeJong, Department of Plant Sciences, University of California, Davis, CA 95616.

Accurate early season yield forecasting is critical for precision crop management and efficient use of agricultural inputs. This study presents an approach to estimate tree-level crop load by quantifying bloom density from aerial RGB imagery. Drone flights were conducted across six almond orchards during the bloom period, and an end-to-end U-Net deep learning model was trained to segment bloom pixels and estimate bloom density per tree. The model achieved strong performance, with precision and recall values of 81% and 65%, respectively, demonstrating reliable identification of bloom areas across varying lighting and environmental conditions. Bloom density estimated by the U-Net showed strong agreement with manual hue-saturation-value (HSV) thresholding results ($R^2 = 0.78$, NRMSE = 0.69%). End-of-season yield data collected over three years from an experimental orchard were used to validate the relationship between bloom density and crop load. A significant positive correlation ($R = 0.65–0.9$, $p < 0.05$) was found between predicted bloom density and measured yield for the Nonpareil cultivar. These results indicate that UAV-based bloom density mapping provides a scalable, non-destructive method for early yield prediction, supporting growers in optimizing nitrogen application, improving resource efficiency, and complying with sustainability regulations.

581

From Online Learning to Virtual Reality Video: Awareness and Adoption Among Faculty. C. Cook and J.C. Ricketts*, Department of Agricultural Business and Education, Agricultural Education Center, Tennessee State University, Nashville, TN 37209.

Understanding faculty adoption of online education technologies is key to delivering scalable, high-quality distance education and advancing immersive pedagogy. Guided by the Technology Acceptance Model, we conducted a descriptive survey of Tennessee State University (TSU) faculty to assess perceptions of online learning and 360° video, using a researcher-adapted instrument with strong internal consistency across constructs. Faculty from all TSU colleges (n=78) completed the survey; most had taught online (91%), but very few had used 360° video in teaching (2.47%). For online learning, respondents reported relatively high trust and contextual usefulness but lower perceived usefulness and ease of use. For 360° video, means were uniformly lower – especially for ease of use and perceived usefulness – indicating unfamiliarity and usability barriers. Comparative analyses between agricultural sciences and non-agricultural faculty revealed a significant difference: agriculture faculty reported higher perceived usefulness of 360° video (M=5.05) than non-agriculture faculty (M=4.29; p=.03), while all other constructs showed no statistically significant differences. Findings suggest that while online learning is broadly accepted, 360° video adoption will require targeted professional development, streamlined workflows, and institutional support to improve perceived usefulness and ease of use – particularly outside agriculture, where experiential learning benefits are less obvious. These results provide actionable direction for faculty training and infrastructure investment to close engagement gaps and responsibly integrate immersive media into TSU's evolving online ecosystem.

582

Advancing Sustainable Smart Farming Solutions at the University of Maryland Eastern Shore. J. Pandya* and N. Dixit, Department of Agriculture, Food and Resource Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853; C. Nindo, Food and Agricultural Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853; A. Nagchaudhuri, Department of Engineering , University of Maryland, Eastern Shore, Princess Anne, MD 21853; M. Mitra, Department of Natural Sciences, University of Maryland, Eastern Shore, Princess Anne, MD 21853; and M. Cosh, USDA-ARS-Hydrology and Remote Sensing Laboratory.

The smart farming research program at the University of Maryland Eastern Shore (UMES) is focused on transforming modern agricultural practices by developing innovative, sustainable, and scalable manner. Leveraging on cutting-edge technologies such as remote sensing, and Variable Rate Technologies (VRT), focusing of optimized agricultural productivity by practicing site specific management system. These strategies are applied and validated on UMES farms. The project emphasis on environmental stewardship by addressing critical challenges such as reducing agricultural soil degradations, water usage, and fertilizer application. The research is committed to harmonize efficiency with ecological responsibility, thereby fostering a resilient and sustainable future for farming. The presentation focuses on the comprehensive overview of design, development, and practical application of these precision agriculture technologies, and their potential to meet the diverse needs of modern farm practices. The presentation provides an overview of precision agriculture technologies, focusing on their design, development, and practical use, highlighting how these technologies can address various needs in modern farming practices.

583

Laying the Groundwork for Barley Production in Tennessee. P.O. Hinson* and H.K. Sahani, Department of Agricultural Sciences and Engineering, College of Agriculture, Tennessee State University, Nashville, TN 37209.

Growth in the craft beer brewing industry in Tennessee has increased the demand for locally sourced malting barley (*Hordeum vulgare* L.) grain. However, production of malting barley in the state is virtually non-existent, accounting for less than 0.1% of total U.S. barley production. A key roadblock to expanding malting barley production in Tennessee is the lack of varieties proven to perform well under southeastern U.S. growing conditions. This leaves producers relying on trial and error and informal networking when making variety selections. Therefore, the aim of this project is to conduct a comprehensive evaluation of 16 genetically diverse barley varieties to identify those best suited for use in Tennessee and to recommend them to producers in the state. A field trial was conducted at Tennessee State University's research farm during the 2025-2026 winter growing season to assess a range of agronomic traits, including crop phenology, canopy development and architecture, forage nutritive quality, grain yield, and grain quality parameters (protein concentration, kernel plumpness, germination). First-year data is currently being collected. We expect the results of this study to facilitate the adoption and expansion of malting barley production in Tennessee and throughout the southeastern U.S.

584

Large Language Model and Artificial Intelligence-Powered Digital Companion and Sensor-Integrated Device for Farmer Decision Support. C. Cook Marshall*, B. Dari, C. Simpson Carroll, and E. Mpere, College of Agriculture and Environmental Science; S. Zhang and M. Fanuel, College of Engineering; S. Davis Richardson and M. Hargrove, College of Education, North Carolina Agricultural and Technical State University, Greensboro, NC, 27411.
North Carolina's small-scale farmers remain among the most vulnerable agricultural producers in the United States. They face overlapping challenges: unpredictable weather, limited access to locally specific data, declining soil health, and reduced economic margins. These farmers often lack reliable decision-support tools that integrate localized weather, soil, and water information with trusted community and Cooperative Extension resources. Our research is developing a modular, handheld decision engine that combines sensor technologies, large language models, ground-level verification, and AI-powered feedback loops. This system transforms data into actionable decisions, unlocking faster responses and enabling resilience. This project responds directly to the needs expressed by small-scale producers in previous Cooperative Extension listening sessions and qualitative interviews. Farmers requested an easy-to-use, one-stop tool that would work in the field without constant internet access, improve operational efficiency, and prepare them for shifts in the weather. The research brings together those functions in one device while building the data foundation for long-term agricultural sustainability and rural economic stability.

585

Assessment of Winter Wheat Crop Canopy Greenness, Yield, Nitrogen Content, and Cost Efficiency under Variable-Rate and Uniform Nitrogen Fertilization Applications. J.N. Oppong*, S. Anyanwu, C.E. Akumu, F. Ogunmokun, and C. Hardy, Department of Agricultural Sciences and Engineering, College of Agriculture, Tennessee State University, Nashville, TN 37209.

Efficient fertilizer management is essential for improving crop yields, preserving soil health, and minimizing environmental harm. Excessive nitrogen (N) application can lead to nutrient runoff and ecosystem degradation. Precision agriculture, particularly variable-rate application (VRA), offers a promising approach by tailoring fertilizer inputs to the specific needs of crops and soils. However, there is limited research exploring how winter wheat responds to different N levels under VRA. This study evaluated the effectiveness of nitrogen VRA in winter wheat by examining canopy greenness (NDVI), yield, plant N content, and N use efficiency, as well as input costs. Treatments included a uniform N rate (100% of the recommended level) and variable applications of 60% and 40%, applied using a John Deere 5095M utility tractor. Early in the season, the 60% treatment exhibited the highest NDVI (0.855), while the 100% rate produced the highest values at mid-season and maturity, with significant differences across treatments and time ($p < 0.05$). The 40% N rate achieved the greatest grain yield (1676.81 $kg\ ha^{-1}$), although yield differences were not statistically significant ($p > 0.05$). Plant N content was highest in the 60% treatment (1.823%), but again, differences were not significant. Notably, N use efficiency was greatest under the 40% rate (71%), significantly outperforming the higher rates. Overall, VRA treatments used just over half the fertilizer and cost of the uniform application while maintaining similar productivity. These findings underscore VRA's potential to improve resource efficiency, reduce costs, and support more sustainable fertilizer management in winter wheat production.

586

Spectral Imaging Remote Sensing and Artificial Intelligence for Precision Nutrient Management and Yield Prediction in Agricultural Crop Systems. A. Y. Alkhaled*, F. Hashem, Department of Agriculture, Food, and Resource Sciences; A. Nagchaudhuri, J. Pandya, Department of Engineering and Aviation Sciences, and S. Mosleh, Department of Natural Sciences, University of Maryland Eastern Shore, Princess Anne, MD 21853.

Efficient nutrient management is essential for sustaining agricultural productivity while reducing environmental impacts. Traditional methods for assessing crop nutrient status and yield potential are often destructive, labor-intensive, and spatially limited. This study integrates spectral remote sensing (400–2500 nm) with artificial intelligence (AI) to develop non-destructive, data-driven tools for precision nutrient monitoring and yield prediction across agricultural crop systems. Machine learning algorithms, including Random Forest (RF) and Extreme Gradient Boosting (XGBoost), were trained on multi- and hyperspectral datasets collected across growth stages and nutrient treatment levels. The models demonstrated high predictive accuracy for in-season leaf nitrogen (N) concentration (coefficient of determination: $R^2 > 0.90$) and yield estimation ($R^2 > 0.83$), effectively capturing spatiotemporal variability in canopy reflectance and management response. Building on validated models originally developed for tuber crops, this research expands application to grain and legume systems within the Delmarva Peninsula, enhancing generalizability and regional adaptability. The integration of AI and spectral imaging enables real-time decision support for site-specific nutrient optimization, reducing fertilizer waste, improving resource-use efficiency, and mitigating environmental contamination. This work contributes to advancing precision agriculture through scalable, intelligent frameworks for sustainable crop production and yield improvement.

587

Agriculture-Smart Technology for Monitoring Soil Health. L.A. Hodges*, Southern University Agricultural Research and Extension Center, Baton Rouge, LA 70813; J. McComb, C. C. Vance, A. Dyson, Jr., Department of Agricultural Sciences and Technology, Southern University and A&M College, Baton Rouge, LA 70813; and A. Muhammad, College of Agriculture and Applied Sciences, Alcorn State University, Lorman, MS 39096.

Louisiana and Mississippi share natural soil boundaries. Therefore, soil health conditions in both states are impacted by shared natural disasters such as the Mississippi River Flooding and Hurricanes. One tool for evaluating soil health for natural disaster response and remediation is Dynamic Soil Properties (DSPs). However, identifying where DSP disturbances occur in a natural disaster-prone landscape traditionally requires extensive ground-truthing to pinpoint their precise locations. Agriculture-Smart Technology: drones and soil moisture probes enable the precision geolocation of DSP disturbances by integrating them with traditional soil sampling techniques. The goal of this project is to inform the agricultural community of the potential of integrating Agriculture-Smart technology into their traditional soil health monitoring practices.

588

Integrating Contextual Learning in Agricultural Education: A Situated Learning Approach. A. Collins*, Department of Agriculture, Alcorn State University, Lorman, MS 39096.

This ongoing study explores the integration of contextual learning principles into agricultural project-based instruction for secondary and vocational students. Grounded in Situated Learning Theory, the research examines how authentic, hands-on experiences across various agricultural enterprises—such as animal production, crop management, and agribusiness ventures—enhance students' understanding of technical skills, enterprise management, and workforce readiness. Thedeveloping curriculum emphasizes experiential strategies including production planning, cost-of-enterprise analysis, and marketing simulations designed to connect classroom theory with applied practice. Data is currently being collected through instructor reflections, student assessments, and classroom observations to analyze how contextual learning environments promote engagement, knowledge transfer, and critical thinking. Preliminary insights suggest thatstudents respond positively to instruction embedded within real-world agricultural settings, demonstrating stronger connections between theory and practice. The study aims to refine a replicable framework for implementing contextual and situated learning in agricultural education programs to strengthen entrepreneurship, sustainability, and student career preparedness.

589

Digital Tools for a Resilient Agriculture Workforce: Leveraging Precision Agriculture Technologies to Strengthen Workforce Readiness and Conservation Practices through Extension-Based Credentialing and Digital Innovation. A. Collins*, Department of Advanced Technologies, Alcorn State University, Lorman, MS 39096.

This ongoing project aims to enhance and redevelop agricultural workforce readiness through the integration of precision agriculture technologies—drones, GPS, GIS, and AI-assisted tools—into Extension-led training and credentialing programs. The research is implementing eight hybrid training sessions designed to provide producers, Extension agents, and adult learners with practical experience in digital agriculture applications that improve decision-making, production efficiency, and environmental stewardship. The project team is developing modular, competency-based instructional content that aligns with digital credentialing frameworks to advance skill recognition and expand access to workforce development opportunities in communities. Through collaboration among university faculty, Extension professionals, and technical consultants, the project is building a sustainable model for technology adoption and workforce training that supports data-driven agricultural practices. Early outcomes indicate increasing participant engagement and growing confidence in the use of precision tools for conservation planning and productivity enhancement. This initiative continues to reinforce Alcorn State University's leadership in advancing agricultural innovation and rural workforce empowerment through applied research, outreach, and digital transformation.

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Target Acquisition with Electro-Optical Infrared Radiation Sources. S.O. Nwaneri*, Department of Advanced Technologies, Alcorn State University, Lorman, MS 39096.

Target acquisitions routinely account for power spectral density (PSD) as temporal background of moving objects. Patches of moving clouds were observed for opacity and transparency relative to the target. Observations of opaque target from at-grade background-and up were assumed to have total radiation and absorption sensitivity of ambient cloud temperature at cloud altitude. Upward or downward observations of target distribution of radiant fluctuations affect sensor sensitivity relative to random horizontal transitions of bulky cloud windows. Detection thresholds due to target cluttered environment were treated for target identification using the Receiver Operator Characteristic (ROC) triangular tracker for target resolution, pixelation, and sensitivity, especially as warm sensitivity with larger footprints. The ROC approximated target identification with true-positive and false-positive scales. These determinations were focused on creating a dynamic target altitude with priory knowledge of the sensors operating wavelength. The result shows conditions (fast, and smooth) entry and exit, as most likely shapes of the random bulky cloud, representing changes on radiation at the operating wavelength. The TDI is a "visual integration" showing the (fast and smooth) entry and (fast and smooth) exit depicting the input and output responses of the cloud's bulky footprint. The convolution of the Poison pulses was analyzed as a shot noise in target environment. Detection and false alarm rates and white noise background were assessed analytically and graphically, between rates of specific detections, like true positive and false positive)

processes. The study is on-going and needs more improvement.

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Sharing Impact Using Storytelling and Data. T. Nyatta*, C. Alston, G. Gibson, and C. D. Knight, 1890 Research and Extension, South Carolina State University, Orangeburg, SC 29117.

This project demonstrates how integrating storytelling with data analysis can effectively communicate research outcomes and community impact within urban agriculture initiatives. By combining quantitative findings with qualitative narratives, the team presents a multidimensional perspective on how local agricultural programs influence food access, sustainability, and community well-being. Drawing on fieldwork and outreach conducted through 1890 Research and Extension projects, data visualization, interviews, and first-person accounts are used to reveal the human experiences behind the numbers. Through stories of local farmers, youth participants, and community partners, this work highlights how personal engagement deepens public understanding of food equity and environmental stewardship. Data collected from soil testing, outreach events, and educational programs are contextualized through these narratives, illustrating measurable outcomes. This dual approach bridges scientific rigor with accessibility, allowing audiences to connect emotionally and intellectually with the research. By pairing data-driven analysis with storytelling, the project demonstrates an effective framework for translating complex findings into meaningful, actionable insights. It underscores the importance of centering community voices in academic communication and shows how narrative-based data interpretation can drive awareness, inspire collaboration, and strengthen the impact of urban agriculture initiatives across diverse audiences.

592

A Low Cost Fully Autonomous UAV based Soil Moisture Payload for Near Surface Measurements. H. Dakshinamurthy*, M. Hare Jr., Public Service and Agriculture, 1890 Research and Extension, South Carolina State University, Orangeburg, SC 29117; A. Ashworth, USDA ARS Fayetteville, Arkansas; and H. Winzeler, Department of Mathematics, The University of Texas at Arlington.

Soil moisture is a key parameter that drives agricultural decision-making, as well as flood and drought modeling. It varies spatiotemporally and is typically monitored at large scales through coordinated efforts between universities and government agencies in the USA. However, these large-scale datasets are often too coarse to be directly applied at the agricultural field scale for real-time decision-making. Continuous soil moisture monitoring at the farm level is essential to maximize land productivity, but current methods have limitations. Manual sampling with handheld sensors is only practical when continuous monitoring is unnecessary. Frequent lab-based sampling introduces delays, and while sensor networks offer real-time data, their installation and maintenance; especially when wired it pose significant challenges. To address these issues, we are developing a low-cost, mobile moisture sensing payload that can be mounted on UAVs or farm vehicles such as tractors or gators. This will be an upgraded version of a previously built and tested UAV-mounted payload. The new system aims to provide scalable, flexible, and continuous soil moisture data collection without the infrastructure burden of fixed sensor networks. As part of this effort, we develop and test sampling strategies for soil moisture measurements using the automated smart soil moisture sampling technology integrated into the UAV payload system. Specifically, we compare grid sampling, random sampling, and conditioned Latin hypercube sampling (cLHS) across two experimental studies conducted in Florence and Olar, SC. These strategies aim to identify optimal sampling approaches that minimize the number of sampling locations while supporting effective decision-making in agricultural settings.

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Artificial Intelligence Powered iOS Mobile App for Weed Identification. B. Biswal*, Department of Computer Science and Mathematics, South Carolina State University, Orangeburg, SC 29117.

Weeds are a major burden in small and local farming communities in the United States due to the lack of technology, awareness, and education. Weed control is one of the biggest factors that affects crop production. Manual weeding gives maximum unique control of the weeds in the field. However, manual weddings have high labor intensity and high labor costs. This makes weed management difficult for small and local farmers in the state of South Carolina,

resulting in loss of crop yield and poor-quality production. In this work, the AI-based iOS mobile app is used to identify weed plants. In our work, we have successfully implemented an iOS mobile app to capture a weed image and identify weed type using CNN, CreateML, Xcode and Swift programming language. Our model was tested with our database of weed plants with a precision of 96%. Our results show that the iOS mobile app developed successfully identifies the weed plant. Our future work will include testing the iOS mobile app with more weed plant data to provide precise weed identification.

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AI-Driven Monitoring and Modeling of Atmospheric Emissions in Organically Amended Agricultural Systems. A. Adem*, A. Fares, R. Awal, M. Celestine, S. Islam, A. Veettil, and R. Atikur, Cooperative Agricultural Research Center, College of Agriculture, Food and Natural Resources, Prairie View A&M University, Prairie View, TX 77446.

Organic amendments, such as biochar and animal manures, offer multiple agronomic and environmental benefits, including nutrient supplementation, improved soil health, and carbon sequestration. Quantifying their impact on atmospheric emissions, particularly carbon dioxide (CO_2), is crucial for evaluating their role in organic agriculture. This study aims to simulate and analyze CO_2 and other atmospheric emissions from organically amended croplands using artificial intelligence (AI) and machine learning (ML) techniques. A field experiment was conducted at the Prairie View A&M University Research Farm, the Greater Houston Area, Texas, employing a factorial design with three replications. Treatments included varying levels of biochar and two types of animal manure (chicken and dairy), applied at four rates (0, low, adequate, and high) to field corn in 2025. An automated field monitoring system was deployed to collect real-time data on soil moisture, soil temperature, air temperature, relative humidity, solar radiation, and plant health indicators. To predict short-term CO_2 emissions, multiple ML models, including Multilinear Regression (MLR), Random Forest (RF), and Generalized Additive Models (GAMs), were applied. Additionally, the Classification and Regression Tree (CART) algorithm was employed to identify critical thresholds and interactions among environmental variables. Preliminary results indicate strong interactions between soil moisture and temperature in determining CO_2 flux, with notable differences observed across organic amendment treatments. This work highlights the potential of integrating AI-driven analytics with sensor-based monitoring to improve our understanding of soil carbon dynamics and inform sustainable land management practices under organic agricultural systems.

595

Evaluating the Impact of Market and Rural Development Policies on Organic Farming Conversion Decisions--The Case of Missouri. S. Geleta*, College of Agriculture, Environmental and Human Sciences (CAEHS), Lincoln University of Missouri, Jefferson City, MO 65101.

The transition from conventional to organic farming presents substantial economic challenges despite growing consumer demand. This study evaluates the effectiveness of market-based incentives and rural development policies in supporting organic conversion among small-scale Missouri farms using linear programming optimization. We analyze 430 certified organic operations and over 61,000 conventional farms in Missouri, modeling farm-level economic outcomes under six policy scenarios: No Support, Organic Price Premiums, Environmental Quality Incentives Program (EQIP) Cost-Sharing, Organic Certification Cost Share Program, Combined Premiums and Cost-Sharing, and the Transition to Organic Partnership Program (TOPP). Our model maximizes farm income subject to land, labor, and certification constraints. Economic benefits are assessed by comparing post-conversion income to a conventional baseline, accounting for transition costs, yield reductions, and additional labor over the three-year certification period. Results show that policy support is important for economic viability. Without intervention, farms incur cumulative losses exceeding $200,000 over four years. The TOPP program achieves break-even in Year 1 and achieves 20% profit by Year 3, outperforming single-intervention approaches. Combined policies (Premiums plus Environmental Quality Incentives) yield 14% gains, while the Organic Certification Cost Share Program offers minimal benefits (2%). Small -- to medium-sized diversified farms (40-180 acres) show the highest conversion potential, with regional variation across agricultural zones. Organic systems demonstrate 41% lower energy use and 33% less water consumption per unit output than conventional systems, though requiring 59% more labor. Our results suggest the need to design targeted agricultural programs that incorporate graduated transition support, region-specific implementation, and integrated market development.