4TH ANNUAL June 8th, 2022

SUMMER SCIENCE & ENGINEERING SYMPOSIUM| 2022

Organized By: Mississippi Academy of Sciences and Mississippi State University
Venue: Mississippi State University, Bost Conference Center Mississippi State, (Starkville Campus), MS 39759

Symposium Chairs

Dr. K. Raja Reddy, Chair
Dr. Jason Keith, Co-Chair
Dr. Scott T. Willard, Co-Chair
Dr. Ham Benghuzzi, MAS Divisional Advisor

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Dr. Jamie Larson
Mississippi State University

Local Arrangement Coordinator
Dr. Raju Bheemanahalli
Mississippi State University

Awards Committee Coordinator
Dr. Michelle Tucci
University of Mississippi Med Center

Major Events

Time	Event
8:30-9:00 AM	Registration, poster set up and breakfast
9:00-9:30 AM	Opening of the event/welcome speeches
9:30-10:45 AM	3-minute oral presentations
10:45-11:30 AM	Keynote lecture
11:30-12:00 PM	Networking
12:00-1:00 PM	Lunch break
1:00-3:30 PM	Poster presentations and judging
3:30-3:45 PM	Coffee break
3:45-4:45 PM	Round table discussion
4:45-5:15 PM	Awards and recognitions
5:15 PM	Closing remarks

Symposium Sponsors

Mississippi State University's
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PROGRAM	
TIME	**EVENT**
8:30-9:00 AM	REGISTRATION, POSTER SET UP AND BREAKFAST Location: Bost Conference Center, Mississippi State University, Mississippi State, MS
9:00-9:30 AM	OPENING OF THE EVENT/ WELCOME SPEECHES *Dr. K. Raja Reddy* MAS President, Department of Plant and Soil Sciences, Mississippi State University *Dr. Jamie Larson* Interim Assistant Director, MAFES, Mississippi State University
9:30-10:45 AM	3-MINUTE ORAL PRESENTATIONS *Moderator: Dr. Priyadarshini Basu* Assistant Professor, Pollinator Health and Apiculture, Mississippi State University
10:45-11:30 AM	KEYNOTE LECTURE *Introduction: Dr. Ham Benghuzzi* Executive Director of Mississippi Academy of Sciences *Topic: My Magnificent Journey in Ag Science and Technology* *Speaker: Dr. Loston Rowe* Grower relations executive with Indigo Ag
11:30- 12:00 PM	NETWORKING
12:00 -1:00 PM	LUNCH BREAK
1:00 -3:30 PM	POSTER PRESENTATIONS AND JUDGING *Coordinator: Dr. Raju Bheemanahalli* Assistant Research Professor, Department of Plant and Soil Sciences, Mississippi State University
3:30-3:45 PM	COFFEE BREAK
3:45-4:45 PM	ROUND TABLE DISCUSSION *Moderator: Dr. Michelle Tucci* JMAS, Editor, University of Mississippi Medical Center, Jackson *Topic: Turning Your Passion into a Professional Career* *Dr. John Ball* Associate Professor and Robert D. Guyton Chair, Electrical and Computer Engineering, Mississippi State University *Dr. Caleb Lemley* Associate Professor, Animal and Dairy Sciences, Mississippi State University *Dr. LaShan Simpson* Associate Professor, Agricultural and Biological Engineering, Mississippi State University
4:45-5:15 PM	AWARDS AND RECOGNITIONS *Dr. Michelle Tucci* JMAS, Editor, University of Mississippi Medical Center, Jackson
5:15 PM	CLOSING REMARKS *Dr. K. Raja Reddy*, Symposium Chair

KEYNOTE ADDRESS

Dr. Loston Rowe, Indigo Ag.
My Magnificent Journey in Ag Science and Technology

Loston Rowe was raised on a family farm near West Point, MS. After graduating from Aberdeen High School, he attended Mississippi State University, earning both bachelor's and master's degrees in the Dept. of Plant and Soil Sciences. He then went on to complete his Ph.D. in Weed Science/Herbicide Physiology in the Crop and Soils Sciences Department at Michigan State University. Dr. Rowe started his professional career with the agricultural products division of the DuPont Company. Over his storied career with DuPont, he held numerous professional and leadership positions in research, product development, sales, and marketing.

Dr. Rowe currently works as grower relations executive with Indigo Ag.
Indigo is an ag tech startup company based in Boston, Mass., and has the mission to improve grower profitability, environmental sustainability, and consumer health by using natural microbial-based products, along with digital cloud-based technologies. In his role with Indigo, Dr. Rowe manages the company's collaboration efforts with strategic farmer partners across the US.

Dr. Rowe realizes that agricultural sciences and food production impacts each one of us every single day. Throughout his career, he has worked to improve student awareness of the many exciting careers in ag and has mentored numerous young professionals into the ag industry. Dr. Rowe was recently named the inaugural recipient of Michigan State University's Diversity, Equity, and Inclusion Award, which recognized his professional accomplishments, service, and contributions to diversity within agriculture. Dr. Rowe also has served on the Mississippi State University CALS Advisory Board, as well as being named a Mississippi State University Alumni Fellow. He, along with his siblings, established the James Robert and Betty Rowe Endowed Scholarship at Mississippi State in honor of their parents.

Dr. Rowe currently resides in the Memphis, TN area with his wife, Rita, who is a fellow Bulldog graduate.

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Vennam, Ranadheer Reddy

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ABBREVIATION
3M-O: 3-minute oral presentation
HS-P: High school student poster
UG-P: Undergraduate student poster
GS-P: Graduate Student poster
I-P: Investigator poster

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ABSTRACTS

3-MINUTE ORAL PRESENTATIONS (3M-O)

3M-O01 CURRENT SPECIES DISTRIBUTION MODEL FOR AMERICAN CHESTNUT (*CASTANEA DENTATA*) IN MISSISSIPPI STATE

Segun Michael Adeyemo, Joshua Granger

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Castanea dentata is an economically and ecologically important multifunctional tree. The modeling of existing habitat suitability for American chestnut (AMC) in the 82 counties of Mississippi State, with a total area of 12,544,406 hectares is motivated by the species scarcity in Mississippi states. The modeling process used forty-one (41) occurrence records, which were verified and filtered to remove any duplicates. Due to the scarcity of AMC stands in Mississippi, data on occurrences was gathered through the United States Department of Agriculture (USDA) Forest Service contact. ArcGIS was used to create the pseudo-absence (*bg* = 1000) as the absence data. 19 bioclimatic variables from WorldClim with a 30-seconds spatial resolution, USGS National Elevation Dataset with one arc-second resolution with 30 m resolution, and soil pH and soil sand content (%) from SSURGO database with 30 m resolution were used as predictor variables. All the predictor variables listed were resampled to the same resolution and extent using the *'resample'* function in the *raster* package in RStudio. The Variance Inflation Factor (VIF) was calculated in RStudio using the *usdm* package's '*vifstep ()*' function with a threshold of 10 to eliminate the multicollinearity problem, and 9 variables were chosen for the model. Bio 2, bio 4, bio 5, bio 8, bio 9, bio 13, bio 14, bio 15, bio 16, bio 19, per Sand, Soil PH, and DEM variables were selected. *sdm* function was adopted to define the model formulation which includes the data (species presence and pseudo-absence data as well as the predictor variables), the methods (generalized linear model – '*glm*', boosted regression trees model – '*brt*', random forest model – '*rf*', support vector machine classifier – '*svm*', and maximum entropy – '*maxent*'), and the settings for the data evaluation where subsampling techniques was used with 2 replicates for each method. For model evaluation, true skill statistics (TSS) and area under the ROC (receiver operating characteristic) curve (AUC) scores were used. To reduce bias and offer a relative assessment of the relevance of each predictor variable across all selected modeling algorithms and improve prediction accuracy, the ensemble modeling method was utilized to combine all five methodologies. The AMC's predicted habitat suitability was divided into five categories, ranging from "not suitable" to "very suitable". The final habitat suitability prediction showed that all five algorithms had TSS and AUC ratings of more than 0.9, which were ensembled. The historic natural range of AMC habitat suitability in Mississippi is significantly reduced, and the model result indicates that the maximum temperature of the warmest month is the key factor contributing to the reduction in its natural range.

3M-O02 SPATIAL AND TEMPORAL VARIATION IN SOCIAL DETERMINANTS OF HEALTH (SDH) AND COVID-19 RELATED HEALTH OUTCOMES IN THE UNITED STATES.

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Since the outbreak in early January 2020, COVID-19 has been responsible for more than 88 million cases and 976 K deaths across the United States. The death toll put the United States at another tragic milestone as the number surpassed the deaths caused by the 1918 flu. The pandemic, however, did not similarly affect the whole United States and studies showed that the health impact related to COVID-19 significantly varies with socio-economic and demographic characteristics. In this study, we have examined the spatial pattern of COVID-19 in the USA and its associations with Social Determinants of Health (SDH) by utilizing County Health Rankings & Roadmaps (CHRR) dataset. Using Geographic information systems (GIS), GeoDa, and SPSS, we conducted exploratory and spatial regression between cumulative COVID-19 cases and deaths based on three periods: 1) January 20, 2020 – June 30, 2021; 2) July 1, 2021 – November 30, 2020; and 3) December 1, 2021 – April 30, 2022. The findings of our analysis revealed significant hotspots of cumulative cases and deaths across the lower south-east and upper north-west USA. Our analysis also showed significant associations between SDH variables and COVID 19-related health outcomes. For example, the percentage of adult smoking, prevalence of diabetes, adult obesity, residential segregation and population older than 65 were significantly associated with both cases and deaths in all three periods. Our analysis demonstrated the usefulness of SDH in predicting the spatial burden of COVID-19 disease and mortality in the USA.

3M-O03 FACTORS INFLUENCING FRUIT-EATING FISH DIVERSITY IN THE AMAZON BASIN

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Introduction: The interaction between fruit-eating fishes and flooded forest plants is very ancient in South America, dating back to the Late Cretaceous. Almost half of all the fish species that consume fruits inhabit South American wetlands (up to 150 of 275). The synchronicity between fruiting and the flooding season to facilitate seed dispersal by water or fish and that during lengthy flooded seasons, fishes spend ~ 87% of their time in floodplain habitats are part of the evidence of the close relationship between flooded forests and frugivorous fishes. However, it is not clear yet what are the factors that sustain the high diversity of frugivorous fishes in the Amazon River basin. Objective(s)/Hypothesis(es): The aim of this work is to assess the influence of variables such as flooded forest diversity, flooded forest extent, white-water river proportion, and elevation on the frugivorous fish species in the Amazon River basin. We expect that all the predictor variables have a positive relationship with frugivorous fish richness except for elevation, as lower elevation values relate to more floodable areas, providing habitat for the fishes. Methods: The area of study corresponds to the Amazon River basin. The units of analysis were sub-basins (n=144). We used occurrence data for frugivorous fishes from the Amazon Fish Database. We calculated vegetation diversity using occurrence data for tree species present in the floodplain forest retrieved from GBIF. We used the floodplain delineation database compiled by Nardi et al (2019) to estimate the flooded forest extent. White-water river proportion was retrieved from SNAAP. Elevation data for each spatial analysis unit was extracted from a Digital Elevation Model with 90m spatial resolution (Saatchi, 2013). To test our hypothesis we performed a Generalized Linear Model, using the Poisson distribution. Results: The results of the GLM showed that vegetation richness, flood extent area, and white-water river proportion have significant effects on frugivorous fish diversity ($p<0.001$). However white-water proportion has a negative relationship, while vegetation richness and flood extent area showed a positive relationship with frugivorous fish diversity. Implications/Conclusions: The results, in part, supported our hypothesis that more diversity in vegetation could offer more diversity of food resources for frugivorous fishes and that a more

extensive flood extent area is associated with providing habitat for fishes around forests. This study provides valuable information for a better understanding of the intricate relationship between forests and fish that can be used to inform conservation strategies in the Amazon region.

3M-O04 AN APPLICATION OF H_2O AUTOMATIC MACHINE LEARNING IN SOIL CARBON MAPPING

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Soil carbon (SC) comprises the largest terrestrial pool of the global carbon cycle while being frequently disturbed by several environmental factors. Most of the previous studies focused on soil organic carbon (SOC) for digital soil mapping, but a combined study with soil total carbon (STC) and inorganic carbon (SIC) is rare. Though the Machine Learning (ML) algorithms can predict SC variability with a high level of performance, most of the approaches skirted the model's key insights and local interferences, namely "Black Box". In this study, eXplainable artificial intelligence (XAI) on a stack ensemble model through H2O Auto ML was performed to visualize STC, SIC, and SOC variability with the hypothesis that using model agnostic techniques can improve the explainability of SC maps and address the "Black Box" issue. The addition of residuals with the stack ensemble of six base learners performed relatively better than the normal stack ensemble, with 54%, 45%, and 52% improved RMSE for STC, SIC, and SOC, respectively. Land cover type, soil pH, total nitrogen, and vegetation index were identified as the top four crucial factors for predicting SOC, whereas bulk density, precipitation, soil pH, and temperature described IC. A combined impact of soil, climatic, and environmental variables was assumed to be responsible for heterogeneous local variability. The H2O Auto ML algorithms used in this study can be utilized to predict and mitigate future C loss under adverse climate conditions and allow diverse knowledge groups to adopt a new interpretable ML algorithm with a better understanding.

3M-O05 MOLECULAR CLONING AND EXPRESSION PROFILING OF RYANODINE RECEPTOR, A TARGET OF DIAMIDE INSECTICIDES, IN SOYBEAN LOOPER, *CHRYSODEIXIS INCLUDENS*

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The soybean looper (*Chrysodeixis includens*) (Lepidoptera: Noctuidae) is one of the most deteriorating pests of soybean due to its defoliation damage and reported to be responsible for 16% of total insect damage in soybean in Mississippi. Diamide insecticides such as chlorantraniliprole have been successful to manage the pest for more than a decade. However, field cases with failure of diamides against soybean looper have increased the possibility of resistance development, leading us to study the molecular mechanism of the diamide resistance in soybean looper. We cloned the full-length sequence of ryanodine receptor (RyR) gene which encodes an intracellular Ca^{2+} channel in muscle tissues. Since the gene has a long coding sequence, we took a strategy to subclone partial sequences and then to combine them later, resulting in an extraordinarily long coding sequence (15,360 kb). In addition, we assessed the RyR gene expression levels in different tissues and developmental stages, comparing 10 different larval tissues and six different developmental stages, respectively. Finally, we treated the insecticide, chlorantraniliprole, against third instar larvae by feeding to measure the gene induction levels. Further studies are currently running in order to understand the molecular mechanisms of the diamide resistance in this pest species.

3M-O06 SOCIAL AND SPATIAL INEQUITY OF ACCESS BETWEEN TRANSIT AND AUTO TRAVEL MODES ACROSS AMERICA

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This study examines the Modal Access Gap (MAG) between transit and automobile modes to employment in the 45 most populated American Metropolitan Areas. We calculate auto and transit access to employment and augment it with data from the American Community Survey and the Smart Location Database. We employ a Spatial Lag Model to explore sociodemographic and built-environment correlates of MAG and the bivariate local indicator of spatial association to create cluster maps to offer a way to assess the spatial equity of MAG as it relates to carless households. The findings indicate that: (1) regardless of the travel-time threshold, the automobile has an advantage over transit in providing access to opportunities, (2) block groups with low MAG are concentrated and clustered in the Central Business District, (3) Millennials and car-free households are more likely to reside in areas with lower accessibility gap to employment, and (4) areas with high access gap and high proportion of carless households have a higher percentage of African Americans and low-income households. We recommend using the bivariate spatial autocorrelation analysis to identify areas where the gap in accessibility and proportion of households without vehicles can be used to identify areas of unusually high or low combinations of these variables. This combination is then used to prioritize different planning actions. We also show that this spatial identification captures racial and economic differences in the underlying population and can help address inequities in accessibility, particularly in high access gap, high carless areas.

3M-O07 MECHANISTIC ROLES OF LYSR-TYPE TRANSCRIPTIONAL REGULATOR IN VIRULENCE AND ADAPTATION OF LISTERIA MONOCYTOGENES VIRULENCE

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Listeria monocytogenes is an important foodborne pathogen that is well adapted to survive in wide environmental niches owing to many transcriptional regulator proteins encoded by its genome. Among these proteins are genes encoding uncharacterized LysR-type transcriptional regulators-(LTTRs). The LTTRs are integral as either activators or repressors of gene expression associated with amino-acid metabolism, nitrogen fixation, oxidative stress, biofilm formation, and virulence. This study aimed to explore the contribution of 1031 encoding LTTRs in L. monocytogenes virulence. To achieve this, F2365Δ1031 mutant was constructed by gene deletion in L. monocytogenes strain F2365, and in-vivo virulence activities and stress responses were tested. After 3 days post-infection, bacterial burdens of the wild-type F2365 strain in the spleen and liver were significantly higher than those mice infected with F2365Δ1031. The expression of listeriolysin O protein and phospholipase activities were significantly lower in the F2365Δ1031 mutant than in the wild-type. Furthermore, the loss of the 1031 gene negatively impacted the biofilm and plaque formation, but the intracellular replication shows no significant reduction compared to the wild-type. The loss of 1031 significantly impacts the glucose and nitrogen utilization, whilst the mutant showed better utilization of nitrogen from glutamine source than from ammonium sources. In the presence of oxidative stress-mediated by 6mM, 8mM, and 10mM H2O2, F2365Δ1031 mutant significantly adapts better than the wild-type. This study is the first to demonstrate the association between the 1031 gene and virulence

in L. monocytogenes. This regulator can be a useful target for vaccine and drug development against listeriosis.

3M-O08 DROUGHT AND HEAT STRESS EFFECTS ON SOYBEAN YIELDS

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Climate change has increased the frequency of heatwaves and periods of prolonged drought spells in most soybean-growing areas globally. The co-occurrence of heat and drought during pod filling can cause significant yield and quality losses in soybeans. However, information related to combined stress effects on the genetic potential is limited. In this study, ten soybean cultivars grown under non-stress conditions were subjected to four different treatments (100% irrigation) characterized as natural growing conditions, heat (38 °C daytime), drought (50 % irrigation), and heat and drought (38 °C+50 % irrigation) during pod filling stage. Individual drought or heat and combined stress treatment-induced changes in yield (pod number, pod weight, seed number, seed weight, 100-seed weight) components and quality (protein and oil) compositions were quantified. The average of all measured parameters was lower in the combined stress treatment relative to the control treatment. The pod weight was reduced by 48 %, pod number was reduced by 35 %, the number of seeds by 42 %, and seed weight by 43 % under combined heat and drought stress compared to that under control. The seed protein and oil contents were negatively correlated in soybeans. Both heat and drought stress resulted in a marked reduction in yield and quality components; drought resulted in more damage than heat stress. Understanding the reproductive, physiological, yield, and quality responses of soybean to interactive stress would assist in breeding soybeans with improved tolerance to future unfavorable climates.

3M-O09 THE FUNCTION OF TOP1 AND TOP2 THIMET OLIGOPEPTIDASES IN CONTROLLED PROTEOLYSIS DURING THE INNATE IMMUNE RESPONSE

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Proteolysis is an irreversible protein posttranslational modification essential for regulating numerous physiological and pathological processes. Complete proteolysis contributes to the maintenance of cellular proteostasis through protein degradation and turnover. Controlled proteolysis produces peptides with biological activity and emerges as a regulatory process of plant immunity. The repertoire of plant bioactive peptides remains largely uncharacterized. Thimet oligopeptidases (TOPs) are conserved metallopeptidases and critical components of the effector-triggered immunity (ETI). We implemented quantitative mass spectrometry-based peptidomics to characterize Arabidopsis Col-0 wild type (WT) and top1top2 mutant during the early stages of ETI triggered by infection with P. syringae carrying AvrRpt2 effector. Differential analysis facilitated the characterization of functional changes associated with TOPs activity and generated TOPs substrate candidates for in vitro screening. Peptides increased in abundance in top1top2 plants compared to wild-type. Out of these, 21 were screened to act as bioactive peptides, and 13 were selected for testing. WT and top1top2 plants were grown in the presence or absence of peptides and challenged with Pst avrRpt2, followed by bacterial growth quantification. Plants treated with two APX1 peptides had compromised ETI. These results indicate that peptides generated through controlled TOP proteolysis contribute to ETI.

3M-O10 IMPACT OF DROUGHT STRESS AT DIFFERENT PHASES OF CORN DEVELOPMENT

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Water demand by corn plants varies depending on crop growth and development stages. Low rainfall or insufficient soil moisture content can affect plant health and physiological processes and potentially causes a reduction in ear size. The risk of potential yield loss due to drought stress often occurs around the reproductive stage by damaging the reproductive and grain filling events. Therefore, drought stress tolerance in corn can only be improved by understanding how the corn plant responds to stress at different phases. Independent experiments were performed to quantify the impact of drought on several morph-physiological and yield-associated phenotypes. We used the pot-culture facility to develop functional relationships between moisture content and early-season vigor traits. Corn was exposed to five levels of soil moisture treatments (100 %, 80 %, 60 %, 40 %, and 20 % of irrigation) at the V2 growth stage for 28 days. The canopy temperature of control-grown plants had a 5 ºC cooler canopy than stressed plants. A decrease in soil moisture content decreased plant functional traits (stomatal conductance and transpiration), plant height, leaf number, and biomass. An increase in anthocyanin and flavonoid content with reduced chlorophyll content was recorded. Further, corn exposed to drought stress (40 % irrigation) decreased stomatal conductance and increased leaf temperature during grain filling. On average, there was a decrease of 64% in grain yield in the drought-stressed plant compared to control (100 % irrigation). Knowledge of corn physiology and growth responses to drought stress at critical growth stages is necessary to develop climate-resilient cultivars for future climatic conditions.

3M-O11 TEMPERATURE EFFECTS ON THE SHOOT AND ROOT GROWTH, DEVELOPMENT, AND BIOMASS ACCUMULATION OF CORN

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Temperature is a critical environmental factor regulating plants' growth and yield. Corn is a major agronomic crop produced globally over a vast geographic region, and highly variable climatic conditions occur spatially and temporally throughout these regions. Current literature lacks a comprehensive study comparing the effects of temperature on above versus below-ground growth and development and biomass partitioning of corn measured over time. An experiment was conducted to quantify the impact of temperature on corn's early vegetative growth and development. Cardinal temperatures (Tmin, Topt, and Tmax) were estimated for different aspects of above- and below-ground growth processes. Plants were subjected to five differing day/night temperature treatments of 20/12, 25/17, 30/22, 35/27, and 40/32 °C using sun-lit controlled environment growth chambers for four weeks post-emergence. Corn plant height, leaves, leaf area, root length, surface area, volume, numbers of tips and forks, and plant component part dry weights were measured weekly. Cardinal temperatures were estimated, and the relationships between parameters and temperature within these cardinal limits were estimated using a modified beta function model. Cardinal temperature limits for whole plant dry weight production were 13.5 °C (Tmin), 30.5 °C (Topt), and 38 °C (Tmax). Biomass resources were prioritized for the root system at low temperatures and leaves at high temperatures. Root growth displayed the lowest optimum temperature compared to root development, shoot growth, and shoot development. The estimated cardinal temperatures and functional algorithms produced in this study, which include both above and below-ground aspects of plant growth, could be helpful

to update crop models and could be beneficial to estimate corn growth under varying temperature conditions. These results could also be applicable when considering management decisions for maximizing field production and implementing emerging precision-based spatial technologies.

3M-O12 A GLUCOSE-CONJUGATING ENZYME THAT IS HIGHLY EXPRESSED IN THE SILK GLANDS OF MOTHS

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Uridine diphosphate glycosyltransferase (UGT) is a multigene family of enzymes responsible for catalyzing glycosylation of small molecules. These enzymes participate in the detoxification of xenobiotics and biotransformation of endobiotics, where glucose conjugation increases the water solubility of lipophilic aglycone compounds. The latest genomic analysis of the corn earworm (*Helicoverpa zea*), a serious agricultural pest species feeding on numerous economically important plants, identified 45 different UGT genes. We found a UGT gene (UGT34) showed high levels of expression exclusively in the silk gland tissue, a tissue which is not believed to be directly involved in detoxification, but was not expressed in the other tissues, such as central nervous system, guts, fat body, and Malpighian tubules. Quantitative and real-time PCR were used to analyze the expression levels of UGT34 in different instar stages and silk gland sub-segments. This revealed that UGT34 is relatively expressed at all instar levels and prominently expressed in the middle and posterior subsegments of the silk glands. Additionally, the same analysis was carried out on a different Noctuidae moth species, the soybean looper (*Chrysodeixis includens*), resulting in similar gene expression trends, suggesting an important role of UGT34 in the silk glands of moths. RNA interference (RNAi) was utilized in this study but found to be unsuccessful in determining UGT34 function. Silk plays a critical role in feeding, protecting, and metamorphosis in many lepidopteran insect species. Altogether, the present study implies that UGT34 plays an important role in silk glands, yet its molecular and physiological function is being explored.

HIGH SCHOOL STUDENT POSTERS (HG-P)

HS-P01 UTILIZING A CONSUMER-GRADE UAV TO MONITOR CORN GROWTH

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Approximately 60% of the annual rainfall occurs outside of the crop growing season in Mississippi State. A large amount of rainfall has resulted in severe soil erosion on farmlands. This problem causes degradation of soil health and water quality through runoff. To resolve this issue, growers intend to plant cover crops after harvest to hold soil and nutrients. This study is aimed to monitor corn growth and development for investigating the effects of cover crops and poultry litter. A consumer-grade unmanned aerial vehicle (UAV) with a digital camera were flown over two fields for multiple days during the cover crop growing season and after the corn emerged. The experiment fields are located at the Mississippi Agricultural and Forestry Experiment Station in Pontotoc County, Upper Coastal Plain Region, Mississippi State. By using Pix4Dcaputre (Pix4D S.A., Prilly, Switzerland) to plan UAV missions, a series of red-green-blue (RGB) images were acquired. The images were then processed on Pix4Dcloud (Pix4D S.A., Prilly, Switzerland) to create orthomosaic images that fully cover the experiment fields. The normalized difference photosynthetic vigor ratio (NDPVR) images were created; as a result, the values of each experimental plot were extracted using QGIS (https://qgis.org/en/site/). The NDPVR data were used to compare corn growth in different plots with and without cover crops or poultry litter. The results indicated that there is a positive association between corn growth and cover crops or poultry litter. This study suggested that cover crops and poultry litter could enhance corn growth in the humid region.

UNDERGRADUATE STUDENT POSTERS (UG-P)

UG-P01 ASSESSING THE INFLUENCE OF BIOGEOGRAPHY ON SOIL MICROBIAL COMMUNITIES

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Soil microbial communities are the major drivers of the agroecosystem, mainly aboveground biotic communities, plant species diversity and productivity. Microbial communities differ substantially between the soil types and under different land management systems. Understanding the variable influence of soil microbial community composition on seedling establishment is important for early seedling growth and development. The focus of this study is to understand how the soil microbial diversity and their interactions with soil factors contribute to specific soil functions. In this study, to assess the differential microbial communities, ten soil samples with different soil characteristics were collected across the state of Mississippi. Sample locations were chosen with a wide range of natural and cultivated systems, including farms, forests, Prairies, edge of the abandoned lime pit, parent materials, slope classes and undisturbed lands. The top 0–10 cm soil samples were collected and homogenized during sampling to create a composite sample for each sampling site. The collected soil samples were stored in a cooler, transported to the laboratory, and stored at -20ºC. Further, to evaluate the distinct soil microbial communities, the soil slurry of each sample will be prepared using sterile phosphate-buffered saline (PBS) and live microbes will be confirmed by plating the soil slurries on LB agar media. Finally, the community level physiological profile of the soil will be analyzed using Biolog Ecoplates. This metabolic profile will be used to analyze the environmental influence of each soil on the microbial communities and subsequently the soil functions.

UG-P02 HAPTOGLOBIN AS A MEASURE OF INFECTION PROGRESSION IN A RAT MODEL OF IMPLANT-BASED OSTEOMYELITIS

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Orthopedic disease or trauma causes a complex immunological response, inducing changes in circulating immune cells and proteins (e.g., haptoglobin) which can be used to longitudinally track infection and/or inflammation. One disease that has been modeled for study of progression and treatment efficacy is osteomyelitis, bone infection commonly caused by staphylococcal strains. Current treatment includes long-term, systemic antibiotics, but low penetration of antimicrobials in bone can result in chronic infections, warranting surgical debridement or amputation. We have previously established an implant-based femoral osteomyelitis model in the rat, which was characterized using representative radiographic/fluorescent imaging and terminal bacterial quantification; however, no quantitative, longitudinal measures were made. We are evaluating chitosan, a derivative of chitin with

antimicrobial properties, in hydrogel form for localized treatment of osteomyelitis. Previously, we have shown that fosfomycin-loaded chitosan hydrogel displayed significant killing of *Staphylococcus aureus* (*S. aureus*) *in vitro*. It was hypothesized that wrapping a porous electrospun polycaprolactone (PCL) membrane around fosfomycin-loaded chitosan hydrogel would increase antibiotic retention at the infection site in our rat model. After one week, the bacteria-soaked screw was removed and treatment was applied: chitosan hydrogel, chitosan hydrogel with fosfomycin, or chitosan hydrogel with fosfomycin and the PCL scaffold. Longitudinal blood samples were analyzed for haptoglobin concentrations. Increased haptoglobin levels were seen as early as day 3, with all groups elevated at day 10. All groups returned to baseline levels by day 21. Future study will include exploration of additional markers for more in-depth understanding of the immunological response to osteomyelitis and antimicrobial treatments.

UG-P03 A TALE OF TWO CONTINENTS: ANALYZING THE CHARACTERISTICS OF EMERGING TECHNOLOGY ADOPTERS

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This paper systematically reviews 57 peer-reviewed studies, specifically conducted in the United States and Europe, to examine the public's acceptance and adoption of emerging technologies. We synthesize extracted articles regarding electric vehicles, autonomous vehicles, and urban air mobility to understand who the potential adopters of these technologies will be based on sociodemographic characteristics and perceived opportunities and challenges. Our findings demonstrate that these adopters are strikingly similar amongst these technologies with majority of the individuals characterized as male, Caucasian, 20-30 years old, high level of education, and high-income level. If these findings are accurate, equity becomes a major concern as these transportation advancements will only serve a specific demographic rather than the whole population. However, if these findings are inaccurate, the possibility of randomness within the studies become apparent, revealing imperfections within the study design or data collection methods. This is inherently important as emerging technologies rely heavily on the public's willingness to adopt, so if data is not collected properly, a clear insight into the future of these technologies would be inaccurate and unreliable.

UG-P04 EVALUATION OF THE PRINTABILITY OF ADDITIVELY MANUFACTURED POLY(LACTIC-CO-GLYCOLIC ACID) AND NANO-HYDROXYAPATITE COMPOSITE BONE SCAFFOLDS

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Large bone defects often require reconstructive procedures and are most commonly caused by trauma, congenital disorders, or cancer. Current treatments for bone injuries are limited due to a finite supply of donor bone for bone grafting procedures. Additively manufactured, or 3D printed, bone scaffolds have the potential to alleviate this problem and allow for patient specificity in scaffold geometry and material composition. A bone scaffold made of poly(lactic-co-glycolic acid) polymer and nanohydroxyapatite ceramic would have the advantages of being biodegradable, readily available, and mechanically strong enough for application in load-bearing bone. A current challenge in 3D printing bone scaffolds is the development of protocols that ensure repeatability in the size and shape of the scaffolds. In this experiment, scaffolds were 3D printed using a CELLINK BIOX2 printer which controls temperature, pressure, and speed of printing. To examine the accuracy of the printed scaffolds to their as-designed geometry, an analysis of images collected via three imaging modalities was performed. Layer-by-layer images were collected during printing via a camera attachment on the printer. Additionally, micro-CT scanning and surface profilometry were performed post-printing to capture 3D volumes and surface topology, respectively. The in-print images were compared to the post-printing images, to offer insight into the accuracy of the print and to inform selection of printing parameters. The next steps in this research will be to analyze images for various printing parameters. This work is important in alleviating the current limitations in bone defect repair and would be an advancement towards personalized medicine.

UG-P05 HIGH-THROUGHPUT METHOD FOR PHENOTYPING SEED QUALITY COMPOSITION IN CORN AND SOYBEAN

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Seed quality of corn and soybean are directly related to plant-human health and international trade. Over the years, genetic enhancement of seed quality traits has been neglected due to a lack of high throughput screening tools. Traditionally, laboratory-based destructive seed quality (protein, oil, starch, and other) measurement methods are laborious, expensive, and time-consuming. The newly developed Near-Infrared Reflectance Spectroscopy (NIRS) helps phenotype many samples for quality traits without seed grinding possible. This study examined the genetic variability in soybean and corn's seed compositions (protein, oil, and starch) using the NIR DA7250. NIRS reproduces highly consistent scans, which indicates the accuracy of the high throughput instrument in detecting variations in seed quality. The reproducibility of NIRS scanning between scans was highly consistent, indicating the accuracy of the high throughput instrument in detecting variations in seed quality compositions. Soybean (10 genotypes) and corn (27 genotypes) showed a wide range of diversity in seed composition. Soybean seed contains 36.0% to 40.6% protein, 20.6% to 22.7% oil and 1.2% to 2.5% starch. Similarly, we investigated natural variation in seed quality composition of corn genotypes. Mature corn seed starch varied from 54.5 to 63.8 %, followed by protein (10.1 to 15.3 %) and oil (2.9 to 5.1 %). Starch in mature corn seeds was negatively correlated with protein ($r = -0.70$, $p<0.05$). A positive correlation was noted between protein and oil ($r = 0.60$, $p<0.05$). These results indicated the accuracy and reliability of the high-throughput approach in capturing the genetic variability of composition traits in corn and soybean crops.

UG-P06 MORPHOLOGY, BEHAVIOR, AND LIFE CYCLE OF THE HIBISCUS SAWFLY, *ATOMACERA DECEPTA* (HYMENOPTERA: ARGIDAE)

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Atomacera decepta, commonly known as the hibiscus sawfly, is considered a minor pest, but it feeds on the foliage of several ornamental plants, including hollyhocks, rose mallows and some other Hibiscus plants, turning it to a lacy skeletons of leaf veins. Such a voracious appetite of the sawfly is an interesting mode of feeding among different herbivorous insects. However, little is known about this insect species. The purpose of this research is to collect basic data of its morphological and behavioral characteristics and to provide better understanding for future research. Discovering characteristics of *A. decepta* has been performed through a few

projects. (1) Morphological features of larvae and adults were investigated by observational examinations and scanning electron microscope (SEM). (2) Observations of live sawflies in the natural habitat as well as in the lab were conducted to grasp their basic behaviors and life cycle. (3) The larvae were dissected to find out what internal organs might be involved in allw299@msstate.edu defensive mechanism. (4) Finally, the whole body transcriptomes were obtained by Illumina HiSeq2000 for the future investigation on digestive and detoxifying enzymes in larvae. As a result, this project has provided clearer information about this less-studied insect, but, at the same time, gave an opportunity for more questions to be addressed. A basic understanding of *A. decepta* characteristics would pave a way for future research on its digestive physiology and defensive chemistry.

UG-P07 EFFECTS ON PRODUCTION, WELFARE AND BEHAVIOR ON LAYERS TRANSFERRED FROM A CAGED TO CAGE-FREE ENVIRONMENT

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A six-week study was conducted to evaluate the behavior, welfare, and production effects on laying hens with a history of cage system after being transitioned to a cage-free environment. A total of 84 Hy-Line W-36 laying hens at the age of 70-weeks were used in the experiment. Each pen consisted of seven birds and contained identical littered floors, waterlines with nipple-drinkers, hanging feeders, and wooden perches. Furthermore, each pen also contained a HikvisionÒ Night Vision camera to observe the behaviors of the hens at various points of time during the day. Hens were adapted for one week for acclimation to the cage-free environment. The production performance data calculated were the following: feed consumption (FC), hen day egg production (HDEP), hen day egg mass (HDEM), and feed conversion ratio (FCR). The production performance data was analyzed as a completely randomized design (CRD) comparing with weeks as a factor, with PROC GLM procedure SAS 9.4. Furthermore, four welfare evaluations were also conducted throughout the trial evaluating the paw, comb, and feather scores. Welfare data was analyzed with PROC FREQ procedure and subjected to Fisher's Exact test. Feed consumption (FC) slowly increased post-adaptation through the 73rd week of life, then rapidly increased in the 74th and 76th week of life (P=0.0001). One possible reason might be that in the new environment birds were prone to litter eating in the first few weeks after transfer. The FCR-g (gram of feed consumed per gram of egg) parallels this increase in consumption (P=0.025). FCR-g began at 1.90 and increased to a ratio of by the week of life. Subsequently, the FCR increased to a rate of 3.22 by the 74th week. There were no differences in HDEP, HDEM, and average egg weight. The positive welfare results opposed the hypothesized negative results as the trial was conducted. Paw scores remained consistent throughout the trial with a lesion percentage of 4.86% to 6.08% through the four scoring evaluations. Feather lesion percentage initially began at 6.99% but decreased to 4.26% by the 73rd week; however, after this the lesion percentage rose to 11.55% (P=0.0005). This is indicated by an increase in dust-bathing behavior after the transfer, or an increase in infighting due to lower amounts of feed present at this time. Comb lesion percentage remained at 5.78% through the first two scoring evaluations, but steadily decreased to 3.95% by the final evaluation (P=0.0733). Thus, as indicated through the welfare results, post-adaptation welfare for hens decreases for comb and feathers, as birds become adjusted to one another and the environment. The focus of energy usage may have shifted from that of constant egg production to body maintenance due to age. Furthermore, four additional weeks were observed to give hens the time required to increase feed consumption and properly convert it. As consumer preference towards alternatively produced eggs in the market becomes more prevalent, further extensive studies that evaluate welfare become more essential to continue the growth of the egg industry.

UG-P08 DOES SEED SIZE AFFECT GERMINATION UNDER CHILLING STRESS IN COTTON?

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The current cotton planting dates in Mississippi are often exposed to temperatures above optimum and low rainfall during the peak flowering and boll formation. These challenges can partially be alleviated by adopting early-season planting. However, poor seedling emergence percentage and post-emergence seedling vigor are hampered by early-season planted cotton due to chilling weather. Under chilling conditions, the seed must be able to germinate and become established. This poses the question of whether seed size has any effect on germination under chilling conditions. This study aimed to evaluate the impact of cotton seed size on germination under chilling stress to explore the relationship between seed size and germination under chilling stress. We measured the seed size variations using cotton cultivars accessible to producers and suitable for production in the U.S. southern region. A wide range of variation in 100-seed weight (7.3-10.5 g) was observed among the cotton cultivars. Using the seeds available in their commercial form, including the seed treatment, germination ability parameters are being measured as a function of seed size under optimum (28 ^{o}C) and chilling (18 ^{o}C) temperature conditions. Additionally, measured radicle and plumule lengths will be used to explore the relationships between seed size and seed vigor on chilling tolerance. A cotton cultivar with the highest seed germination percentage and fitness traits might provide opportunities for farmers to shift planting dates towards cooler temperatures.

UG-P09 INVASIVE AQUATIC PLANT SPECIES DETECTION ON NVIDIA JETSON NANO USING DEEP LEARNING AND COMPUTER VISION

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Wetland ecosystems are vulnerable to the infestation and uncontrolled spread of invasive aquatic plant species. Such species, if left unchecked, can hinder the growth of native plants as well as animals in that ecosystem. Sometimes floating invasive plants like water hyacinth can displace native submerged plants and co-dependent wildlife entirely by blocking the necessary sunlight for photosynthesis and suitable temperature and disturbing vital gaseous exchange between water and air, making it toxic. The solution to this problem is to correctly identify and treat these plants with suitable herbicides, however, doing so is a very time-consuming and labor-intensive task. It requires highly skilled personnel with knowledge and experience with identifying such invasive plants, and there are only a few that have the time and resources to do it. With machine learning methods getting traction in almost every field, it can be very useful in automating the detection and identification of invasive plants as well. There are only a handful of research that aimed at using deep learning for plant species identification. The aim of this project was to put together a detection tool implementing deep learning algorithms and computer vision techniques to detect and identify 8 most commonly found invasive species in Mississippi's wetland ecosystems. This was achieved using a micro controller called Nvidia Jetson Nano (nano) running deep learning models like Convolutional Neural Network (CNN) and Resnet-18 that were trained over 1600 hand-taken

images of those 8 plant species. Moreover, Mobilenet-ssd was used as the detection architecture for live detection with the help of a low-resolution camera connected to the nano. Once fully optimized, this tool can be deployed on automated robots like crawlers, water boats, or even drones to do real-time detection and identification of each invasive plant in the vision frame.

UG-P10 ALLELOPATHIC POTENTIAL OF SWEET POTATO VARIETIES ON THE GROWTH OF PALMER AMARANTH

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There is tremendous interest in developing effective and sustainable methods to suppress the spread of Palmer amaranth (*Amaranthus palmeri*) in agriculture. This weed is problematic because it is easy to spread, resistant to numerous herbicides, and causes crop yield loss. Numerous studies on the chemical control of Palmer amaranth have been conducted, but the interaction of this weed with other crop plants that have allelopathic effects is still unclear. This study aimed to evaluate the allelopathic effects of 17 sweet potato varieties on the growth of Palmer amaranth (*Amaranthus palmeri*). This study was conducted under controlled conditions in the greenhouse in a stair-step set up in the Department of Plant and Soil Sciences at Mississippi State. Plant height was collected weekly. Four sweet potato varieties were most effective in suppressing Palmer amaranth. The variety that reduced (up to 85%) Palmer amaranth height the most was Hatteras. The variety Centennial presented the most expressive initial height reduction, up to 32%. In the presence of the variety Morado, the germination of the weed was delayed until four weeks after emergence, followed by growth inhibition. The variety Evangeline showed an up to 36% height reduction of Palmer amaranth. Among the sweet potato varieties studied, these three varieties performed the best and can be considered growth suppressors of Palmer amaranth.

GRADUATE STUDENT POSTERS (GS-P)

GS-P01 COUPLING CLIMATIC AND OCCURRENCE DATA TO UNDERSTAND AND PREDICT ANNUAL SURVIVAL OF REDBANDED STINK BUG

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The non-native redbanded stink bug (RBSB), *Piezodorus guildinii* (Westwood), (Hemiptera: Pentatomidae), first emerged as an economically important pest of soybean in Louisiana in 2000. Drivers of interannual fluctuations in the distribution of RBSB populations are poorly understood, but such fluctuations may depend on the cold tolerance of overwintering RBSB, a chill susceptible species. Using geospatial analysis of climate data, cold tolerance metrics, and occurrences of RBSB across the southeast over the past two decades, we examined the relationship between winter weather and RBSB presence in the southeastern United States. We hope these efforts improve annual forecasts of economically significant RBSB populations across soybean growing regions of the Southeastern United States.

GS-P02 ASSESSING THE RELATIONSHIP BETWEEN SOIL HEALTH AND SURFACE RUNOFF WATER QUALITY IN THE MISSISSIPPI DELTA

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Enhancing soil health and understanding its interaction with the environment is essential due to its potential impacts on crop productivity, nutrient cycling, and water quality. The goal of this study is to explore relationships between soil health and runoff water quality from agricultural fields, under different management scenarios in a Mississippi Delta watershed. A soil/health quality index was determined using the Soil Management Assessment Framework (SMAF). Nine (9) soil health indicators (aggregate stability, microbial biomass carbon, soil organic carbon, bulk density, beta-glucosidase enzyme, Mehlich 3 extractable phosphorus and potassium, electrical conductivity and pH) were selected to compute the SMAF based on the soil data collected by the USDA-ARS National Sedimentation Laboratory in Beasley Lake Watershed near Inverness, MS. Runoff water samples from fields managed under row crops, vegetative buffers, or Conservation Reserve Program (CRP) were analyzed for the years 2008 and 2012. Preliminary results showed that soil health/quality improved for all management treatments in 2012 as compared with 2008. There was a significant reduction in orthophosphate-P and total Kjeldhal nitrogen measured in surface runoff in 2012 relative to 2008. These surface runoff water quality parameters were positively correlated with the soil quality/health indicators aggregate stability (R=0.56), and microbial biomass carbon (R=0.85), respectively. Overall, areas managed under CRP had higher soil health indicators and improved runoff water quality, while row crops fields had the lowest indicators, those management practices that improve soil health may have a benefit on runoff water quality in agricultural landscapes of the Mississippi Delta.

GS-P03 GLOBAL DIETARY AND HERBAL SUPPLEMENT USE DURING COVID-19 -A SCOPING REVIEW

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The lack of effective treatment options for COVID-19 has raised many concerns among populations in its first two years, prompting many attempts to find alternative options to prevent the disease from spreading or to slow the progression of the infection. The aim of this scoping review is to summarize dietary supplement use in the general public published to date, during COVID-19 pandemic. A systematic search was conducted in December 2021 following PRISMA guidelines. PubMed, ERIC, and Scopus databases were searched, and 956 results were screened for eligibility. Fourteen cross-sectional studies from 11 countries and 3 continents were examined. All studies were large population surveys investigating healthy eating and supplement use during COVID-19. Vitamin C, vitamin D, zinc, and multivitamins were the most widely reported, as well as natural/herbal products such as ginger and honey. The most common reason cited for supplement use was to strengthen the immune system and to prevent infection of COVID-19. These studies reported that populations are relying on healthcare providers, family, friends, and social media to learn about supplement use. Future studies on the treatment of COVID-19 should

GS-P04 ROLE OF BRANCHED-CHAIN FATTY ACIDS IN LISTERIA MONOCYTOGENES PATHOGENESIS

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Listeria monocytogenes is a food-borne bacterial pathogen that can survive and multiply in a wide range of temperatures, including refrigerators in food storage. The ability of L. monocytogenes to survive at low temperatures leads to frequent recalls of contaminated food products and fatal outbreaks of listeriosis. A critical mechanism that enables L. monocytogenes to grow at low temperatures is the ability to retain its normal membrane fluidity through branched-chain fatty acids (BCFA) synthesis. Branched-chain α-keto acid dehydrogenase (BKD) plays a vital role in BCFA biosynthesis pathway. BKD is a multi-subunit enzyme complex composed of four polypeptides: a dihydrolipoamide dehydrogenase (E3), a dehydrogenase (E1α), a decarboxylase (E1β), and a dihydrolipoamide acyltransferase (E2) encoded by lpd, bkdA1, bkdA2, and bkdB gene respectively. We constructed BKD deficient L. monocytogenes strain by in-frame deletion method. Our result showed that BKD is required for full L. monocytogenes virulence in mice, growth kinetic at lower temperatures by maintaining membrane fluidity, and plaque formation in L2 fibroblast cells. Furthermore, locking PrfA in its "active" conformation (PrfA*) restored the wildtype phenotype (virulence, cold tolerance, BCFA composition, and membrane fluidity) in BKD-deficient strains. This result indicates that PrfA* allows the BKD-deficient strain to bypass the biochemical step that requires BKD for the biosynthesis of BCFA under relevant host conditions. It is not fully understood how PrfA*, a regulator that enables virulence, would influence BCFA biosynthesis. Further study will investigate this mechanism. This study demonstrates a novel role of PrfA and BKD complex in listerial pathogenesis, which may provide insight into the development and application of antimicrobial agents.

GS-P05 PHENOTYPIC CHARACTERIZATION OF SOYBEAN CULTIVARS FOR HEAT AND DROUGHT STRESS TOLERANCE

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Soybean production is projected to face a significant impact of climate changes, with an increased frequency of heatwaves occurring along with periods of prolonged drought spells. The coincidence of these stressors during pod filling is expected to affect the yield and quality of soybean. We hypothesized that the soybean cultivar with individual drought or heat stress tolerance might not show the combined stress tolerance. To address this hypothesis, we (i) quantified yield and quality traits responses of soybean under control (100% irrigation+32°C daytime temperature), drought (50% irrigation), heat (38°C daytime temperature), and combined stress (38°C daytime temperature +50% irrigation) conditions; (ii) compared the tolerance score of soybean cultivars across the stress treatments. All cultivars' yield components and quality (protein and oil) composition varied under stress treatments compared to the control. Averaged across soybean cultivars, the magnitude of the decrease followed the order of heat stress < drought stress < combined stress for the seed yield per plant. The pod weight was reduced by 48%, pod number by 35%, seed number by 42%, and seed weight by 43% under combined heat and drought stress compared to that under control. The seed protein and oil contents were significantly affected in response to treatments. Drought stress had a greater impact on yield compared to heat stress. Stress susceptibility index in heat or drought did not show a significant correlation with combined stress, indicating that the selection of soybean for individual stress might not perform under combined stress conditions.

GS-P06 DESIGN OF A PERFUSION-COMPRESSION BIOREACTOR FOR EVALUATING IMPLANT OSSEOINTEGRATION

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Mechanical loading *in vivo* is necessary for new bone formation leading to successful implant osseointegration. Our objective is to develop a perfusion-compression bioreactor system that will apply a physiologically relevant perfusion flow and mechanical compression regime to study implant osseointegration *in vitro*. The system consists of a bioreactor chamber, a perfusion flow set-up, and a mechanical loading frame. The bioreactor chamber is equipped with inserts allowing for specimens of varying sizes to be cultured. A bioreactor chamber capable of maintaining a large bone explant (d=10 mm, h=7 mm) allows for enough tissue to examine the effects of mechanical stimuli while preserving the native bone matrix and tissue integrity. A peristaltic pump perfuses culture media throughout the bioreactor chamber, inducing stimulatory shear stresses on the specimen and facilitating nutrient exchange and waste removal from the culture environment. On the aluminum and steel loading frame, a captive stepper motor linear actuator in line with a micro load cell allows for dynamic compression of the specimen and recording of the applied force. A custom LabVIEW program allows for force feedback control of the stepper motor actuator. Future work will involve the addition of a Linear Variable Differential Transformer (LVDT) to monitor explant displacement during compression. The perfusion-compression bioreactor system can be used to guide orthopedic implant design, reduce the need for animal models in initial implant osseointegration studies, and further our understanding of how differing mechanical loading regimes affect implant osseointegration.

GS-P07 LEAF MASS PER AREA, NITROGEN, AND □15N REFLECT PHOTOSYNTHETIC CAPACITY, WATER, NITROGEN USE, AND TRADEOFFS ACROSS EASTERN COTTONWOOD AND HYBRID POPLARS

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Eastern cottonwood (DD) and six taxa of *Populus* hybrids (*P. deltoides* × *P. maximowiczii* (DM), *P. deltoides* × *P. nigra* (DN), *P. deltoides* × *P. trichocarpa* (DT), *P. trichocarpa* × *P. deltoides* (TD), *P. trichocarpa* × *P. maximowiczii* (TM), *P. deltoides* × *nigra* × *maximowiczii* (DN×M) were selected and planted at two sites in the southeastern U.S. to select most productive and high water use efficiency (WUE) taxa and clones. During the first growing season, gas exchange and stable isotope carbon and nitrogen were measured in July. We found that under a low nitrogen site (Monroe site, 0.49 mg/g of N), DD exhibited the highest leaf nitrogen content (LNC) and WUEiso than some *Populus* hybrids. In contrast, under high nitrogen site (Pontotoc site, 1.06 mg/g of N), some of the hybrids exhibited higher LNC and WUEiso than DD. Although gas-exchange data calculated WUE were positively and significantly correlated with WUEiso, different patterns of WUE across DD and hybrids were observed. LNC was significantly and positively correlated with WUE, while photosynthetic nitrogen use efficiency (PNUE) was negatively correlated with WUE in the Monroe site but positively in the Pontotoc site. Our results suggest that the WUE of poplar can be affected by LNC and PNUE, and different taxa show different WUE and PNUE under different soils. Tradeoffs between WUE and PNUE were observed in the Monroe site, which may indicate that soil nitrogen availability limits poplar WUE and PNUE.

GS-P08 PROTEOMIC ANALYSIS OF CHLOROPLAST PROTEINS OF SOYBEAN PLANTS IN RESPONSE TO SILICON APPLICATION

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Soybean is an important economic crop around the world. It has good nutrition value due to rich source of protein content along with dietary minerals and vitamins. Mostly, soybeans are grown over 50 percent of Mississippi non-irrigated sites. Considering a significant area of crop production under water-limited rain-fed conditions, there is a great need to develop production systems to sustain yield potentials under water deficit stress. Drought stress is one of the major abiotic stresses. Moreover, climate change may also lead to increase the intensity, duration and frequency of drought stress. Silicon has recently been recognized as an important element in plant nutrition. In our previous study, it has been shown that supplying soybean with soluble silicon in the soil could improve vegetative growth and biomass production under water limiting conditions. However, the mechanism how silicon alleviates water deficit stress is not understood. Moreover, the previous studies do not have enough information about the interaction of silicon with chloroplast proteins. In this study, we examined the effects of silicon application on chloroplast proteins expression. Soybean plants were cultivated in pots containing soil supplied with 2 millimolar solution of sodium silicate. Equal amounts of sodium chloride were used to reverse the effects of sodium along with control plants. Intact chloroplasts were isolated from the leaves of silicone-treated and control plants exposed to water stress. Proteins were then extract from isolated chloroplasts. Two-dimensional gel electrophoresis and mass spectrometric approaches were used to identify differential chloroplast proteins in response to silicon application under water deficit stress. Proteins that shown differential expression in response to silicon application include photosynthetic proteins and enzymes. These results suggest that silicon application could affect enzymes important for photosynthesis and stabilize photosynthetic proteins and enzymes under water deficit stress.

GS-P09 AUTOMATED MEANS FOR WOOD FAILURE PREDICTION

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The current method for estimating wood failure using the American Society for Testing Material ASTM D5266-13 (2020) standard is highly subjective, requiring visual evaluation and mental estimation, and having made only minor advancements over the years. Additionally, various techniques have been proposed with the goal of improving the current protocol. However, none of them have been accepted as an accurate method by ASTM. Convolutional neural networks (CNN) have been demonstrated as a robust and trustworthy method for classifying, detecting, and segmenting objects in images in many different fields. To the best of our knowledge, there is no study to estimate wood failure using CNN. The overarching goal of this research is to use artificial intelligence/machine learning (AI/ML) to estimate wood failure in bonded three-ply hardwood plywood from mechanical shear strength specimens. The CNN approach needs to be accurately trained and validated with different parameters, namely wood and adhesives types, to be able to correctly generalize and predict truly unseen data. In preliminary experiments, we created a CNN based on the SegNet network. We trained and validated our approach with custom manufactured plywood. Shear specimens were prepared and tested. Pictures of 99 shear bonded areas were taken. These pictures were processed to create input masks from the failed areas. Eighty (80) pictures and input masks were used for training, and nineteen (19) for validation. The CNNs' prediction was tested on the validation set using four metrics and achieved accuracy = 0.99, F1-Score = 0.99, Matthew's Correlation Coefficient (MCC) = 0.98, and Jaccard Index (J) = 0.98. The next steps of this research include increasing the dataset and comparing the CNN's prediction with external evaluators' results. The major expected outcome of this research is that AI/ML will provide support to the wood composites industry, with a tool that estimates real wood failure with fast and highly accurate results, and with limited subjectivity.

GS-P10 CUTTING PROPAGATION OF SWEETBAY MAGNOLIA

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Sweetbay magnolia (*Magnolia virginiana*) is native to the southeastern United States, as well as areas in Pennsylvania, Delaware, Maryland, New York, New Jersey, and Massachusetts. It can survive from hardiness zones 5 to 9. Propagation of sweetbay magnolia from vegetative cuttings has been noted to be difficult among the different cultivars. Two studies were conducted in order to provide growers with relevant cutting propagation recommendations. The first study, conducted in 2020, was to determine if basal wounding and/or hormone source would improve rooting of sweetbay magnolia cuttings when treated with a basal quick dip in a range of indole-3-butyric acid (IBA) concentrations. The auxin formulation applied was Hortus IBA (Hortus IBA Water Soluble Salts™). The interaction between basal wounding and level of auxin had no significant effect on any data parameter collected. Basal wounding alone had no significant effect on any data parameter collected. Auxin level did not have a significant effect on growth index or cutting quality. Root percentage, root number, root quality, and average root length (of three longest roots) were all significantly affected by auxin level. Overall results suggest that dipping sweetbay cuttings in Hortus IBA at 5000 ppm, 7500 ppm, 10000 ppm, regardless of basal wounding, will result in a higher quality liner. Building off the findings of the 2020 study, a second study was conducted in 2021 to determine if auxin application method and/or propagation substrate could further improve rooting of sweetbay magnolia cuttings. Treatments included two substrates (100% pine bark or 100% perlite) and six methods of auxin application (no auxin, quick dip, single over-the-top spray, single over-the-top spray with surfactant, multiple over-the-top sprays, and multiple over-the-top sprays with surfactant). The auxin formulation applied was Hortus IBA (Hortus IBA Water Soluble Salts™) at a concentration of 10000 ppm, as per the results of the first study. After treatment application, cuttings were inserted into 12 cm containers and placed under intermittent mist. The interaction between substrate and auxin application method had no significant effect on any data parameter collected. Substrate alone had a significant effect on root number and root percentage, but no significant effect on average root length (of three longest roots) or root quality. Auxin application method did not have a significant effect on average root length (of three longest roots) or root number. Root percentage and root quality were both significantly affected by auxin level. Within the substrate types, auxin application method had a significant effect on root percentage in 100% pine bark, but not in 100% perlite. Auxin application method had no significant effect on root number of pine bark or perlite. Overall results suggest that sweetbay cuttings propagated into 100% pine bark with Hortus IBA 10000 ppm applied via a quick dip, single over-the-top spray, single over-the-top spray with surfactant or multiple over-the-top sprays, will result in a higher quality liner.

GS-P11 FUNGAL ACTIN SUSCEPTIBILITY TO THE ANTIFUNGAL OCCIDIOFUNGIN, USING *S. CEREVISIAE SHUFFLE STRATEGY*

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Occidiofungin is a novel antifungal with a broad spectrum of activity against yeast and filamentous fungi. Studies have identified actin, a highly conserved protein found in all eukaryotic cells, as its biological target. Comparing *S. cerevisiae* with *C. glabrata* and *C. albicans*, the *ACT1* gene codes for a protein that shares 100% and 94% amino acid identity, respectively. Interestingly, previous studies have shown that *C. albicans* and *C. glabrata* exhibit a 2-4-fold resistance to occidiofungin relative to *S. cerevisiae*. This study aims to identify whether these amino acid differences in the *ACT1* gene contribute to occidiofungin susceptibility. Using a haploid *S. cerevisiae ACT1* shuffle stain in which the genomic copy of *ACT1 wa*s deleted but present on a *URA3* plasmid, the functionality of *ACT1* gene products from *C. albicans* and *C. glabrata* were analyzed. Functional complementation measured cell doubling time, actin protein levels, and nuclear positioning. Data indicates that cells expressing the *ACT1* gene from *C. albicans* or *C. glabrata* exhibited characteristics indistinguishable from that of *S. cerevisiae*. Data for susceptibility to occidiofungin by minimum inhibitory concentration assays also indicate a similar sensitivity profile as *S. cerevisiae.* These finding suggests that amino acid differences in the *actin protein* between *S. cerevisiae* and *C. albicans* are not responsible for the variances in occidiofungin sensitivity, which points to other factors contributing to these differences. Additional studies to include testing of *ACT1* from other fungal organisms that require >10-fold higher concentrations of occidiofungin relative to *S. cerevisiae* will help strengthen these findings.

GS-P12 INEQUITY OF ACCESS TO EMPLOYMENT FOR SOCIALLY VULNERABLE POPULATION ACROSS AMERICA

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This study examines spatial mismatch for low-wage American minorities living in areas where transit offers better access to high-wage employment. The analysis has been conducted across the 50 most populated American metropolitan areas. We measure the spatial distribution of high and low-wage employment and then calculate Transit Access Gap between high and low-wage employment opportunities. This data is augmented with the socioeconomic characteristics of residents to identify the areas of spatial mismatch. Four main findings are obtained. First, as the time threshold increases, the transit access gap between high-wage and low-wage employment increases. Second, transit provides better access to high-wage employment compared to low-wage employment. This indicates that the transit system not only fails to facilitate access to low-wage employment for socially vulnerable communities rather it acts as a catalyst to aggravate the spatial mismatch. Third, among different sociodemographic cohorts, African-Americans experience the highest spatial mismatch. In Rochester 50%, Hartfield 44%, and Philadelphia 42% of low-income African-Americans reside in areas where the transit system offers access to high-wage employment. Fourth, the ratio of the vulnerable population facing spatial mismatch to the vulnerable population who does not face mismatch is higher among the carless households compared to other sociodemographic groups. This ratio is higher in Dallas, Rochester, and Baltimore with 7, 5.6, and 4.7 values, respectively. This study offers a snapshot of how socially vulnerable communities experience spatial mismatch in America. It can, therefore, help to decrease social inequity by detecting areas in need of transit service improvement.

GS-P13 IMPACTS OF EARLY SEASON DROUGHT STRESS ON CORN GROWTH AND DEVELOPMENT

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Drought is a severe threat to agriculture production that affects all growth stages of plants, including corn (*Zea mays* L.). One of the significant factors associated with higher yield potential is seedling vigor at the early vegetative stage. To investigate how corn plants respond to drought stress at the early vegetative stage, we have examined the responses of morphological and physiological traits that may contribute to early vigor. In this study, two corn hybrids were subjected to five levels of volumetric soil water content (0.15, 0.12, 0.09, 0.06, 0.03 $m^3 m^{-3}$) conditions at the V2 growth stage for 28 days. In addition to morpho-physiological, parameters, leaf hyperspectral reflectance properties were measured. Both the hybrids showed a decrease in transpiration ($r^2 = 0.90$) and stomatal conductance ($r^2 = 0.90$) in response to declining levels of soil moisture content. Canopy temperature increased by 5°C in response to severe soil stress (0.03 $m^3 m^{-3}$) levels compared to the control. Whole-plant dry weight declined with a decrease in soil moisture content. Under severe water deficit conditions, corn root biomass decreased by 46% (P1316 YHR) and 40% (A6659 VT2RIB). Root to shoot ratio increased with decreasing soil moisture levels. This study improved our understanding of how corn plants adjust their physiology and shoot-root traits in response to varied soil moisture content. The functional relationships developed through this study can be used to create crop modeling, predict plant performance, and improve agronomic practices under stressful conditions. In addition, the phenotypic data generated from this study can help to prioritize traits associated with the early-season drought tolerance in corn.

GS-P14 PREDICTING YIELDS OF RAINFED GROWN COTTON USING UNMANNED AERIAL SYSTEM DATASETS

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Cotton (*Gossypium* spp.) is the most economically important fiber crop grown in the southern U.S. and globally. Early yield prediction can provide information to make informed management decisions and estimate the market value more accurately. However, in-season yield prediction is challenging due to in-field variability in soil types and environmental variables. Most yield prediction studies have focused on boll counting within a portion of the field. This study evaluated the potential of using cotton fiber pixel area and plant height to predict the final cotton yields under rainfed conditions. A field experiment was conducted in 2021. An unmanned aerial vehicle (UAV) carrying a five-band multispectral sensor was flown at 60 m above ground level before crop harvest or at 153 days after planting (DAP). Similarly, a UAV-mounted LiDAR sensor was deployed to collect structural and topographic data. The multispectral imagery was used to extract the projected cotton fiber pixel area. A support vector machine algorithm was applied to the imagery to segment the cotton fiber pixel from the cotton canopy and background soil with an overall accuracy of 99%. Bare ground data collected using the LiDAR sensor was used to make a digital

terrain model, and the LiDAR collected data at 153 DAP was used to create a crop surface model. Multiple linear regression was performed between observed cotton yield and projected cotton fiber area and plant height. Results showed a strong correlation ($r^2 = 0.82$, $p<0.001$) between UAV-derived datasets and observed cotton yield at harvest.

GS-P15 IMPACT OF NITROGEN AND SULFUR APPLICATION ON YIELD AND QUALITY OF MISSISSIPPI CORN

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There has been a drastic decline in atmospheric industrial ejections due to an improvement in the SO_2 pollution management strategies in the last two decades, reducing sulfur (S) deposition to soils. However, the soil S withdrawal is steadily increasing due to high yielding cultivars, low tillage intensity, increased use of fertilizer with minimal to no S. Therefore, to determine the corn yield response to S and N and their interactions in rainfed corn in Mississippi, studies were conducted at three different locations (Starkville, Brooksville, and Stoneville). Experiments were set up in a randomized complete block design with four replications with a total of 13 treatments each including a control. The treatments included multiple N and S rates. The optical sensors (SPAD, Crop circle, and Mica Sense) were used at each location to sense corn's in-season N and S status at different growth stages. The results were variable across different locations where Stoneville showed significant yield response to N and S, Brooksville responded only to N, and Starkville corn yield was not affected by any fertilizer. The highest recorded yield was at rates (336 kg. N ha^{-1} & 67 kg. S ha^{-1}) and (336 kg. N ha^{-1} & 45 kg. S ha^{-1}) at Brooksville and Stoneville respectively. Within each N rate, non-significant incremental S trends were noted at Brooksville and Stoneville. Conclusively, it was found that the yield responses are location-specific and based on the local soil characteristics and health. Therefore, soil testing is suggested to make nutrient management decisions.

GS-P16 AGRONOMIC OPTIMUM NITROGEN RATE FOR MAIZE (*ZEA MAYS* L.) PRODUCTION IN MISSISSIPPI

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The variable influence of the environment on nitrogen (N) supply and demand dictate the need for yearly updated fertilizer N recommendations. Currently, crop yield goal (CYG) methods are used by 34 land grant universities, including Mississippi State University, which does not consider environmental variations. This research tested the efficacy of CYG by distinguishing the agronomic optimum N rate (AONR) and economic optimum N rate (EONR) for Mississippi corn production. A total of 12 treatments in 2020 and 11 in 2021 were replicated four times over four locations in a randomized complete block design. The optimums were calculated by fitting linear, quadratic, linear-plateau, and quadratic-plateau models by means of four different goodness of fit measures. Furthermore, differences between a calculated CYG rate using the Mississippi yield goal equation and AONR were compared. Overall, AONR varied from 134 kg ha^{-1} to 252 kg ha^{-1} at different management levels. When comparing the AONR to the CYG rate, the CYG rate would over recommend N in each of the possible comparisons with differences ranging from 4 kg ha^{-1} to 93 kg ha^{-1} greater than the AONR. Differences between AONR highlight variability caused by factors such as soil, environment, and their interaction with N supply and demand, which is unaccounted for by the CYG method.

GS-P17 GENOMIC DIVERSITY IN BERMUDAGRASS (*CYNODON* SPP.) REVEALED BY SINGLE NUCLEOTIDE POLYMORPHISMS

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The development of new cultivars and the advancement of bermudagrass breeding is hampered by a lack of information about genetic and phenotypic diversity in bermudagrass (*Cynodon* spp.). To exploit diversity in bermudagrass, a total of 206 common bermudagrass (*C. dactylon* var. *dactylon*) and African bermudagrass (*C. transvaalensis*) accessions of worldwide origin were assembled for this study. DNA sequencing libraries were prepared following the genotyping-by-sequencing (GBS) protocol with *Ape*KI enzyme and sequenced with 101 bp single end reads on an Illumina Novaseq SP platform. With a minor allele frequency of 0.05 and a minimum call rate of 0.5, a total of 37,496 raw SNPs were called de novo using the UNEAK pipeline of TASSEL 3 standalone. Population structure was assessed by running the ADMIXTURE program ranging from k values 1 to 10 and optimum k value came out to be 4 from cross-validation error plot. The results of admixture found to be consistent with principal component analysis (PCA) and phylogenetic analysis. According to principal component analysis (PCA), PC1, PC2, and PC3 explained 15.6 %, 10.1 %, and 3.8 % of the genetic variance in the germplasm panel, respectively. The various genetic diversity parameters nucleotide diversity or average pairwise divergence (π), estimated mutation rate or expected nucleotide diversity (θ), Tajima's D statistic, and Fst statistic has been calculated to look at the genetic diversity. Genotypic data will greatly help in the genetic dissection of agronomic traits by genome-wide association studies (GWAS) in the future. Genomic diversity analysis revealed substantial amount of variation in the panel, demonstrate the overall potential of population for further genetic studies and its capability to generate new varieties in breeding programs.

GS-P18 EXPLORING THE MICROBIAL PROFILE OF RAW GOAT MILK FROM MISSISSIPPI FARMS AND UNDERSTANDING PRODUCER FOOD SAFETY PRACTICES AND PERCEPTIONS

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Currently, 30 states allow the sale of raw milk, including Mississippi, which imposes strict regulations that limit sales to very small farmers (n<9 goats). These regulations are largely management-based and not food-safety related. The objectives of this exploratory research were to analyze the microbial profile of raw goat milk from Mississippi farms and assess food safety practices and perceptions of dairy goat farmers in Mississippi to identify deficiencies and opportunities for improvement in raw goat milk safety. Raw milk samples (n=30) were collected by farmers using their everyday milking techniques and enumerated for pathogenic bacteria and fecal indicators. Pathogens are dangerous microorganisms that are often causative agents in foodborne outbreaks leading to human illness. Farm management and milk handling practices data was collected through a knowledge-based survey designed in Qualtrics and distributed through social media groups targeting dairy goat producers in Mississippi (n=29). Staphylococcus spp. was present in most (70%) milk samples but aligned with the drying-off period at the end of lactation. E. coli, Enterobacteriaceae, and coliforms were observed in 13.3%, 33.3%, and 40% of samples, respectively; no Salmonella spp. or Listeria

monocytogenes were detected. The survey highlighted farmers' need for educational opportunities on safe milk handling with an emphasis on handwashing and the effects of pasteurization. Most producers (80.8%) are willing to invest more in their farms, creating strategic opportunities for extension outreach to help with market expansion and sustainability. Overall, training accessibility could help producers nationwide by encouraging safe milk handling and best management practices.

GS-P19 IN EVALUATION ON THE EFFECTS OF ADDITIONS AND DELETIONS OF SPECIFIC NUTRIENT MANAGEMENT STRATEGIES ON CORN YIELD AT DIFFERENT PLANT DENSITIES

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Improved nutrient management strategies are needed to increase yield production and quality while maintaining soil health. The present study aimed to determine the suitable cultural practices for improved corn production in Mississippi. Two experiments were set up at Verona and Stoneville, MS, in a randomized complete block design with four replications. Treatments included row configurations (single and twin-row), plant populations (79074 and 98842 seeds ha^{-1}), and one included stepwise additions and other stepwise deletions of different nutrients. The nutrients tested were two nitrogen rates (235and 314 kg N ha^{-1}), phosphorus (45 kg P ha^{-1}), potassium (112 kg K ha^{-1}), sulfur (22 kg S ha^{-1}), and zinc (11 kg Zn ha^{-1}). An additional fungicide application was applied to the last treatment for the additions and five out of six treatments for the deletions. At Verona, all three main effects of population, rows, and fertilizer significantly affected corn yield in the addition study. Similarly, in the deletion study, we found a three-way interaction among the main effects. In 2020 at Stoneville, fertilizer was the only factor that affected corn yield in both studies. In 2021 at Stoneville, population and fertilizer significantly affected corn yield in the addition study. Population and rows significantly affected the corn yield in the deletion study, while fertilizer treatments showed no effect. Overall, most of the factors that produced higher yields were site-specific and based on soil characteristics and health. Producers should determine soil deficiencies before deciding the appropriate nutrient management strategy.

GS-P20 EGGSHELL STRENGTH IN THREE CAVITY-NESTING DUCKS IN MISSISSIPPI

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Wood ducks (*Aix sponsa*), hooded mergansers (*Lophodytes cucullatus*), and black-bellied whistling ducks (*Dendrocygna autumnalis*) are sympatric secondary cavity-nesting duck species in the southeastern United States. Interspecific clutches are common, eggs accumulate in nests from parasitic laying, and strife between females may occur, potentially subjecting eggs to breakage. Understanding the durability of eggs of these species is important for explaining variation in nest and egg hatching success. Our prediction was that eggshell breaking strength (EBS) of hooded merganser eggs would be the greatest among the three species. We collected a total of 67 fresh eggs of the species from nest boxes at two sites in Mississippi in spring-summer 2021. We measured eggshell strength using an Instron Universal Testing Machine (Model 3345; Instron Inc., Norwood, MA) and eggshell thickness using a micrometer (Ames, IA). We measured EBS (Newtons) at the equators of all eggs. We used Tukey's pairwise comparison to test for differences in eggshell strength among species. Mean EBS differed among all species ($P < 0.0001$) and was greatest in hooded merganser, followed by black-bellied whistling duck and wood duck. The EBS was 120.05 (SD = 12.03, n = 7) for hooded merganser, 52.44 (SD =10.04, n=30) for black-bellied whistling duck, and 32.95 (SD =3.90, n = 30) for wood duck. Eggs of hooded merganser had the highest EBS, likely attributed to greater eggshell thickness among these species. Our results are preliminary, and further analyses will explore if eggshell strength correlates inversely with egg breakage in our study, and we will investigate mineral composition of eggshells for the three species.

GS-P21 OPTICAL PROBING OF STRUCTURAL ALTERATION OF BRAIN TISSUES IN PROGRESSIVE ALZHEIMER'S DISEASES USING PARTIAL WAVE SPECTROSCOPY (PWS)

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Alzheimer disease (AD) is the most common form of dementia, characterized pathologically by amyloid plaques and neurofibrillary tangles. One of the earliest overt signs of AD is a loss of cognitive function. It has been reported that AD affects the nanoscale structure of the brain cells which begins long before the cognitive symptoms appear. However, these alterations are undetectable in the initial stages with currently used bulk diagnostic techniques such as MRI and OCT. Thus, the elucidation of a neuroimaging method that can uniquely characterize these structural disorders at nanoscale is imperative for clinical diagnosis. Recently developed finer-focused partial wave spectroscopy (PWS) is a sensitive technique for probing nanoscale structural alterations in cells/tissues in terms of the average structural disorder strength. Results of PWS technique measurements of brain tissues from an animal model and human subjects show significant increase in the disorder strength with the progression of AD relative to their controls. The increased disorder strength can be explained by the higher mass density fluctuations caused by the rearrangements of macromolecules due to the deposition of the amyloid beta protein and damage in DNA with progress of AD. This structural alteration may be reflected in other clinical parameters for early detection of AD and possible treatment.

GS-P22 DETERMINING THE EFFICACY OF OCCIDIOFUNGIN AGAINST CANDIA ALBICANS BIOFILM

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Biofilm formation is a complex process that involves cell attachment to a surface, colonization, and maturation. *Candida albicans* biofilm consists of a structured network of mixed cell morphotypes within an extracellular matrix complex (ECM). Heterogeneous cell layers within a protective ECM confers resistance against clinical antifungals. Targeting of morphologically diverse cells by antifungal agents may be key to biofilm prevention. The antifungal compound occidiofungin is effective against the yeast form of *Candida* species. Recent work has shown that occidiofungin also inhibits hyphae formation in *C. albicans* and *C. tropicalis*. Given these findings, we aim to determine whether occidiofungin can target the heterogenous cell population found in *Candida* biofilms by measuring its efficacy at different biofilm stages and correlating these to changes in biofilm structure. *C. albicans* biofilms formed on silicon elastomer were used to determine the minimum concentration of occidiofungin required to eliminate cells at three stages of biofilm formation: attachment, initiation, and maturation. Antifungal efficacy was evaluated using

an XTT assay to measure metabolic activity and CFU assay to quantify viable cells. XTT results indicate that occidiofungin targets cells at all stages of biofilm with a higher concentration required to eradicate cells in a mature biofilm compared to the attachment and initiation stages. CFU data confirms a reduction in viable biofilm cells. These combined results suggest that occidiofungin may be an effective antifungal agent for *C. albicans* biofilm-associated infections. Future plans include determining the impact of occidiofungin exposure on the architecture of biofilm by confocal and scanning electron microscopy.

GS-P23 EFFECT OF ALLELOPATHIC SWEET POTATO VARIETIES ON PALMER AMARANTH GROWTH: A GREENHOUSE STUDY

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The present study was conducted with 17 varieties of sweet potato to evaluate the allelopathic effect of sweet potato on the growth of Palmer amaranth (*Amaranthus palmeri*). The study was conducted in the Department of Plant and Soil Sciences greenhouse at Mississippi State University, MS, under controlled conditions. The experiment was carried out in a stair-step setup, and data was collected for plant height, biomass, and chlorophyll content. Palmer amaranth showed a significant height reduction in the presence of sweet potato varieties Morado, 529, Centennial, Heart-O-Gold, and Hatteras. The reduction in Palmer amaranth's height was above 80% in the presence of variety Morado at four weeks after transplantation (WAT), while the reduction was above 70% in the presence of varieties 529 and Centennial, compared to Palmer amaranth control. Reduction in chlorophyll content at 4 WAT was above 50% in the presence of varieties 529, Centennial, and Hatteras. Varieties Hatteras, Evangeline, Covington, 529, and Centennial drastically reduced Palmer amaranth dry biomass. Results of the ANOVA for weekly plant height showed that the variation among the sweet potato varieties is significant, thus suggesting different sweet potato varieties have different effects on Palmer amaranth growth. Some of these varieties have already been reported to produce allelochemicals (Soni et al., 2020). The present findings show that sweet potato varieties Centennial, Evangeline, Hatteras, 529, and Morado suppressed the Palmer amaranth growth and can be considered for further allelopathic studies to identify the cause and pathway responsible for weed growth suppression.

GS-P24 EVALUATION OF CORN GROWTH USING RECOVERED NUTRIENTS FROM BIOELECTROCHEMICAL SYSTEMS

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A growing environmental concern is excess nutrients being introduced to water bodies. Agriculture and municipal wastewater are composed of many essential nutrients that can be used for plant and crop growth. A proposed environmental solution is to use recovered nutrients in the place of virgin fertilizer. Bioelectrochemical treatment systems (BES) were used to treat synthetic agricultural (DWW) and synthetic municipal wastewater (SWW) for nutrient recovery. An experiment took place using the expended BES that treated the DWW and SWW by crushing them and amending the topsoil with them to evaluate corn plant growth. The BES were constructed using biochar, terracotta, and bentonite. A total of four soil amendments were used, biochar (BS), terracotta (TS), BES-DWW, and BES-SWW. The amendment made up 10% of the growing medium for each soil group. A control soil of unamended topsoil was used. There was a total of 12 corn plants grown in each of the five soil groups for a total of 60 plants. The corn plants were treated with three different nutrient treatments: 100% Hoagland nutrition solution, 50% Hoagland nutrition solution, and 0% Hoagland nutrition solution. The plants received the nutrient treatment once a day for 30 seconds. The experiment lasted for 38 days at the Environmental Plant Physiology Laboratory at the Rodney Foil Plant Science Research facility of Mississippi Agriculture and Forestry Experiment Station at Mississippi State University. The plants were analyzed for various agro-morphological traits, gas exchange, and pigments. The results confirmed that the BES-SWW and BES-DWW soil amendments can improve corn plant growth.

GS-P25 CONSTRUCTION AND CHARACTERIZATION OF *AEROMONAS HYDROPHILA* MUTANTS AND OPTIMIZATION OF VACCINATION AGAINST MOTILE AEROMONAS SEPTICEMIA IN CATFISH

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Aeromonas hydrophila is a Gram-negative facultatively-anaerobe rod causing motile Aeromonas septicemia (MAS) in fish. MAS has been an important problem in the channel catfish industry, causing rapid and high mortalities. Approved antibiotics are added to fish feed for treatment of MAS, but moribund fish become anorexic, limiting the effectiveness of medicated feed. Also, antibiotic use adds to the production cost and results in antimicrobial-resistant strains. Thus, vaccine-based prevention of MAS is a good alternative. In this work, 24 *A. hydrophila* genes involved in bacterial virulence systems such as the type IV secretion system, secretion pathway, twin-arginine translocation system, flagellar system, and lipopolysaccharide assembly were deleted in-frameSafety and efficacy testing of these mutants in channel catfish by intraperitoneal injection resulted in four attenuated and protective *A. hydrophila* strains. During vaccination, fish mortality rates were % 5-10. After 21 days post-vaccination, the challenge of vaccinated fish with wt *A. hydrophila* resulted in 72-96% relative percent survival. Vaccination in *A. hydrophila* is challenging, and hence, we also optimized injection and immersion vaccination methods. The attenuated strains are expected to be potential vaccine candidates against MAS in catfish.

GS-P26 DETERMINING OPTIMAL PARTICLE SIZE FOR CROP LEAF NUTRIENTS USING FOURIER TRANSFORM MIDINFRARED SPECTROSCOPIC ANALYSIS

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Fourier Transform Mid-Infrared (FT-MIR) spectroscopy is a reliable tool for estimating the chemical properties of plants and soils in laboratory settings; however, this method requires fine-ground samples, as large particles may compromise model accuracy. Fine grinding is time-consuming and expensive, as large sample sets are necessary for model calibrations. There have been no studies on the effect of grinding on plant leaf MIR spectroscopy. The objectives were to determine the optimal leaf particle size required for accurate model calibrations of leaf nutrients. For that, a Bruker Alpha II spectrometer was used to measure absorption from 8000-350 cm-1 of coarsely ground leaf samples (n = 150) from 12 crops. Samples were scanned after grinding for 2, 5, and 10 minutes. The

particle size distribution of 20 samples was measured at each grinding level using an optical microscope and image processing. Models were calibrated and validated for spectra at each grinding level using partial least squares regression for 11 different chemical properties, including N, P, and K. The average particle size for non-fine-ground samples was 21 µm, decreasing ~10 µm after grinding for 2 minutes. Additional grinding produced little change. Model predictions for non-fine-grinding and after two minutes of grinding were the highest in accuracy, with an average r2 of 0.88 and 0.85, respectively. We found that leaf particle size of 10-20 µm was sufficient for accurate model predictions. Additional grinding was less effective in reducing particle size and providing accurate models.

GS-P27 STRUCTURED ILLUMINATION REFLECTANCE IMAGING AS NEW TECHNIQUE FOR DETECTING BROILER BREAST FILLETS AFFECTED BY MUSCLE MYOPATHY

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Muscle myopathies or defects (e.g., white striping, woody breast) downgrade quality of broiler meat, which are reportedly to cause loss of hundreds of millions of dollars annually for the U.S. poultry production. White striping (WS) is manifested as white streaks in muscle tissues, while woody breast (WB) is characterized by hard, pale and convex meat a. Visual inspection is currently practiced for assessing myopathy conditions including white striping in broiler meat. However, this method is prone to human evaluation error, labor-intensive, and costly a=. Imaging techniques under conventional uniform illumination have been investigated for assessing broiler meat quality, including checking for myopathies. However, their performance is not always satisfactory, especially for detecting subtle defects with few visual symptoms. Structured illumination or light, as opposed to uniform illumination, is potentially more effective for enhanced imaging of biological tissues. The method shines spatially modulated and patterned light over samples. This study presents a novel proof-of-concept evaluation of the utility of structured-illumination reflectance imaging (SIRI) for detecting the myopathy condition in broiler breast fillets. Images of myopathy-affected chicken fillets were acquired by an in-house assembled broadband SIRI system under phase-shifted sinusoidal illumination at different spatial frequencies. The acquired pattern images were demodulated into direct components (DC) and amplitude components (AC) at each spatial frequency, from which texture and statistical features were then extracted for building discriminative models. Machine learning classifiers including Nearest Neighbor and Linear Discriminative Analysis were used for classifying chicken fillets into four grades according to the severity of myopathy. The classification accuracy based on DC and AC images at different spatial frequencies was assessed to determine the optimum spatial frequency of illumination patterns for myopathy assessment of broiler meat. SIRI would provide a potentially useful for enhanced detection of muscle myopathies of broiler meat.

GS-P28 STUDYING THE EFFECTS OF THROUGH-THICKNESS REINFORCEMENTS ON SANDWICH COMPOSITE T-38 MAIN LANDING GEAR STRUT DOORS

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The use of sandwich composite materials in the aerospace industry has increased in recent years, since sandwich composites have a high strength-to-weight ratio and often exhibit a superior bending stiffness over traditional materials such as aluminum. However, one of the main issues with sandwich composites is face sheet-core separation due to low out-of-plane mechanical properties. 3D stitching in sandwich composites can provide the necessary through-the-thickness reinforcement to enhance the interlaminar tensile and shear strengths. The objective of this study is to apply through-thickness stitching to composite T-38 doors to study the effects of stitching on sandwich structures and gain a better understanding of their effectiveness in full scale structural applications. Finite element analysis (FEA) is used to establish critical loading points and reinforcement areas as well as determine the locations of stress concentrations developed while under load. This is accomplished through the comparison of two finite element models (FEMs) based on a sandwich composite door and currently in-service titanium door. Each composite door will utilize a 110 kg/m^3 machined foam core and incorporate varying stitch densities based on a previous study. Figure 1 shows an example of a stitched composite strut door with the optimal stitch density of 0.0093 $stitches/mm^2$. These results are the groundwork for performing structural level testing of the doors once the fabrication process has been completed.

GS-P29 CROP FIELD PATH PLANNING FOR AUTONOMOUS TRACTOR BASED SYSTEM AND OBSTACLE FUSION

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The time it takes to plant and collect crops in agriculture manually can significantly affect food distribution and increase the expenses to farmers. The implementation of autonomous vehicles can significantly enhance the production and harvesting of crops in agriculture, which will result in reduced expenses in the production and distribution of crops. A typical farming plantation can have several different crops growing at once, resulting in irregular-shaped crop fields due to the available space a farmer has for crop production. Considering this, we need to develop a dependable system that must be compatible with irregular poly-shaped fields to be implemented in real-world crop environments. Our research aims to develop a multidisciplinary path planning algorithm for unmanned vehicles in various areas such as seed placement, crop maintenance, dusting, and surveillance. An autonomous seed and harvesting tractor-based robot is used to effectively demonstrate the efficiency of the proposed model, along with a surveillance and crop-dusting drone used for exploring and surveying the crop fields. The proposed model contains a global path planner, an obstacle approximation and fusion algorithm, a local navigator, and a path smoothing algorithm to develop a near-optimal path. Utilizing these methods, we can navigate and survey through crop fields with little ease and computational effort with the proposed model. The proposed methods show great potential to navigate various poly-shaped crop fields efficiently and safely, thus being a valuable component for the robot. The feasibility and effectiveness of the proposed methods are validated by simulation and comparison studies.

GS-P30 INSECTICIDE APPLICATION EFFICACY OF SUAS COMPARED TO TRADITIONAL DELIVERY SYSTEMS

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Small and large uncrewed aerial systems (sUAS and UAS, respectively), also referred to as uncrewed aerial vehicles (or UAVs), have been used for agricultural purposes as technology advances for remote sensing and observing. Needed is an evaluation and expansion of sUAS in agriculture. Treating crops and crop pests with sUAS (UAS weighing less than 24.95 kg (55 lb)) is one way to maximize the use of sUAS in agriculture. This paper will address

the efficacy of sUAS insecticide efficacy to control common crop pests of the midsouth region. sUAS application will be compared to self-propelled spray equipment in a variety of crops commonly grown in the midsouth region.

GS-P31 CONCUSSION REPORTING AMONG COLLEGIATE CLUB ATHLETES

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The current study investigates concussion-reporting among U.S. collegiate club athletes. There is robust evidence that a large proportion of college-aged athletes have sustained unreported concussions, but there is a lack of research specifically on club-level athletes. It is predicted that these players self-report significantly fewer professionally diagnosed concussions than total concussions sustained. Participants completed a survey about health, sports, and concussion history as part of a larger study on cognitive performance post-concussion. Participants included 26 male, club athletes (M=19.84 years old, SD=1.28, range=18-23) recruited from a university in the southeast United States. Exclusion criteria included an existing or prior learning disability diagnosis, ADHD, or other serious neurological issues. Participants self-reported experiencing a significantly higher number of concussions (M=2.38, SD=1.44) than were documented by a professional (M=1.39, SD=1.20); $t(25) = 3.41$, $p<.01$. Details were provided for 62 total concussions. Of note, 19.2% of participants (N=5) reported having none of their concussions professionally diagnosed, and 26.9% of participants (N=7) indicated their first concussion was never diagnosed. Conclusions: Results support the assertion that concussion non-disclosure is a significant issue among college-aged U.S. club athletes. Current findings highlight the need for research to better understand and encourage these reporting behaviors and how coaches and those who work with these athletes can promote increased, accurate concussion-reporting.

GS-P32 BENEFITS OF NEONICOTINOID SEED TREATMENTS ON THRYVON COTTON

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In the Mid-South, thrips are an important early season pest on cotton. Mississippi planted over 500,000 acres of cotton in 2020, all of which were infested with tobacco thrips Frankliniella fusca (Hinds), which resulted in about $6.5 million of economic losses. Therefore, cotton is typically treated with a preventative thrips control product at planting and generally about 25-30% requires an additional foliar treatment to reduce damage from thrips. A new Bacillus thuringiensis trait (ThryvOn®, Bayer CropScience, St. Louis, MO) has been developed that provides good control of thrips. Currently, there is some debate about the need for an insecticide seed treatment to improve thrips control. We conducted a study to determine if the addition of an imidacloprid seed treatment improves efficacy against tobacco thrips and to determine if reduced rates of seed treatments (100, 75, 50, 25, and 0% of the labeled rate) provide benefits for thrips control in ThryvOn cotton. Preliminary results suggest that a 50% seed treatment rate of imidacloprid provided similar control and yield protection as a 100% imidacloprid seed treatment rate. These preliminary data suggest that ThryvOn cotton could be utilized with a reduced rate of imidacloprid compared to other current commercial varieties, drastically decreasing the number of neonicotinoids released in the environment.

GS-P33 COMPARISON OF VIS-NIR AND MIR SPECTROSCOPY FOR ESTIMATION OF TOTAL CARBON AND NITROGEN USING A MISSISSIPPI SOIL DATASET

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Reflectance spectroscopy in the visible and near-infrared (vis-NIR) and mid-infrared (MIR) ranges has emerged as a promising tool for quantitative soil analysis, with the potential to replace or complement the traditional lab-based wet-chemical analysis of certain soil properties. However, the soil property estimation using spectroscopy has not been tested for Mississippi soils. The goal of this study was to examine the accuracy of total carbon (TC) and total nitrogen (TN) estimation using vis-NIR and MIR spectroscopy. For this purpose, a total of 184 soil samples from two depths between 0-15 cm were collected from a commercial cotton farm in the northern Mississippi State, USA. A subsample of each sample was sent to a lab for TC and TN measurements using the conventional combustion method. The vis-NIR reflectance (350 to 2,500nm) spectra of the samples were measured using an ASD LabSpec 4 spectrometer with an attached muglight accessory. Attenuated Total Reflectance (ATR) and Diffuse Reflectance Infrared Fourier Transform (DRIFT) spectra for all samples were acquired using a Bruker Alpha II spectrometer in the MIR range (1,250 to 28,570nm). Partial least squares regression was applied to calibrate models using 75% of the data and validated by the remaining data. The results showed that the R2 values for TC and TN estimations from DRIFT, ATR, and ASD were 0.87, 0.82, 0.70, and 0.84, 0.70, 0.56 respectively. Overall, MIR spectra were more effective at predicting TC and TN of soils compared to vis-NIR reflectance spectra.

GS-P34 A COMPARATIVE CONTENT ANALYSIS OF TWO LOCAL TELEVISION (A) ABC-AFFILIATE WKRN-TV (LICENSED TO NASHVILLE, TN) AND (B) DUAL CBS/CW-AFFILIATE WHLT (LICENSED TO HATTIESBURG, MS) BORADCASTER'S TORNADO WARNING COMMUNICATION

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Despite the rise in prominence of smartphone alerts in delivering tornado warning messages, local television is still an important source to help individuals understand their personal risk from tornadoes. While the content of text-based weather alerts and other short messages communicated through social media have been the subject of past research, in-depth analyses of the content of broadcast tornado warning coverage are limited. This study attempts to fill gaps in our knowledge regarding the content of the hours of coverage devoted to tornado warning communication each year by closely examining two local television news station's coverage of two separate events from 3rd March 2020 and 19th April 2020. The two local television news stations were network affiliates from Nashville, TN, and Hattiesburg, MS. The length of Nashville coverage was just over 3 hours, while the Hattiesburg coverage was 2 hours 33 minutes. A combination of deductive and inductive coding approach was used to summarize the content of the broadcasts in NVivo. The analysis explored the content for several elements based on past research including jargon and metaphors used, recommendations for protective action, and messages related to lead time and locations. Other themes emerged from the analysis including ways the broadcast meteorologists continued to monitor the situation and ways they communicated the severity of the

hazard. We found that both stations heavily use radar products (e.g., velocity and reflectivity) although it significantly varies between stations. For example, the Hattiesburg coverage had a higher percentage of velocity products (56%) than Nashville coverage (34%). However, for reflectivity, Nashville has a higher percentage (52%) than Hattiesburg (23%). In addition to visual components, we also found several differences in verbal sections. The broadcast meteorologists in the Hattiesburg coverage more frequently used meteorological words such as 'lead time', 'mesocyclone', 'wind gust', 'shear' 'wall cloud', and categories ('ef3', 'ef4') compared to the Nashville coverage. In the Hattiesburg transcript, the broadcast meteorologist also used quantitative information such as frequency of hazard events (i.e., 443 lighting strikes) to describe the severity of the situation. Finally, references such as "information from National Weather Service" (such as confirmed and expired tornado warnings) was more often used in the Hattiesburg tornado warning coverage.

GS-P35 NOVEL USE STRATEGIES OF NPV-HELIGEN IN MISSISSIPPI SOYBEAN

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The cotton bollworm, *Helicoverpa zea* (Boddie), is a yield limiting insect pest of cotton and soybean in the Mid-southern U.S. In Mississippi during the 2020 growing season, yield losses exceeding 1.68 million bushels of soybeans resulted from bollworm infestations. Nuclear Polyhedrosis Virus (NPV) is a baculovirus used as a form of biological control targeting lepidopteran larvae in many agricultural production systems. Heligen® is a Heliothis NPV that has been formulated to provide control of bollworm infestations in certain crops. We conducted two studies to determine the residual of Heligen and the feeding habits of bollworms after virus ingestion. To evaluate residual time, we applied Heligen to a soybean field and evaluated its efficacy at different time intervals (0, 12, 24, 36, 48, and 72 hours) after application in laboratory bioassays with treated leaves. Preliminary results indicated that Heligen remained viable for up to 48 hours in the field. To evaluate the feeding habits of bollworms at the ½'' and ¼'' life stages, Heligen exposed larvae and untreated larvae were weighed at 0 (before diet exposure), 4, and 7 days. At 4 days after exposure, body weight was reduced anywhere from 56 to 86% for larvae exposed to Heligen compared to control larvae. Together, these studies suggest that Heligen can be an effective form of biological control when larvae are exposed between 0-48 hours of application at the ½'' and ¼'' life stage.

GS-P36 PATTERNS AND PROCESS OF SANDBAR REVEGETATION ON THE MISSOURI NATIONAL RECREATIONAL RIVER

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Decades of flow regulation have reduced sandbar area and recruitment of cottonwood and willow along the Missouri River. Conflicts exist between managing sandbars for habitat (removing vegetation) for threatened sandbar-nesting birds (i.e., Piping Plover) and allowing natural recruitment of early successional riparian woodland (set-aside bars) that may support other species and ecological values. Recent changes in topography, geomorphology, and vegetation were examined on sandbars that have been "set aside" from management within seven reaches of the Missouri National Recreational River (MNRR) in southeastern South Dakota, USA. An existing time series of maps of sandbar land cover, derived from satellite imagery, was analyzed using ArcGIS to track vegetation and geomorphic changes from 2008-2016. Digital Elevation Models (DEMs) were used to detect elevational changes from 2012-2014/2016, the years following the 2011 flood. Sandbar area was highest on most reaches in 2012 and declined thereafter, and most areas did not show significant elevation changes from 2012-2014/2016. Cottonwood was the most frequent tree species, followed by Russian olive, while sandbar willow was the most abundant shrub species. Redcedar and sweet clover were the most frequent woody and herbaceous invasive plant species, respectively. My findings will inform managers from the National Park Service and US Army Corps of Engineers about how the sandbars in the MNRR have evolved since the 2011 flood. This information is critical for managing the bars in a way that will balance the needs of sandbar-nesting birds and the multiple species of birds and other wildlife that use early successional riparian vegetation.

GS-P37 AUTONOMOUS BROILER MORTALITY DETECTION AND REMOVAL ROBOTS

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Manual collection of broiler mortality on a daily basis is time and labor-consuming, and an autonomous robotics system can solve this issue effectively. Among many components of developing the autonomous poultry mortality detection and removal system, robot path planning is one of the essential parts and is not yet utilized for robot navigation in a broiler house. Therefore, this paper proposes a broiler mortality detection and removal system consisting of two robots, one broiler mortality detection robot that searches the entire broiler house for dead broilers and indicates the position of the dead birds, while the other broiler mortality removal robot performs collection and removal of dead broilers. The broiler mortality detection robot can precisely and efficiently search, identify and indicate dead broilers through the broiler house environment and historical data of the broiler mortality. It contains a coverage-directed self-adaptive path planner, and You Only Look Once (YOLO) V4 broiler mortality detector. The other broiler mortality removal robot composing of a multi-target path planner achieves the function of removing broiler mortality in the minimum traveling distance with collision-free trajectories. Moreover, equipped with the onboard LIDAR equipment, a local reactive navigator is introduced to simultaneously avoid static and dynamic obstacles (i.e., live birds and feeding and drinking lines). The proposed methods show great potential to navigate the poultry detection and removal robots in broiler houses efficiently and safely, thus being a useful component for robotics. The feasibility and effectiveness of the proposed methods are validated by simulation and comparison studies.

GS-P38 RELATING INSECTICIDE EFFICACY TO HONEYBEE TOXICITY

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The use of foliar insecticides is critical for management of tarnished plant bug, Lygus lineolaris (Palisot de Beauvois), in cotton (Crow et al. 2020, George et al. 2021). In the Mid-South region of the U.S., multiple insecticide applications are generally required each year to prevent severe economic losses (Cook and Threat 2021). Although foliar insecticides are important for crop protection, they have been linked to honeybee, Apis mellifera (L.), decline in many parts of the world (Krupke et al. 2012, Lawrence et al. 2016). The response of bees to multiple insecticides is highly variable, but so is the level of control of tarnished plant bug in cotton. Therefore, it is important to consider both efficacy against the target pest and toxicity to honeybees when choosing insecticides for crop protection when honeybees are present.

GS-P39 ASSESSING THE RELATIONSHIP BETWEEN SOIL HEALTH AND SURFACE RUNOFF WATER QUALITY IN THE MISSISSIPPI DELTA

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Enhancing soil health and understanding its interaction with the environment is essential due to its potential impacts on crop productivity, nutrient cycling, and water quality. The goal of this study is to explore relationships between soil health and runoff water quality from agricultural fields, under different management scenarios in a Mississippi Delta watershed. A soil/health quality index was determined using the Soil Management Assessment Framework (SMAF). Nine (9) soil health indicators (aggregate stability, microbial biomass carbon, soil organic carbon, bulk density, beta-glucosidase enzyme, Mehlich 3 extractable phosphorus and potassium, electrical conductivity and pH) were selected to compute the SMAF based on the soil data collected by the USDA-ARS National Sedimentation Laboratory in Beasley Lake Watershed near Inverness, MS. Runoff water samples from fields managed under row crops, vegetative buffers, or Conservation Reserve Program (CRP) were analyzed for the years 2008 and 2012. Preliminary results showed that soil health/quality improved for all management treatments in 2012 as compared with 2008. There was a significant reduction in orthophosphate-P and total Kjeldhal nitrogen measured in surface runoff in 2012 relative to 2008. These surface runoff water quality parameters were positively correlated with the soil quality/health indicators aggregate stability (R=0.56), and microbial biomass carbon (R=0.85), respectively. Overall, areas managed under CRP had higher soil health indicators and improved runoff water quality, while row crops fields had the lowest indicators, those management practices that improve soil health may have a benefit on runoff water quality in agricultural landscapes of the Mississippi Delta.

GS-P40 THE BRAIN TRANSCRIPTOME IN A MILD MODEL OF EXPERIMENTAL AUTOIMMUNE ENCEPHALOMYELITIS: SIMILARITIES TO MS AND IMPACT OF CANNABIDIOL

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Experimental autoimmune encephalomyelitis (EAE) is a robust animal model that imitates human multiple sclerosis (MS). However, EAE symptoms are variable and can range from asymptomatic to tail and limb paralysis. To analyze our mild EAE model compared to MS and the impact of CBD, the brain transcriptome was compared to MS lesions that were obtained from an online repository. Female C57BL/6J mice were immunized with Complete Freund's Adjuvant, Heat-killed Mycobacterium tuberculosis, and myelin oligodendrocyte glycoprotein. Twenty-four hours after induction, mice were treated with 75mg/kg CBD or corn oil via oral gavage. RNA sequencing (RNA-Seq) was performed on the brains. Reads were assessed for quality, trimmed, and mapped to the GRCm39 genome. Differential expression analysis was performed in CLC Genomics Workbench (Qiagen). Differentially expressed genes (DEGs) with a false discovery rate (FDR): S 0.05 were considered significant. RNA-Seq was repeated on various MS lesions and healthy controls that was obtained from the gene expression omnibus (GSE138614) and mapped to GRCh38 genome. DEGs were modeled in Ingenuity Pathway Analysis (Qiagen) to identify canonical pathways. Pathway analysis revealed that symptomatic EAE mice shared many canonical pathways with MS active lesions. Notably, the number one gene that was increased asymptomatic, CBD treated EAE mice was oxytocin (Fold Change= l,311, FDR=O). Results present evidence that mild EAE is a valid model that mirrors MS active lesions. The variability in immunization success and neuroprotection by CBD, may provide insight into mechanisms that are shared between EAE and MS as well as success with CBD treatment.

GS-P41 INVESTIGATION OF LOW-HIGH FIDELITY TURBULENT MODELS IN SCRAMJET ENGINES

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The design of high-speed vehicles at the hypersonic range has been a challenging task due to non-linear aero-thermal-structural interactions. Additionally, the interaction of shock waves with the turbulent boundary layer promotes flow separation due to adverse pressure gradient at the point of impingement. In the case of air-breathing engines like scramjets, shock-induced separation can lead to localized heating, low-frequency large scale unsteadiness of the shock structure, acoustic noise at the intake, and a decrease in the stagnation pressure, which are responsible for the drop in the efficiency of the engines. However, shock wave interactions may not always result in negative consequences. For example, in the scramjet flow, they can be used as a source for air-fuel mixing, and in external flows, they can be used to split the shock system, thereby decreasing the drag. Hence, it is essential to understand the mechanism behind the control phenomenon. In our previous work we have studied the predictive capability of low to high fidelity turbulent models for an external flow configuration involving shock wave-turbulent boundary layer interaction, which is the case of a flow in which wall-generated-turbulence dominates. The results indicated that only the DHRL model coupled with ILES could capture the separation characteristics successfully, while the other models like URANS, PANS, and IDDES over predicted the flow separation. In the present work, we will investigate the predictive capability of different turbulent models in the hypersonic flow for the scramjet configuration used by DLR, which is the case of a flow involving both the wall-generated turbulence and free-shear turbulence.

GS-P42 INVESTIGATING PHYSIOLOGICAL RESPONSES TO NOVEL EXOGENOUS HORMONE TREATMENT IN AN ANURAN MODEL SPECIES

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Due to inadequate simulation of environmental cues to stimulate the hypothalamo-pituitary-gonadal axis within *ex situ* settings, amphibians in captive breeding programs often require treatment with exogenous hormones to release gametes for reproduction. Synthetic and non-synthetic forms of Gonadotropin Releasing Hormone (GnRH) can be administered with and without dopamine antagonists to stimulate gamete release in anuran species. In this study, a commercially available hormone mixture Ovaprim™ containing salmon GnRH and the dopamine antagonist Domperidone was used to induce spermiation in a model anuran species the Fowler's toad (*Anaxyrus fowleri*) and physiological responses of weight change and spermiation response were recorded. Males were treated with 300 µl of Ovaprim (n=15) and urine was collected over a 24-hour time course, with toad weights taken at each time point. Toads were considered responders if they gave a spermic urine sample. Sperm parameters were analyzed

including motility, abnormality, and concentration. Of the 15 individuals given Ovaprim™, 11 gave spermic urine at least once during the time course (73%). Rather than uniformly distributed sperm within urine, aggregations of sperm within viscous matrices of additional biochemical components occurred in samples from 6 individuals given Ovaprim™. Using a Wilcoxon signed rank test, we found that weight increased significantly (p<0.05) between time points during the first 3 hours due to fluid retention possibly due to the dopamine antagonist influencing aquaporin activation. Induction of spermiation using this treatment results in the release of sperm within aggregations of biological material and fluid retention in the model species *Anaxyrus fowleri*.

GS-P43 WINEGRAPE QUALITY OF 'MIDSOUTH' FOLLOWING EITHER LEAF REMOVAL OR SHOOT THINNING

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Low total soluble solids and high titratable acidity limit 'MidSouth' use as a red wine grape. However, leaf removal or shoot thinning could potentially improve these fruit qualities. Average berries per cluster, berry weight, cluster weight, crop yield, yield to pruning weight ratio (Ravaz index) (kg/kg), total soluble solids, titratable acidity, juice pH, monomeric anthocyanin pigment, and total phenolic content were measured in 'MidSouth' vines after receiving one of three treatments: either post-fruit set leaf removal, post-fruit set shoot thinning, or neither leaf removal nor shoot thinning (control) treatments. Shoot thinned vines had lower crop yields and Ravaz index and higher total soluble solids and monomeric anthocyanin pigment and total phenolic content in 2021 wine. Leaf removal vines had lower juice pH in 2020 and higher monomeric anthocyanin content and total phenolic content in 2021 must. Because these treatments did not appear to have enough of a desired effect on 'MidSouth' winegrape quality, leaf removal and shoot thinning at post-fruit set cannot be recommended for improving the quality in 'MidSouth' in South Mississippi.

GS-P44 EVALUATION OF SURFACTANTS FOR USE IN ONE-TIME FOLIAR AUXIN APPLICATIONS IN THE PROPAGATION OF WOODY ORNAMENTALS

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Use of foliar applications are increasing in the nursery and greenhouse industry. However, previous research has shown that insufficient auxin is being absorbed or translocated to the site of action. Addition of surfactants to foliar applications of auxin has been theorized to help with the absorption and translocation of auxin to the site of action. Research was conducted to determine whether addition of surfactants to one-time foliar applications of indole-3-butyric acid (IBA) would be as effective as the current industry standard, the basal quick dip. Terminal cuttings of common camellia (*Camellia japonica*) and Teddy Bear® magnolia (*Magnolia grandiflora* 'Southern Charm') were sprayed to the drip point using Hortus IBA Water Soluble Salts™ at concentrations of 0 ppm, 500 ppm, 1,000 ppm, or 1,500 ppm or dipped for 1-sec in a solution of either 4,000 ppm or 2,500 ppm for camellia or magnolia, respectively. A foliar application of 1,500 ppm after sticking was as effective as the basal quick-dip for cuttings of Teddy Bear®, while other spray treatments were less effective. A basal quick-dip was more effective than a foliar spray for rooting cuttings of camellia.

GS-P45 COMPARING PORTABLE AND BENCH-TOP MID-INFRARED SPECTROMETERS FOR MACRO AND MICRONUTRIENTS ESTIMATION OF MAIZE

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Quick and accurate decisions are critical for efficiently managing the plant nutrients as global food demands rise in tandem with the world's fast-rising population. Compared to conventional laboratory analysis, spectroscopic techniques to estimate plant nutrients has multiple benefits, i.e., rapid, affordable, and non-destructive. This study aimed to compare the prediction accuracies of two spectrometers (Bruker AlphaII- 400 to 4000 nm, ArcOptix - 2000 nm to 6000 nm) operated in two distinct modes. To this end, the Diffuse Reflectance Infrared Fourier Transform (DRIFT) spectra of 154 maize leaves were obtained using the ArcOptix spectrometer, followed by fine grinding to obtain both DRIFT and Attenuated Total Reflectance (ATR) spectra using the Bruker AlphaII. The fine-ground samples were also analyzed for eleven nutrients (N, P, K, Ca, Mg, Zn, S, Cu, B, Fe and Mn) following the conventional laboratory approach. Partial least squares regression (PLSR) was used to calibrate models using 75% of the data, then validated with the remaining set. The best model performance was observed was for Nitrogen using ArcOptix spectrometer (R^2 = 0.81 and Ratio of Performance to Deviation (RPD) = 2.21) followed by Phosphorus (R^2 = 0.8 and RPD = 2.16) and Potassium (R^2 = 0.78 and RPD = 2.01) acquired from Bruker AlphaII spectrometer in ATR mode. Both spectrometers predicted all the macronutrients (N, P, K, Ca, Mg) and two micronutrients (Zn and Mn) with R^2 > 0.6. The ATR spectra yielded the best accuracies for all calibrated models, and DRIFT spectra from both spectrometers showed similar performances.

GS-P46 UNDERSTANDING VASCULAR CALCIFICATION THROUGH THE LENS OF CANONICAL WNT SIGNALING

KarLee McNeel

Arteriosclerosis, characterized by hardening of the arteries, is a dangerous precursor to a degenerative condition called vascular calcification. Vascular calcification is a process by which a phenotypic transition of vascular smooth muscle cells causes generation of osteoblast mimicking cells within arteries. This process is initiated by the wingless-related integrated (WNT) pathway mimicking osteogenesis as mechanical stress from arterial injury leads to this remodeling. There are many causes of calcification which include diabetes, kidney failure, and obesity. Based on data from the American Heart Association and the National Institutes of Health in 2017, someone in the United States dies of cardiovascular disease every 37 seconds2. Vascular calcification can be an underlying cause of these often-fatal events and is becoming more heavily studied due to a lack of characteristic symptoms. Once calcification begins, buildup of hydroxyapatite in arteries can lead to hypertension and a decrease in arterial compliance and elasticity1. Often, calcification is not discovered until a heart attack or stroke occurs because it is not screened for and has no obvious symptoms. Current protocols focus on treatment of calcification and not consequences associated with it the disease. Considering the lack of treatments to prevent and reverse calcification, a novel therapy for treatment of this disease is long overdue. By studying human aortic smooth muscle cells and confirming the role of WNT-Signaling as it relates to calcification, a possible therapeutic target for calcification can be identified.

GS-P47 TINY THRIPS BIG PROBLEMS

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Foliar-applied insecticide treatments may be necessary to manage thrips in cotton (*Gossypium hirsutum* L.) under severe infestations or when at-planting insecticide seed treatments do not provide satisfactory protection. The most common foliar-applied insecticide is acephate. Field observations in Tennessee suggest that the performance of acephate has declined. Thus, the first objective was to perform leaf-dip bioassays to assess if tobacco thrips, Frankliniella fusca (Hinds), in cotton production regions have evolved resistance to foliar applied insecticides. A second objective was to assess the performance of commonly applied foliar insecticides for managing thrips in standardized field trials in Arkansas, Tennessee, Mississippi, and Texas. For both objectives, several insecticides were evaluated including acephate, dicrotophos, dimethoate, lambda-cyhalothrin, imidacloprid, and spinetoram. Field trials and bioassays were completed from 2018 to 2021. Dose-response bioassays with acephate were performed on tobacco thrips field populations and a susceptible laboratory population. Bioassay results suggest that tobacco thrips have developed resistance to acephate and other organophosphate insecticides; however, this resistance seems to be most severe in Arkansas, Tennessee, and the Delta region of Mississippi. Resistance to other classes of insecticides were perhaps even more evident in these bioassays. The performance of these insecticides in field trials was variable, with tobacco thrips only showing consistent signs of resistance to lambda cyhalothrin. However, it is evident that many populations of tobacco thrips are resistant to multiple classes of insecticides. Further research is needed to determine heritability and resistance mechanism(s).

GS-48 EFFECT OF INTEGRATING COVER CROPS AND GRAZING ON SOIL MICROBIAL COMMUNITY COMPOSITION, FUNCTION AND SOIL HEALTH IN EAST-CENTRAL MISSISSIPPI SOYBEAN PRODUCTION

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Integrating crop and livestock systems have been considered an important systems-based decision to improve soil health, fertility, and increase carbon sequestration. Adoption of conservation systems that reduce soil disturbance and increase residue cover through cover crops are considered important strategy to improve soil health. A two-year study (2019-2021) at Coastal Plain Branch Experiment Station in Newton, MS aimed to evaluate soil microbial diversity related to soil health in an Integrated Crop–Livestock System (ICLS) in the warm, humid regions, specifically southeastern USA. Cover crop treatments included mixture of Oats, Crimson clover and Tillage Radish. Genomic DNA was extracted from collected soil samples from grazed paddocks during soybean (Glycine max) establishment. Amplicons targeting bacterial 16S rRNA genes and fungal ITS2 regions were sequenced. Taxonomic assignment and microbial diversity characterization were performed using QIIME2® bioinformatics pipeline. Soil properties were measured and analyzed in SAS® 9.4 using PROC GLM ($p < 0.05$). Soil bacterial diversity showed no significant difference across treatments. However, soil fungal diversity pattern showed significant difference (alpha diversity, $p = 0.018$ in yr. 2020 and beta diversity, $p = 0.034$ in yr. 2021). Correlation between soil properties and soil microbial diversity using Canonical Correspondence Analysis (CCA) and Mantel test showed significant influence on fungal diversity due to carbon (rm = 0.2581, $p = 0.022$), nitrogen (rm = 0.2921, $p = 0.0165$), electrical conductivity (rm = 0.1836, $p = 0.0583$) in yr. 2021, and on bacterial diversity due to EE-GRSP (rm = -0.1888, $p = 0.0693$) in yr. 2020. It is important to perform long-term study to determine the change in microbial diversity due to cover crops and grazing for sustainable agriculture.

GS-P49 QUASI ID MODELLING OF A SCRAMJET ENGINE CYCLE

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Giving the fact that scramjets are the hope for achieving sustained hypersonic flight, many domestic and international efforts have been deployed in order to produce a better understanding of the aircraft engine. In this thesis, a model describing the thermodynamic cycle of the device has been proposed. The goal is to provide a descriptive insight on how the different design parameters affect the flow characteristics throughout the engine, thrust production, and other engineering constraints. The model adopts a 2D-planar inlet design to calculate the properties within the section, accurately predicts the flow separation and pressure jumps within the isolator, provides a comprehensive combustion model based on mixing efficiency and adiabatic flame concept, and finally evaluates the performance of the nozzle based the law of thermodynamics and compressible flow governing equations. The model also predicts the failure of the engine to self-start, among other things. A comparison to other models has been provided to validate the results of discussed approach.

GS-P50 EFFECTS OF INTEGRATING COVER CROPS AND POULTRY LITTER ON DRYLAND SOYBEAN YIELD AND SOIL HYDRAULIC PROPERTIES

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The Mississippi region is known for its fertile land for agricultural production. However, continuous crop production has been found to decrease the soil organic matter, water holding capacity and increase soil erosion, runoff, and nutrient leaching in recent years. A field experiment was conducted from 2017 through 2022 at Pontotoc County in the eastern Mississippi to evaluate the effects of different cover crops (cereal rye, native vegetation, vetch, mustard/cereal rye, and wheat) along with the use of organic amendment (poultry litter) on dryland soybean yield and soil properties. Data collection for this study included water holding capacity, saturated hydraulic conductivity of soil (Ksat), biomass and grain yield of soybeans. The results indicated that the poultry litter application over the course of the study has improved the soybean biomass as compared to treatments of commercial inorganic fertilizer and no fertilizer inputs. The soybean grain yield has been increased when poultry litter was applied as compared to commercial fertilizer treatment (82 vs. 69 bu/ac) and when compared with no fertilizer treatment (82 vs. 50 bu/ac) in the year 2021.Poultry litter increased Ksat by 8% (1.49 vs. 1.38 cm min^{-1}) compared with the soil received commercial fertilizer. Overall, the poultry litter application improved Ksat as compared to commercial fertilizer application and no fertilization treatments but cover crops did not change the soil properties or increase soybean yield.

GS-P51 BEST MANAGEMENT PRACTICES EFFECTIVENESS ON STREAM WATER QUALITY IN LIVESTOCK MANAGEMENT AREAS

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This study evaluates the pre and post-implementation effects of a Best Management Practices (BMPs) set on the variation of stream health and water quality along the reach flowing through the MSU Dairy Farm. The BMPs include stream-crossings, riparian zone planting/fencing. Water quality monitoring consisted of bi-weekly grab sampling and in-situ testing from July 2019 to March 2022. Results evidenced poor water quality conditions for pre-implementation. Concentrations of total phosphorus (TP), total nitrogen (TN), and total suspended solids (TSS) increased along the stream reach, which does not meet nutrient criteria for MS streams. Water quality detriment is influenced by upland and land use activities; unrestricted cattle access to the stream; and sediment supply from active streambanks. Post-implementation results indicate that BMPs significantly ($p=0.05$) impact stream water quality, reducing nutrient and sediment concentrations and improving physicochemical water quality parameters. Despite reductions, TP and TN concentrations remain above the established nutrient criteria. The removal efficiency in summer, fall, and winter was, respectively, 48%, 39%, and 42% for TSS; and 17%, 31%, and 32% for TN. TP concentrations decreased by 18% for summer and fall but increased by 19% during winter. Reductions in temperature and increases in dissolved oxygen suggest a positive shading effect on water quality. Reductions in pH and turbidity demonstrate the success of the BMPs in mitigating the impact of the livestock management area. Overall, despite the partial effectiveness of BMPs, additional conservation practices above the study area are needed to accomplish the criteria of the attained use for the stream.

GS-P52 ANTI-CANCER EFFECTS OF WATERCRESS EXTRACT ON GROWTH AND FUNCTIONS OF OVARIAN CANCER CELL LINES

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Ovarian cancer (OVCA) is the fifth leading cause of death in post-menopausal women in comparison to all other gynecologic malignancies. Late detection of OVCA is common as screening is done mostly in women over 63. This delay in screening coupled with poor prognosis presents the need for novel treatment measures. For years, natural occurring products are in prominence as anti-cancer therapeutics. The current study is carried out on one gm of coarsely crushed watercress leaves which were extracted in methanol and further filtered through a 0.22-µm filter. HPLC analysis evidenced that watercress extract has significant amount of kaempferol in it. Kaempferol (kaemp) is known to produce anti-cancerous effects in various types of cancer cells. The purpose of our experimentation is to observe the differential cellular activity (growth analysis, metabolic activity, autophagy) in the presence of wcm and kaemp. We used Hey A8 and Hey MDR, two isogenic ovarian cancer cell lines along with a mouse embryonic fibroblast (MEF) cell as a non-cancerous normal cell line for all the experiments related to wcm and kaemp. Cellular studies revealed that wcm and kaemp treatment inhibited the cell viability of both HeyA8 and HeyA8MDR cells by 50%; however, promoted the growth of non-cancerous MEF cells which indicates the selective nature of cellular toxicity of wcm and kaemp. The wcm and kaemp both mediated oxidative stress in OVCA cells were further determined by detecting the elevated level of reactive oxygen species (ROS) through DCFDA fluorescence. We have further shown that wcm and kaemp treatment is inducing formation of autophagic vesicles in OVCA cells. Cancer cells are equipped with altered metabolic activities including enhanced glucose uptake and lipogenesis. Kaemp treatment reduces glucose uptake and lipid droplet biogenesis along with enhanced acidification of the cells as demonstrated by increased lysotracker red fluorescence. Overall, our data indicates anti-cancer activities of both wcm and kaemp in the OVCA cell lines which could be implicated by targeting various pathways simultaneously. Our preliminary finding creates a better understanding between the oncogenic signaling pathway and the influence of plant products in the chemoresistance and proliferation of ovarian cancer. Further studies are underway.

GS-53 EVALUATION OF COVER CROP INFLUENCE ON POTASSIUM UPTAKE DYNAMICS IN THE SOUTHEASTERN COTTON BEL

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Growers and industry workers have planted and researched cover crop relevance in cotton for many years. Potassium is essential to cotton in its growth and development. It is integrally involved in the metabolism of plant and water relations. Cover crops serve as a potassium placeholder in the offseason of a cash crop. Limited research exists evaluating the dynamics of cover crops in correlation with potassium in cotton grown in the Midsouth. Field experiments were conducted in 2021 and 2022 to determine the potassium uptake dynamics in the Midsouth cotton belt. Experiments were established at three different sites in Mississippi, The R.R. Foil Plant Science Research Center (Starkville, MS), MAFES Black Belt Branch Experiment Station (Brooksville, MS), and the North Mississippi Research and Extension Center (Verona, MS). Cereal ryegrass was sown at 59 kg per ha-1. Crimson Clover was sown at 20.4 kg per ha-1 and a blend at half the rate of each cover crop. Cover crop biomass was measured in a metered square before planting in each plot. Plots were fertilized using 0-0-60 (Muriate of Potash) at two different application timings and two different application scenarios. The first application timing occurs at cover crop termination and the second application occurs at pinhead square. The scenarios include a full rate of 160 kg ha-1 at cover crop termination or pinhead square or 50% at cover crop termination followed by 50% at pinhead square. Phytogen 400 W3FE was planted in 4-row plots and evaluated on leaf K+ content, yield, and fiber quality.

GS-P54 SYNTHESIS AND BINDING STUDIES OF TWO ISOMERIC NITRO-SUBSTITUTED DIPODAL UREAS FOR ANIONS: COMPARISON OF THEIR BINDING AFFINITY BY BOTH EXPERIMENTAL AND THEORETICAL METHODS

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Two simple isomeric nitro-substituted dipodal ureas L1 and L2 have been synthesized by the reaction of p-xylylenediamine with 2- and 3-nitrophenyl isocyanate, respectively. The binding affinity of these receptors has been investigated thoroughly by colorimetric, UV-Vis and NMR studies for a wide range of anions. Comparative studies from UV-Vis and NMR titrations demonstrate that the meta-nitro substituted receptor (L1) exhibits an enhanced binding for the anions investigated, as compared to the ortho-nitro analogue (L2). Colorimetric studies suggest that L1 effectively detects fluoride and bicarbonate showing an intense color change while a visible color change is observed for fluoride, acetate, bicarbonate, and dihydrogen phosphate in DMSO. DFT calculations support the experimental data showing the superior binding with L1 for anions as compared to L2. Acknowledgement: The project described was supported by the US Department of Defense (Grant Number W911NF-19-1-0006).

GS-P55 THERMAL DATA DE-IDENTIFICATION FOR CROSS-SYSTEM PROCESS-DEFECT MODELING FOR METAL-BASED ADDITIVE MANUFACTURING

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The objective of this research is to develop a secured data sharing mechanism for additive manufacturing (AM) process data that masks the printing path information while retaining the critical quality control characteristics. There is a need of aggregating AM process data since large amounts of training data are necessary to develop a reliable machine learning model for in-situ AM certification. However, a core problem in data aggregation from multiple AM users is the data privacy concern of sharing process raw data, which usually contain confidential design information. This is a major challenge for small-to-medium-manufacturers (SMM), where collecting copious amounts of data is prohibitively expensive. The proposed Adaptive Design De-identification for Additive Manufacturing (ADDAM) methodology applies an adaptive de-identification approach to mask the printing path information contained within the AM thermal history. Furthermore, support vector machine (SVM) classifiers are leveraged to evaluate the performance of the proposed ADDAM methodology on its ability to de-identify printing path information, while simultaneously preserving data utility, i.e., anomaly detection accuracy. A real-world case study based on the fabrication of a cylindrical shaped disk, using the directed energy deposition (DED) process, is used to validate the proposed method. The results demonstrate a significant improvement in the protection of confidential design information contained within the AM thermal history while retaining the anomaly detection accuracy. Ultimately, the ADDAM algorithm facilitates the safer aggregation and sharing of AM thermal process data from multiple users, leading to the development of more robust and accurate in-situ defect detection models.

GS-P56 GROWTH PERFORMANCE AND COST-BENEFIT OF RABBITS FED COMMERCIAL FEED AND GOURMET PET FOOD

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Department of Animal and Dairy Sciences, Mississippi State University, MS 39762

Rabbit production has a quick turnover and requires efficient financial strategizing to remain profitable. The study assessed the optimization of two diets and their effects on growth performances and cost-benefit analysis. Nine (9) weaned Mini Rex rabbits were randomly assigned to one of two dietary treatments (Commercial Feed and Gourmet Pet Food) in a completely randomized design experiment. Rabbits were placed in individual cages with ad libitum access to water and fed 300 grams daily for approximately 33 days. Daily feed intake was determined, and the rabbits were weighed weekly. Proximate analysis and cost-benefit analysis of these feeds were conducted to compare the nutritional compositions and provide insights into the feed's economic impact.

The results revealed that the Gourmet Pet Food had a higher dry matter (DM) and fat content and lower ash and crude fiber content when compared to the Commercial feed. Also, each rabbit in the feeding trial gained weight. However, the rabbits from both treatments had similar average daily gains at the end of the trial. The cost-benefit analysis revealed that the Commercial feed is more economical than the Gourmet Pet Feed.

GS-P57 CHEMICAL CONTROL OF *ERIGERON SUMATRENSIS* WITH CROSS-RESISTANCE TO ACETOLACTATE SYNTHASE INHIBITORS

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The selection of fleabane populations resistant to the herbicide chlorimuron-ethyl is an emerging phenomenon in most soybean and corn producing regions of Brazil. Studying herbicides with different modes of action in weed management systems is an important tactic to combat acetolactate synthase (ALS) inhibitor resistance. Currently, most herbicides used as an alternative or complement to chlorimuron-ethyl are also ALS inhibitors, such as diclosulam and cloransulam-methyl. Since the repeated use of herbicides with similar modes of action has resulted in the development of herbicide-resistant weed biotypes, there is a critical need to rotate herbicide modes of action. In our previous study, a resistant population showed cross-resistance to chlorimuron-ethyl and cloransulam-methyl applied post-emergence, and cross-resistance to chlorimuron-ethyl and diclosulam applied pre-emergence. Chlorimuron-ethyl resistance was, therefore, observed in two different modes of application (pre-and post-emergence). The objective of this work was to evaluate alternative herbicides for the control of a Sumatran fleabane population with cross-resistance to ALS inhibitor herbicides. Two greenhouse experiments were conducted, one with pre-emergence applications and another in post-emergence. The control percentage at 28 days after the application was evaluated. The use of residual herbicides for fleabane control is an essential tool for its management since the success of the herbicides applied post-emergence is linked to the stage of the plants and the environmental conditions at the time of application. Alternative herbicides to ALS inhibitors effective in fleabane control may be recommended in rotation with different modes of action to curtail resistance. The herbicides tembotrione, mesotrione, clomazone, amicarbazone, metribuzin, atrazine, flumioxazin, fomesafen, trifluralin, s-metolachlor, pyroxasulfone, and indaziflam evaluated pre-emergence in this work were efficient to control the resistant population (100% control). In post-emergence, saflufenacil and ammonium glufosinate isolated or associated with glyphosate, glyphosate+2,4-D, and glyphosate+dicamba are practical tools for management (more than 98% control). The contact herbicides paraquat, diquat, and [paraquat+diuron] also provided effective control (100% control). The results obtained in this study present options for pre and post-emergence control of the resistant population with cross-resistance to ALS inhibitors.

GS-P58 MECHANISM OF ACTION OF BENOXACOR SAFENER IN PROTECTING TOMATO AGAINST HERBICIDE DAMAGE

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Mississippi State University, Mississippi State, MS, USA

Safeners are substances used to protect crops. The mechanism involves the ability to metabolize different compounds, including herbicides. The primary action of safeners includes raising the crop´s endurance to herbicide damage by inducing the protein(s) involved in herbicide metabolism, catalyzing their detoxification in the crop´s system. This study aimed to understand the biochemical effect of benoxacor safener for use in tomato culture, including the activation of the detoxifying enzyme glutathione Stransferase (GST). The experiment was conducted in a randomized factorial design 4 x 2, with four replications which were separated into two treatments, A: four herbicides (Flumioxazin, Femosafen, Linuron,

and Control), and B: two safener treatments (benoxacor and control). Both treatments were applied to the aerial part of the tomato seedlings. Visual injury at 3, 7, 14, and 21 days after application (DAA) and biomass at 21 DAA were evaluated. To determine GST activity, leaf tissues were collected 24 and 48 hours after herbicide application. A lower crop injury was observed with fomesafen, and linuron at 7 DAA with tomato was pre-treated with benoxacor. Biomass was higher in benoxacor pre-treated plants than benoxacor non-treated plants in fomesafen and linuron treatments. A close perusal of data indicates that seeds pre-treatment with benoxacor raised the GST activity of tomato plants, and the absence of the herbicide improved the GST activity. Benoxacor safener reduced crop injury and increased the GST enzyme activity in the presence of fomesafen. The use of benoxacor safener showed high potential in increasing GST enzymatic activity, assisting the detoxification of plants caused by herbicides. Knowledge of the defense mechanism(s) in plants will help improve our understanding of how safeners can offer protection against herbicides, thus leading to improved weed management strategies.

INVESTIGATOR POSTERS (I-P)

I-P01 INFLUENCE OF COVER CROPS AND FERTILIZER TREATMENTS ON THE SOIL MICROBIAL COMMUNITY DYNAMICS IN A DRYLAND SOYBEAN PRODUCTION SYSTEM

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Soil microbial communities play indispensable roles in maintaining soil health by improving soil organic matter dynamics, nutrient cycling, altering biochemical soil environment and ultimately crop productivity. Soil management practices affect soil microbiome, however, the variability of microbial communities to soil management practices and its relationship to soil quality is complex. In this study, changes in the soil bacterial and fungal communities were evaluated in response to no-till, cover crops and fertilizer treatments in dryland soybean production system. We conducted two experiments, early and late planting of soybeans at Pontotoc Ridge-Flatwoods Branch Experiment Station, MS, USA. Soil samples were collected at the time of planting and amplicon sequencing of 16S rRNA and ITS2 genes was used to study the bacterial and fungal community composition. In the early planting, poultry litter amendment and cover crops significantly influenced soil bacterial diversity. However, greater fungal diversity was observed in the inorganic fertilizer treatment. The Mantel test of correlations showed that the soil pH and EE-GRSP were significantly correlated with bacterial communities. In the late planting, microbial diversity and richness remained unaffected by cover crops and fertilizer treatments. We observed a similar abundance of beneficial bacterial and fungal phyla in both experiments which play a major role in organic matter decomposition and nutrient cycling. Microbial community composition varied by planting dates and exhibited temporal and spatial variability. This study suggests that long-term research is needed to assess the impact of soil management practices on soil microbiota and its implications for soil quality in soybean production.

I-P02 HARNESSING THE GENETIC POTENTIAL OF CORN HYBRIDS FOR BETTER SYNERGY WITH THE COVER CROP FARMING SYSTEM

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[1]Geosystems Research Institute, Mississippi State University, Mississippi State, MS; [2]Department of Plant and Soil Sciences, Mississippi State University, Mississippi State, MS

Corn growth and development possess a wide phenotypic diversity that is influenced by genotype (G), environment (E), and management (M). Limited research has focused on understanding corn hybrids' role in sustainable farming. We phenotyped how corn hybrids respond to reduced nitrogen (N) with and without a cover crop farming system. The treatments included were cover crops (Australian winter peas and cereal rye) and N treatments: no cover crop (NCC) with 100% N (270 kg ha^{-1}), cereal rye cover crop with 75% N (RCC), and peas cover crop with 50 % N (PCC), and subplots were five corn hybrids. Treatments had a significant effect on growth, physiology, yield, and quality. At 36 days after planting, early-season shoot biomass was notably greater in PCC>NCC>RCC. Likewise, PCC increased mean chlorophyll content by 20% compared to NCC. Even with 50% reduced N application, corn shoot biomass showed no difference between PCC and NCC at maturity. Corn yield was reduced by 37% under RCC compared to NCC. 'NK15730-3110' and 'MC4319' recorded the nonsignificant difference in yield between PCC and NCC treatments when averaged over five hybrids. Kernel protein was significantly affected by treatment and hybrids. Interestingly, treatments had no significant effect on kernel starch content. Our findings suggest that combining leguminous cover cropping (peas) with the right genetics could be the best alternative to reduce fertilizer-intensive farming without compromising yield and quality. Our study indicates the need for more collaborative efforts better to understand the G × E × M interactions to develop farmer-friendly management tools to sustain yield and quality.

I-P03 ANALYSIS OF SOIL ORGANIC CARBON AND %-NITROGEN IN MISSISSIPPI CROPLANDS USING HYPERSPECTRUM & DEEP LEARNING NEURAL NETWORKS

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[1]Department of Computer Science & Engineering, Mississippi State University; [2]Geosystems Research Institute, Mississippi State University; [3]IGBB, Mississippi State University

This work is a surface soil reflectance spectroscopy (hyperspectral) study to estimate soil organic Carbon (SOC) and percent-Nitrogen (%N) concentration. The objectives are (1) to improve estimation accuracy (2) evaluate alternate signal representations and (3) discrete non-exhaustive search to ascertain dependencies on the band-wise estimates to SOC and %N. This research contributes to the development of remote sensing based non-invasive, accurate, rapid, and cheaper methods for estimating SOC and %N storage in agricultural ecosystems to monitor nutrients and ensure sustained plant health. For 349 Soil samples collected from croplands across Mississippi, 3494 hyperspectral signatures (over 10 signatures per sample) and their corresponding laboratory SOC and %N ground-truth measurements (dry combustion analyzer) were collected. A Spectral Evolution handheld spectroradiometer recorded data in the wavelength range of [350, 2500] nm using a soil probe. This study currently restricts to soil samples with SOC $\in$ [0.0, 4.0] and %N$\in$ [.05, .42]. Linear discriminant analysis (LDA) on a quantized dataset showed the possibility of the estimates being distinguishable from only using the hyperspectra. We compare the estimation performance of regression [multilinear regression (MLR), support

vector regression (SVR), ridge regression (RR), random forest (RF), gradient boosting (GB)] and (2) convolutional neural network-based approaches on the following data representations: raw spectrum, principal component analysis (PCA) representation, and Wavelet projection. Our experiments show MLR models, RR models, SVR models yielding $R^2 \in [0.8, 0.9]$ and decision tree models, such as RF and GB, yielding $R^2 \in [0.85, 0.92]$.

SUSTAINING MEMBERS

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Gulf Coast Community College
Holmes Community College
Itawamba Community College
Jackson State University
Millsaps College
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