Conference on Water, Climate, and Food Security for Students and Early Career Scientists

March 6 – 10, 2023

Hosted by Prairie View A&M University

Supported by the Feed the Future Innovation Lab for Small Scale Irrigation

Jointly organized by

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THE BORLAUG INSTITUTE for International Agriculture

TEXAS A&M AGRILIFE RESEARCH

PRAIRIE VIEW A&M UNIVERSITY

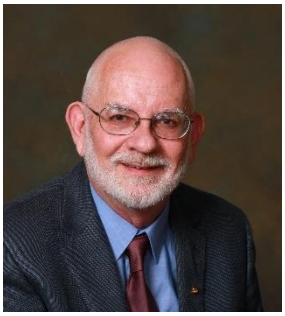
With support from the Feed the Future initiative, this conference will focus on the significant issues in the sustainable management of water and natural resources for food security amid climate change toward improving livelihoods in developing areas and countries. Participants will learn about recent research in international agricultural development and network with research and industry leaders.

Conference Themes

- Climate change impacts on agricultural production
- Change in agricultural practices and its effects
- Water and nutrition linkages
- Water-energy-food nexus challenges and opportunities

Keynote Speakers

Dr Melkamu Derseh, Animal nutritionist at the International Livestock Research Institute (Ethiopia). He holds a PhD in Animal Nutrition from Wageningen University, MSc in Animal Nutrition from University of Bonn and BSc in Animal Production and Rangeland Management from Hawassa University. Dr Derseh is Principal Investigator for irrigated fodder research under the Feed the Future Innovation Lab for Small Scale Irrigation and recipient of the Neville Clarke Award for International Research from Texas A & M University Agrilife Research.



Dr. Steven R. Evett, Research Soil Scientist, USDA Agricultural Research Service; Past-President, American Society of Agronomy; Past-Chair, Alliance of Crop, Soil, and Environmental Science Societies (ACSESS). Dr. Evett studies and develops soil water content and plant water stress sensors, supervisory control and data acquisition systems to control irrigation systems, decision support systems for irrigation management, including variable rate irrigation, and methods to quantify crop water use. He uses field measurements, electronic sensing and automation systems and energy and water balance models to study irrigated and dryland crop water use and water productivity as affected by irrigation application methods, agronomy, and automation. In addition to research in the USA, he has had research projects in many countries.

Timothy Richard Green, PhD, Research scientist, USDA Agricultural Research Service (ARS) and Faculty Affiliate in the Department of Civil and Environmental Engineering, Colorado State University. He has a B.S. in Civil Engineering from the University of Washington, Seattle, and M.S. and Ph.D. degrees in Civil and Environmental Engineering from Stanford University. Tim's research is focused primarily on understanding water movement in complex terrain and soils as it relates to plant dynamics, and how to characterize and scale spatial patterns of terrain, soil, water and plant variables. He has conducted field-based measurements for scaling and modeling of soil hydrology. Tim's international work includes simulation of projected climate change effects on groundwater recharge, leading to membership on a UNESCO panel of experts to assess climate change related to subsurface water. Tim collaborates with colleagues at: University of Trento, Italy; Inner Mongolia Agricultural University, China; and United Arab Emirates University.

Michael Michener, Deputy Assistant Administrator in the Bureau for Resilience and Food Security in the United States Agency for International Development. Over a thirty-five year career in public service and the private sector, he has led and managed successful international and multilateral projects for U.S. government agencies and trade associations. He has a MA focused in Public Administration.

Dr. Rabi Mohtar, TEES Research Professor, Biological and Agricultural Engineering, Texas A & M University and founder of TAMU's Water-Energy-Food Nexus Initiative. He holds a Ph.D. in Agricultural Technology and Systems Management from Michigan State University, M.Sc. in Irrigation Science from American University of Beirut, and M.Sc. in Civil and Environmental Engineering from , Michigan State University. Dr. Mohtar's research interests are developing the tools to provide societies and their policy makers the information to address these needs by addressing global resource challenges. Developing and outlining policies and strategies for global resources security, especially for arable soils and water, are critical for the healthy future of our planet. Dr. Mohtar is an Executive Board member of International Water Resources Association (IWRA), and a Fellow of the American Society of Agricultural and Biological Engineers ASABE.

Dr. Ephraim Nkonya, Research Agricultural Economist in the Rural Economy Branch of the Resource and Rural Economics Division of the United States Department of Agriculture Economic Research Service, and non-resident fellow of the International Food Policy Research Institute. Dr Nkonya contributed to quantitative research on the linkages between small scale irrigation, livelihoods and nutrition under the Feed the Future Innovation Lab for Small Scale Irrigation. He has a PhD in natural resources, econometrics, and statistics, and MSc in agricultural economics from Kansas State University, and B.S. in agriculture from Sokoine University of Agriculture.

Dr. Seifu Tilahun, Senior Researcher in Hydrology and Water Resource Management at the International Water Management Institute (Ghana). He was the project lead for the Feed the Future Innovation Lab for Small Scale Irrigation partnership while a Professor of Hydrology at Faculty of Civil and Water Resources Engineering, Bahir Dar Institute of Technology-Bahir Dar University, establishing innovative and reward-winning achievements with the BiT Maker Space. He holds a PhD and MSc from Cornell University and BSc Engineering from Bahir Dar University.

Dr. Skyller Walkes, Associate Dean, Diversity, Equity, Inclusion and Antibias, Columbia Climate School. A graduate of the Adult, Professional, and Community Education doctoral program at Texas State University, her scholarship focuses on Critical Race Theory, Afro- Latinx identity, art activism, race and intersectionality. Bachelor's degrees in Communications, English, and Mass Media Journalism from Rutgers University and a master's degree in Early Childhood Education and Administration from Kean University. She also holds a Master's in Science in Juvenile Justice from Prairie View A&M University.

Clinton D. White, Counselor for the United States Agency for International Development. He has more than 20 years of experience in the public sector and is a member of the Senior Foreign Service. He has held numerous positions in USAID and worked with national and municipal governments as well as a range of private-sector and civil-society groups, including those representing women, youth, and marginalized communities, in their efforts to improve the lives of families, communities, and countries. Mr. White holds a BS in Business (Marketing) from the University of West Florida and an MBA from the University of West Florida. He studied Organizational Development and Leadership at the University of West Florida, as well as Public Financial Management at Duke University.

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Program

Prairie View A&M University, Memorial Student Center (MSC)

Session	**Focus**	**Location / Presenter**
March 6 – 8	Training: SWAT, APEX, FARMSIM	
March 8 – Wednesday		
	Participants arrive	
4:00 – 5:30 PM	Farm and lab facilities visit at PVAMU	
5:30 – 7:00 PM	Meet and greet social and dinner for students	
March 9 – Thursday		
7:30 - 8:30 AM	**Breakfast on campus**	
8:30 – 9:45 AM	**Opening Session** Moderator: Ali Fares - Welcome from PVAMU - Mike Michener, USAID, Deputy Assistant Administrator, Bureau for Resilience and Food Security - James Palmer, PVAMU Provost and Senior Vice President - Henry Fadamiro, TAMU Associate Vice President for Research - Gerard D'Souza, Dean & Land Director of Land-Grant Programs, CAHS - Elsa Murano, Norman Borlaug Institute of International Agriculture and Development	**Plenary**: Conference participants & PVAMU students MSC Auditorium
	Group Photo	

9:45 – 10:15 AM	**Health break**	
10:15 AM – 12:00 PM	**Moderator:** Gerard D'Souza, Dean and Director of Land-Grant Programs, College of Agriculture and Human Sciences, PVAMU **Keynote:** Skyller Walkes, Associate Dean, Diversity, Equity, Inclusion and Antibias, Columbia Climate School, Columbia University **Keynote**: Rabi Mohtar, TEES Research Professor, Biological and Agricultural Engineering, Texas A&M University *Food-Energy-Water Nexus* **Keynote:** Timothy Green, USDA Agricultural Research Service *Hydrology of environmental and agricultural systems across scales* **Keynote**: Steven Evett, USDA Agricultural Research Service *Addressing climate change through modeling and analytical tools*	**Plenary**: Conference participants and PVAMU MSC Auditorium
12:00 – 1:00 PM	**Lunch**	
	Conference Session	
1:00 – 3:00 PM	**Theme 1: Climate change impacts on agricultural production** Moderator: Laura Carson, Emmitt Higgins	MSC Ballroom
1	Impacts of elevated levels of CO_2 and water stress on the physiological growth of young woody plants	Gabriel Ahoma
2	Implication of climatic variations on Sugar Cane Production and Distribution in Louisiana	Cynthia C. Ogbu
3	Climate Change Impacts on Agriculture in the Midwest	Kyla S. Bryant
4	Assessing Climate Change and Agriculture Impacts on California's Water Supply	Recheal Naa Dedei Armah
5	Impact of climate change and precipitation patterns on crop production in Southeast USA	Lucinda A. Kangwana
6	The Impacts of Climate Change on Low-income Communities in the U.S.: A Literature Review	Peter Owolabi
7	Investigation of coastal forest and riparian buffer decline along the Chesapeake Bay using dendrochronological analysis of Pinus taeda	Charles Smith
8	Assessing Farmers Perception of Climate Change and the Potential for Adaptation in Delaware, Maryland, and Virginia Peninsula	Erasmus Aduteye
9	Use of National Water Model Forecast Product to Enhance Agricultural Land Management within the Middle Alabama Basin	Ruben Doria-Garcia
10	Changes in hydrological extremes under future climate change scenarios in the Bosque watershed, North-Central Texas	Gebrekidan Worku Tefera
11	An Assessment of Texas Future Water Scarcity Under a Changing Climate	Anoop Valiya Veettil
12	Sweet Corn Responses to Climate-Smart Agricultural Practices	Binita Thapa

13	Impacts of Climate Change on Corn and Soybean Evapotranspiration in Selected Counties, Alabama	Gamal El Afandi
3:00-3:20 PM	**Health break**	
3:20 – 5:00 PM	**Theme 2: Change in agricultural practices and its effects** Moderators: Anoop Valiya Veettil, Atikur Rahman	MSC Ballroom
1	UV-C LED irradiation for controlling plant-damaging oomycetes in water as a sustainable substitute for traditional chemical methods	Bhawana Ghimire
2	Effect of plant defense elicitor in preventing ambrosia beetle attacks in flowering dogwoods exposed to simulated flood stress condition	Madhav Parajuli
3	Long-term effects of cover crops, tillage, and ecological succession on soil health parameters	Charles Carpenter III
4	Soil Moisture Dynamics in the Selected Climate-Smart Agriculture Practices in Sweet Corn Fields	Nigus Demelash Melaku
6	Evaluating under-utilized crops with global potential for enhancing food security	Taylor M. Walters
7	Increasing Applications of Fertilizer Effect on Water Quality Within and Below the Root Zone	Reggie O. Jackson
8	Soil Health: Evaluation of Soil Respiration and Select Soil Properties Under Different Tillage Practices on the Eastern Shore of Maryland	Rhyan Knight
9	Differences in Dynamic Soil Health Properties Among Agricultural Management Systems on the Eastern Shore of Maryland	Dev Gurung
10	Evaluation of Soybean Cultivars for their Resistance to Insect Pests in the Delmarva Peninsula	Alhadi Ahmed
11	Acetic Acid is effective as a growth control agent against Amaranthus palmeri among developing soybean crop	Armania Smith
12	Plant Nutrient Uptake In Response to Selected Climate Smart Agricultural Practices	Alexis Brown
13	Climate Smart Practices and Fate of Soil Carbon Under A Sweet Corn Cropping System	Atikur Rahman
14	Use of System Dynamics Approach to Discern the Lingering Role of Sediment Pond on Surface Mining Water Quality	Mohammad Nazari-Sharabian
5:00 – 7:00 PM	**Bowling & Dinner; Return to hotel**	Panther Plaza

March 10 – Friday		
7:30-8:30 AM	**Breakfast on campus**	
8:30 – 10:00 AM	**International development: Partnerships, priorities, and opportunities** Moderator: Nicole Lefore, Director, Feed the Future Innovation Lab for Small Scale Irrigation **Keynote:** Increasing collaboration between Feed the Future Innovation Labs and Minority Serving Institutions: Results of 2020 study. Victoria Parker and Levon Esters, Purdue University **Panel discussion: Priorities and opportunities in international agricultural and climate research** Dr Melkamu Derseh, International Livestock Research Institute Dr Ephraim Nkonya, USDA ERS Dr Seifu Tilahun, Bahir Dar University & International Water Management Institute **Remarks:** Clinton White, Counselor, USAID	**Plenary**: Conference participants & PVAMU students MSC Auditorium
10:00 – 10:30 AM	**Health break**	
10:30 AM – 12:00 PM	**Career Development and Networking** Speed talks - Internships and career pathways: USAID, Bayer, USDA Foreign Agricultural Service - Research internships: Florida A&M University - Research abroad: Central State University (video) Tables and networking	**Plenary**: Conference participants & PVAMU students MSC Ballroom
12:00 – 1:00 PM	**Lunch**	
	Conference Session	
1:00 – 2:00 PM	**Theme 3: Water and nutrition linkages** Moderators: Dinesh Ghimire, Atikur Rahman	MSC Ballroom
1	Evaluating the Inhibition of Lippia dulcis on Pancreatic Lipase and α-amylase enzymes	Shelby Devereaux
2	Effects of Industrial Hemp Wax Coating On Postharvest Quality Of Tomatoes	Robert Earl Lewis III
3	Protective action of garlic powder against developmental toxicity caused by golden yellow dye	Rahman
4	Antioxidant and Antimicrobial Activity of Cucurbitaceae Plant Leaves: A Comparative Study	Tasbida

5	Observation of antimicrobial susceptibility testing against sweetpotato leaf extracts (Ipomoea batata L.), and a few other leafy vegetables extracts through disc diffusion method	Airin
6	Effects of cooking methods on the bioactive compounds and physiological functions of sweetpotato leaves (Ipomoea batatas L Lam)	M.H.A. Jahurul
7	Precipitation and Temperature Influence Survival and Transfer of Escherichia coli to Fresh Produce in Manure-Amended Certified Organic Soils in Maryland	Annette Kenney
2:00 - 3:00 PM	**Theme 4: Water-energy-food nexus challenges and opportunities** Moderators: Anoop Valiya Veettil, Emmitt Higgins	MSC Ballroom
1	A Case Study of Machine Learning Aided Computational Fluid Dynamics Applications on Offshore Wind Turbines	Angel Randall
2	Pre-treatment of Produced Water by Photocatalysis of TiO_2-rGO-CdS	Gladstone Ukoima
3	Effect of Zinc Oxide Nanoparticles on Mustard Plants	De Zarae Guthrie
4	Use of Microalgae in the Diets of Poultry	Ayanna N. Williams
5	SMAP Soil Moisture Product Validation Using In-Situ West Texas Mesonet (WTM) Data	Ehiguese Obiomon
6	Impact of Viticulture Production Upon USDA-MRLA 131A Southern Mississippi River Alluvial Soil	LaShunda A. Hodges
7	Use of modern Agricultural Automation and Smart Farming	Jesuraj Pandya
8	Genome Wide Association Studies to Dissect Root Architectural Traits in Soybean	Joshua Y Asiamah
9	Evaluation of Water Use Efficiency, Yield Component and Seed Compositional Traits of Grain Hemp Varieties towards Developing Crop Improvement Strategies	Kusum R. Tamang
3:00 – 3:30 PM	**USAID and Participant Engagement**	MSC Ballroom
3:30 – 4:00 PM	**Closing** - Closing and thanks, PVAMU	Conference participants and PVAMU, MSC Auditorium
Evening	**Dinner**	
March 11 – Saturday - Participants depart		

Organizing Committee		
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Abstracts

Theme 1: Climate change impacts on agricultural production

Impacts of Elevated Levels of CO_2 and Water Stress on the Physiological Growth of Young Woody Plants

Gabriel Ahoma, Zhu H. Ning, Yaw Twumasi, Judith Oppong, Raymond Antwi, Jacob Annan, and Julia Atayi

[1]Southern University and A&M College, Department of Urban Forestry, Baton Rouge, LA,
Email: gabriel_ahoma_00@subr.edu

Warming temperatures and increased drought conditions are expected to cause a decline in soil and water quality and quantity and continue to have real impacts on farms across the globe. The duration and intensity of water stress are anticipated to increase in the future as global climate continue to change; however, a detailed counteract to the response of water stress remains incomplete. In most rangelands around the world, woody plants are increasing prevalence and dominance. The purpose of this study is to assess the effects of elevated levels of carbon dioxide (CO_2) and chronically water stress on the physiological growth dynamics of four juvenile woody plant species (Cornus drummondii, Rhus glabra, Gladitsia triacanthos and Juniperus osteosperma) at the USDA-ARS Crops Research Laboratory greenhouse in Fort Collins, in a complete randomized block design. Data on gas exchange, starch and biomass of the woody plants were

analyzed to determine the effects of elevated levels of CO_2 and water stress on the growth of young woody plants. Preliminary results from the study revealed elevated levels of CO_2 counteracts much of the physiological effects of chronic water stress on the four woody plants measured. The alleviation of water stress from increased CO_2 concentrations will result in juvenile woody plants continuing to expand and thrive North American rangelands. The ultimate goal of this research is to help range managers, foresters, and agriculturists in making long-term management decisions for reducing woody plants in rangelands.

Implication of Climatic Variations on Sugar Cane Production and Distribution in Louisiana

Cynthia C. Ogbu[1], Yaw A. Twumasi[1], Zhu H. Ning [1], Gerald N. Attamah [2], ChinweJ. Aghadinuno [3], and Opeyemi Oladigbolu [1]

[1]Department of Urban Forestry and Natural Resources. Southern University and A&M College, 102 Fisher Hall, Baton Rouge, Louisiana 70813, U.S.A.; [2]Zoology and Environmental Biology, Faculty of Biological Sciences, University of Nigeria (U.N.N.); [3]Electrical/Electronic Engineering, Southern University and A&M College, 102 Fisher Hall, Baton Rouge, Louisiana 70813, Email: ogbucynthia83@gmail.com

Global climate change has already had observable effects on the environment. Climate change is one of the major challenges facing humanity in the future and the effect of climate change has been detrimental to the agricultural industry. Sugarcane is an essential raw material for the production of sugar and bio-energy. About 80% of the global sugar is produced from sugar cane. In the U.S., sugarcane accounts for 45% of the total sugar manufactured locally. Over the years, sugarcane production in the U.S. has increased from 6 million STRV in the early 1980s to 9 million STRV in 2017. The increase in production is as a result of strategies such as the use of improved cane varieties, the adoption of new technology, and/or acreage expansion. Louisiana alone produces about half of the U.S. sugarcane. Sugarcane production and distribution are affected by climatic variations especially changes in precipitation, temperature, and most importantly hurricanes. This study intends to show the possible impacts on sugar cane production in Louisiana, by presenting an analysis of crop-climate relationships, using historic production statistics.

Climate Change Impacts on Agriculture in the Midwest

Kyla S. Bryant, Yaw A. Twumasi, Zhu H. Ning, Nicholaus Pryor, Sarah Neal, and Tess Brown

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Increasing global temperature with accompanying impacts such as changes in precipitation patterns and sea level rise is one of the major concerns by the global community. For more than three decades there has been frenzied discussions and conferences by international community

with the objectives of finding ways to reducing agents of climate change. In the Midwest, rising extreme temperatures, increased humidity, and precipitation are all having harmful effects. Rainfall and humidity increases have damaged soils, and made it easier for pests and viruses to spread. Projected changes will bring Midwest agricultural productivity down to levels of the if significant technological and cultural breakthroughs are not made. As a result of population fluctuations, socioeconomic upheavals, pollution of the air and water, and changes in the landscape, the area is highly vulnerable to both climate variability and climate change. The objective of this study seeks to detail the extent to which agriculture and climate change impacts the Midwest. Historical data from both primary and secondary sources will be used to assist in the investigation of the impact of climate change on agriculture in the Mid-west.

Assessing Climate Change and Agriculture Impacts on California's Water Supply

Recheal Naa Dedei Armah, Yaw Twumasi, Zhu Ning, Matilda Anokye, Caroline Apraku Yeboaa, and Priscilla Mawuena Loh

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Industrial agriculture and climate change coupled with a growing population are straining. Although California experienced a flood of rain and snow earlier this winter, standard water supply planning and analysis are proving insufficient to assist the state prepare for future requirements. Despite making up less than 2% of the state's economy, California has the second-largest agricultural sector in the country, earning more than $50 billion annually. Recent reports from researchers detail that, although climate change is in part to blame for California water crisis, growing demand or agriculture also plays a role in water shortages. The objective of this study seeks to (1) detail the extent to which agriculture and climate change impacts water stability in California and (2) use remote sensing technology to monitor changes in surface water levels over the years evaluating the severity of the drought.

Impact of Climate Change and Precipitation Patterns on Crop Production in Southeast U.S.A.

Lucinda A. Kangwana, Yaw A. Twumasi, and Zhu H. Ning

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Large-scale crop production has always been dependent on climatic conditions in order to obtain the best yields. Specific crops are associated with a particular climate and cannot produce maximum yield if the conditions are altered. However, climate change has always been happening and itâ€™s being accelerated by anthropogenic factors. As this change continues, the world might be in the wake of fluctuating weather patterns including prolonged droughts and increased precipitation patterns. Even though this aspect has been overlooked, there is enough evidence to

explain how the change in climatic conditions can trigger dissimilar precipitation events which fail to favor the existing crop production systems. This paper discusses the impact of climate change and precipitation patterns on crop production in Southeast U.S.A. Using the Global Climate Model, the research analyzes how changes in climate and precipitation threaten crop production. By exploring the IPCC reports, the research studies the specific elements in the climate of Southeast U.S.A. that resulted in changes in precipitation patterns. The paper also examines the research methods used in identified journal articles and uses them to draw general findings, discussions, and conclusions. It unveils the prolonged changes in the average precipitation and how these changes have resulted in significant outcomes on crop production.

The Impacts of Climate Change on Low-income Communities in the U.S.: A Literature Review

Peter Owolabi and Su Ye

Lincoln University of Missouri, Email: peter.owolabi516@my.lincolnu.edu

Climate change is a significant change in global temperature, precipitation, wind patterns, and other measures of climate that occur over several decades or longer. Directly or indirectly, climate change affects all sectors and regions of the United States. However, the impacts of climate change are not uniform across regions, economic sectors, or population groups. Some likely benefit, while others may lose. Developing adaptation and mitigation policy options to reduce the climatic vulnerability of rural communities and low-income communities is necessary. Regional and local studies are needed to identify climate change impacts across rural and urban communities and develop significant policies to mitigate these impacts. This study will review recently published studies and check how climate change affected low-income and underserved rural communities and their resilience and adaptive capacity in the United States. The findings will help shape future research questions and propose relevant policies to mitigate the negative impacts of climate change on the low-income community and promote environmental justice. Academic articles and government reports published in the last two decades will be searched systematically and reviewed carefully. The focus will be on how low-income communities are affected differently from other communities, what factors contributed to the differences, and what measures can take to reduce the disparities.

Investigation of Coastal Forest and Riparian Buffer Decline along the Chesapeake Bay using Dendrochronological Analysis of Pinus Taeda

Charles Smith and Stephanie Stotts

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Agricultural runoff is often blamed for elevated nutrient levels in coastal waterways. A healthy riparian forest buffer can provide nutrient filtration, erosion protection, habitat provision, flood mitigation, and carbon sequestration. The establishment and restoration of riparian forest buffers is considered one of the most cost-effective approaches to achieving nutrient reductions required by total maximum daily loads, leading state and federal organizations to start programs encouraging the planting of forest buffers. However, climate change and sea level rise place stress on trees within buffers in coastal regions, driving reduced functionality due to tree decline and death. This study develops a tree-ring chronology for *Pinus taeda* (loblolly pine), an ecologically and economically important species in the Mid-Atlantic region, to better understand the impact of climate change and sea level rise on riparian buffer stability. Salt tolerant vegetation in the understory, canopy gaps, and cessation of regeneration are all indicators of salt stress. Using standard dendrochronological techniques, increment cores were collected from 80 trees within a salt impacted riparian buffer at the Monie Bay component of the Maryland National Estuarine Research Reserve in Princess Anne, MD. The chronology was then processed for quality control and the identification of missing and false rings with COFECHA, and cores that significantly reduced the inter-series correlation coefficient were removed from the chronology. Age-related growth trends were then removed using the dplr package in R. The resulting chronology will serve as the foundation for a moving correlation analysis between climate and water level variables in future research, providing an improved understanding of the impact of climate change and sea-level on forested riparian buffer health, ultimately leading to more resilient riparian buffers.

Assessing Farmers' Perception of Climate Change and the Potential for Adaptation in Delaware, Maryland, and Virginia Peninsula

E. K. Aduteye and S. L. Tubene

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Agriculture and food security are predicted to be impacted by global warming, causing food prices to increase and reducing food production. The farm sector contributes to greenhouse gas emissions, and the perception of farmers on climate change is extremely important. Studies on farmers' perception of climate change have been conducted in the United States; however, little has been done in Delaware, Maryland, and Virginia (Delmarva) Peninsula to address farmers' understanding of climate change and potential adaptation strategies. The objective of this study was to assess Delmarva farmers' perceptions of climate change and document appropriate and effective climate change adaptation strategies used by Delmarva farmers. A questionnaire was designed and used to collect data from the respondents. The result was analyzed and presented in tables and frequencies. More than half of the respondents believe climate change is occurring. Factors influencing farmers' perceptions of climate change were analyzed using a binary logit model. From the binary logit model, observation of changes in climate over the past 5 -10 years, age, level of education, and farmers who accepted adaptation strategies due to climate change positively influenced their perception of climate change, while the size of farm and farmers who believe

agricultural activities contribute to climate change have no significant influence on farmers' perception of climate change. The result showed that an increase in temperature, uneven rainfall distribution, and a high incidence of pests and diseases are the major threats to agriculture in the Delmarva Peninsula. Adaptation strategies currently used by Delmarva farmers include avoiding planting in the flooded areas of the farm, growing selective crops, practicing soil conservation techniques, and buying crop insurance.

Use of National Water Model Forecast Product to Enhance Agricultural Land Management within the Middle Alabama Basin

Ruben Doria-Garcia, Joseph E. Quansah, and Souleymane Fall

Tuskegee University, Department of Agricultural & Environmental Sciences; Tuskegee, AL, Email: rdoria9733@tuskegee.edu

National Water Model (NWM) is a large-scale, process-based, and physical-based hydrologic modeling system that simulates observed and forecast streamflow over the entire continental United States. Streamflow measures and related NWM products (soil moisture/depth) are critical in developing agricultural-based water use and water management plans to help optimize crop yield and increase resilience to climate change. This research aims to utilize streamflow and other output products of the NWM in combination with the Soil and Water Assessment Tool (SWAT) and other hydrologic model simulations at the local scale to assess the spatial dynamics of the hydrology within the Middle Alabama Basin (MAB). NWM predictions and products will be processed and analyzed for different hydrologic conditions, including droughts and flood trends within the MAB. Furthermore, the SWAT model will be set up, calibrated, and validated for the research watershed, utilizing NWM outputs. Integrating and combining the NWM and SWAT output will provide a valuable tool for assessing recent and near-future spatial trends in water availability and soil moisture critical in studying flash droughts/floods and related agricultural risks within the MAB. Such an integrated modeling approach will provide a more comprehensive understanding of water availability and use at the local and watershed scale, improve the predictions of drought/flood conditions, and help farmers make informed water use and irrigation decisions to minimize adverse impacts. The research results will help provide critical data for making informed decisions on sustainable water use for agricultural production for limited resources and underserved farmers within the MAB and other rural communities within the Alabama Black Belt Region.

Changes in Hydrological Extremes under Future Climate Change Scenarios in the Bosque Watershed, North-Central Texas

Gebrekidan Worku Tefera and Ram L. Ray

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The study develops climate change scenarios by blending multiple Global Circulation Models (GCMs), Representative Concentration Pathway (RCPs) scenarios, and statistical downscaling techniques. The multi-model ensemble and single-climate model simulations were used to quantify changes in hydrological extremes under future climate scenarios. To ensure hydrological model robustness, the hydrological model i.e Soil Water Assessment Tool (SWAT), was calibrated and validated using the Differential Split-Sample (DSS), where the observed period was divided into relatively 'dry' and 'wet' periods based on observed streamflow. The SWAT model was also calibrated and validated at the multi-gauges of the watershed. Future climate change scenarios revealed a reduction in precipitation (in the order of -9.1% to 4.9%) and a consistent increase in maximum temperature (0.34℃ to 4.10℃) and minimum temperature (-0.15 ℃ to 3.7℃) in different climate model simulations. A decrease in high flow (Q5) and low flow (Q95) was projected from future climate change scenarios. A higher reduction of low flow and annual minimum flow is also simulated in future climate scenarios. Whereas an increase in annual maximum flow is simulated in climate change scenarios developed from the RCP8.5 emission scenario. The study suggests optimal water management structures, which can reduce the effect of change in high and low flows.

An Assessment of Texas Future Water Scarcity Under a Changing Climate

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The compound impact of limited water availability, population growth, and climate change are the lead causes of Texas' water scarcity and challenges to its long-term water management plans. Therefore, conscious water resources management practices based on a clear understanding of a climate-driven water crisis are vital for eradicating the conflicts between agricultural and municipal water demand. In this study, we performed a comprehensive surface and groundwater security assessment for historical and future periods of Texas. The U.S. Geological Survey's Monthly Water Balance Model (MWBM) output was used to quantify the surface and ground blue water availability under RCP4.5 and RCP8.5 climate change scenarios. Future agricultural (i.e., irrigation and livestock) and municipal sectors' water demands were calculated based on the 2022 Texas State Water Development Plan projections. The results indicate that the decreasing groundwater availability will lead to significant water scarcity in Texas' western counties, especially High Plains and Trans-Pecos, despite the projected decrease in future agricultural water demands. Groundwater scarcity in the municipal sector is projected to increase due to declining groundwater availability and increasing municipal water demand. Also, Texas' Lower Valley counties showed a significant surface blue water scarcity due to the combined impact of decreasing

water availability and increasing water demand. The surface and groundwater-based water security accounting framework developed here provide a useful integration of future hydrologic and human water demand by mapping the emerging critical hotspots due to the conflicting water demand in the agricultural and municipal sectors.

Sweet Corn Responses to Climate-Smart Agricultural Practices

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Soil amendments, chicken, and dairy manures have been widely used to improve soil properties as crop fertilizers. Recently, charred material and biochar have been gaining acceptance in production agriculture as a soil amendment that improves soil quality, plant growth, and climate change mitigator. This study compared the combined effects of manures and biochar levels on sweet corn growth parameters. A field experiment was established at Prairie View A&M University Farm in a factorial design of two levels of biochar (2.5 and 5 t ha-1) and three levels of dairy and chicken manure (0, 224, 448 kg total N ha-1). The treatments were replicated three times. Sweet corn seeds were seeded 1 foot apart within rows and 2 feet between rows at a rate of 6.8 lb ac-1. Plant biomass, plant height, cob length, cob diameter, and cob height from ground level were measured from all treatments. The results indicated that plant biomass did not change with manure type and rate, but biochar at a rate of 5 t ha-1 had significantly greater biomass compared to control treatments after 21 days of planting. Similarly, the cob length and height of the cob from the ground were significantly affected by the manure rate. While the cob diameter was significantly affected by manure and biochar rates. No interaction effects were observed between soil amendment types, manure, and biochar rates. Based on the results, the combined application of biochar and manures positively affected some sweet corn growth parameters, corn biomass, and diameter.

Impacts of Climate Change on Corn and Soybean Evapotranspiration in Selected Counties, Alabama

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The physiological growth processes of maize (corn) and soybean were simulated using the Calibrated Crop Environment Resource Synthesis (CERES) maize and CROPGRO soybean models under 2045 and 2075 projected climate change scenarios for six representative counties in Alabama. The evapotranspiration (ET) rates of each county were assessed by using future

climatological emission scenarios, Representative Concentration Pathway (RCP) 4.5, based on the IPSL-CM5A-MR high-resolution climate model. Average corn evapotranspiration increases of 12-42% were respectively projected under RCP 4.5 for 2045, and an 8-33% increase in 2075. Soybean average evapotranspiration decreased 11-22% in 2045 and 5-12% in 2075. The variations in ET were largely influenced by an increase in temperature and a decrease in precipitation from corn's April planting date and soybean's May planting date compared to the baseline (1980-2010) evapotranspiration rates. Corn ET in Autauga and Limestone Counties exhibited the highest decrease in 2045 and 2075. Limestone County also experienced the highest yield decrease in ET in 2045 and 2075, with Baldwin County being the only county with an ET increase in soybean production.

Theme 2: Change in agricultural practices and its effects

UV-C LED Irradiation for Controlling Plant-damaging Oomycetes in Water as a Sustainable Substitute for Traditional Chemical Methods

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Use of chemical approaches such as chlorination of irrigation water is a widespread practice used to control the aggregation of microorganism in the water. However, repeated chlorination of water could lead to the production of harmful byproducts which can have negative effects on human health and the environment. Water inhabiting phytopathogenic oomycetes such as *Phytophthora cinnamomi*, *Phytophthora nicotianae*, *Phytopythium vexans*, and *Phytopythium helicoides* are economically important phytopathogens. Use of germicidal UV-C light (240-290 nm) to treat water could be a novel alternative to chlorine. Efficacy of UV-C LED irradiation to inactivate the main infectious propagules of oomycete pathogen was evaluated using a collimated beam UV-C reactor unit. Zoospore suspensions were exposed to various quantifiable doses of UV-C radiation for different exposure times. The UV-C dose was calculated by multiplying the average fluence rate (mW.cm-2) by the exposure time (secs). The suspensions were stirred during the exposure to ensure even distribution of the UV-C radiation. The surviving populations of the pathogens were counted after the exposure to UV-C radiation. The study found that the effectiveness of UV-C radiation in inactivating the pathogens followed a logarithmic relationship, and a log-linear model was fitted to the experimental data with high R^2 values (0.96, 0.96, 0.96, 0.97, and 0.97) and low RMSE values (0.01, 0.11, 0.11, 0.0040, and 0.065) for the four pathogens, respectively. The D_{10} values (the UV-C dose required to reduce the pathogen population by 90%) were calculated for each pathogen, with values of 5.66 ± 0.36, 4.77 ± 0.29, 7.79 ± 0.44, and 13.71 ± 0.58 $mJ.cm^2$ for

P. cinnamomi, *P. nicotianae*, *P. vexans*, and *P. helicoides*, respectively. The results of this study could be further used to study the appropriate UV-C radiation dose and exposure time required to effectively control these pathogens in different irrigation systems with varying water types.

Effect of Plant Defense Elicitor in Preventing Ambrosia Beetle Attacks in Flowering Dogwoods Exposed to Simulated Flood Stress Condition

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Ambrosia beetles (Xylosandrus spp.) are an economically important wood-boring pest of flowering dogwoods (Cornus florida L.). They preferentially infest trees weakened by abiotic and biotic stressors. In this study, Acibenzolar-S-methyl (A.S.M.), a plant defense elicitor, was evaluated for effectiveness in inhibiting ambrosia beetle tunneling (i.e., attacks) into dogwoods exposed to simulated flood stress. Three-year-old container-grown dogwood trees of size ranging from 1.8 to 2 cm stem diameter were assigned to A.S.M. drench + flooding, A.S.M. foliar + flooding, A.S.M. drench + no flooding, A.S.M. foliar + no flooding, no A.S.M. + flooding, and no A.S.M. + no flooding conditions. A.S.M. was applied preventatively 3 days before the initiation of water stress. The trials were conducted near the edge of a deciduous forest. The experiment was arranged in a completely randomized design with six single-plant replications. Trees were flooded for 14 days and were then drained and watered as needed. Ambrosia beetle attacks were counted every other day for 28 days. Plant tissue core samples were collected at 7 and 14 days after flood initiation to determine ethanol content using solid-phase microextractionâ€ "gas chromatographyâ€ "mass spectrometry. Ambrosia beetle-attacked trees were collected at the end of the trial. The number of attacks with successful gallery formation, gallery depth, galleries with fungal colonization, galleries containing egg, larvae, and adult was recorded by dissecting the trees. Result showed that trees exposed to no A.S.M. + flooding had the highest number of ambrosia beetle attacks, but the number of attacks was significantly reduced in A.S.M. treated trees assigned to flooding. Trees assigned to no flooding conditions had the least or no beetle attacks. Only the plant tissues collected from the flooded trees produced ethanol. Moreover, A.S.M. significantly reduced attacks with gallery formation, gallery depth, galleries with fungal colonization, galleries containing egg, larvae, and adult. Our results indicate A.S.M. can induce plant defense response to ambrosia beetles attack and tunneling into dogwoods under flooding conditions.

Long-term Effects of Cover Crops, Tillage, and Ecological Succession on Soil Health Parameters

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Soil Organic Carbon (S.O.C.) is an essential part of soil organic matter (S.O.M.), making up more than half of S.O.M. Measuring the amount of S.O.C. helps conceptualize the amount of organic matter in the soil. Tracking S.O.C. changes in agroecosystems are complex and occur at a slow pace, which could take at least a decade to be detected. In our research, we collected soil samples at the KBS Long-term Ecological Research Main Cropping System Experiment at 10 cm depth. Seven treatments were sampled, four annual cropping systems (Conventional, No-till, Reduced input, and Biologically based), and three successional systems (Early-, Mid-, and Late successional). We used several methods to quantify the amount of carbon and nitrogen in two pools that vary in mean residence time (active and stable). We quantified the amount of active S.O.C. pool using two methods: Permanganate Oxidizable Carbon (POX-C), 24h aerobic S.O.C. incubation (C-min). For the active S.O.N. pool, we ran a 7-day anaerobic incubation study. Additionally, we physically fractionated the soil samples into particulate O.C. (P.O.C.), and mineral-associated O.C. (MAOC). On June 15, results showed that at 0-10 cm depth all systems had on avg. 38.5 % of total S.O.C. was allocated in the MAOC pool (i.e., stable pool), and only Early successional had ~2x higher percentage of P.O.C. per total S.O.C. Both S.O.C. pool stocks vary between systems, where Early and Late successional had the highest (avg. 6 Mg P.O.C. and 10 Mg MAOC ha-1; respectively). Annual row crop systems MAOC stocks were significantly correlated with Total S.O.N. stocks. Only No-till and Early successional systems had a greater potential to store and stabilize more S.O.C., whereas Conventional had the greatest potential to mineralize S.O.C. In conclusion, less aggressive and more diverse cropping systems promote S.O.C. accumulation, and therefore, enhancing soil health in the long-term.

Soil Moisture Dynamics in the Selected Climate-Smart Agriculture Practices in Sweet Corn Fields

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Understanding how selected climate-smart agriculture, such as soil amendment, affects soil moisture dynamics has become imperative as the use of manure and biochar is increasing. A field study was conducted at Prairie View A&M University research farm to investigate the effects of selected climate-smart agriculture practices on soil hydro-physical properties and soil moisture dynamics in Texas. Twelve treatment combinations of two rates of biochar (2.5 and 5 t ha-1) and two types of organic manure (chicken manure and dairy manure) with three rates (0, 224, and 448 kg N ha-1) were used in a factorial randomized block design. The findings of this study revealed

that the combined application of biochar and dairy manure significantly (p < 0.01) improves soil bulk density, porosity, soil hydraulic conductivity, and soil moisture dynamics. The application of 448 kg N ha-1 dairy manure and 5 t ha-1 biochar reduces the soil bulk density by 6.8% compared to 0 kg N ha-1 and 2.5 t ha-1 of biochar. Similarly, the combined application of biochar and manure significantly improved the soil hydraulic conductivity, porosity, and soil moisture dynamics by 10.2%, 41%, and 25%, respectively. In general, the experiment results showed that biochar and manure application could help improve soil water storage capacity and infiltration, which can be a strategy to withstand better drought, which is becoming more frequent and severe due to global warming.

Evaluating Under-utilized Crops with Global Potential for Enhancing Food Security

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Underutilized crops have the potential to help humankind tackle global food insecurity. Egyptian spinach (*Corchorus olitorius L.*) is popular in some parts of the world and has a growing niche market in the U.S. As such, it is necessary to develop production strategies for small-scale farmers to adopt to grow it successfully to meet the demand. This two-year study investigated nutrient requirements for Egyptian spinach to determine the optimum nitrogen rate it requires since this information is largely unavailable for this crop in Texas. The study was designed as a randomized complete block with three replications per treatment involving two Egyptian spinach, i.e., African variety (G.S.) and Asian variety (K.S.), and four nitrogen (N) rates (0, 20, 40, and 60 kg N ha^{-1}). Egyptian spinach was broadcast seeded at 1g per $1m^2$ on the raised bed covered with plastic mulch and lined with drip tape. Each nitrogen rate was delivered using urea fertilizer (46-0-0) broadcast and applied over two split applications at four weeks intervals. Damage score, SPAD reading, leaf area index, stand count, total biomass, biomass per plant, and rate were not affected by variety or nitrogen rate (P >0.05). However, variety affected plant height ($P = 0.0133$) and leaf weight per plant ($P = 0.0001$). Plant height and leaf weight per plant were significantly greater from K.S. compared to G.S. Leaf weight per plant ranged from 641 to 888 g per plant. Total biomass/m^2 was greater for K.S. than G.S. variety at $P = 0.0742$. Residual nitrogen in soil may have resulted in the lack of Egyptian spinach response to N application.

Increasing Applications of Fertilizer Effect on Water Quality Within and Below the Root Zone

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Agricultural management practices significantly influence soil and water quality. Furthermore, non-point source pollution from agricultural land, which includes excessive use of inorganic fertilizers, threatens surface and groundwater quality. The main goal of this study was to assess the impact of the application of an increasing rate of inorganic fertilizer on water quality within and below the root zone of sorghum grown in the Southeast Texas environment. Twenty-seven plots were developed on Prairie View A&M University's Research Farm to grow sorghum in the Summer of 2021. Inorganic fertilizer and irrigation at three different application levels were used and replicated three times. We collected water samples bi-weekly and analyzed them in the laboratory during the growing season. We focused on water quality parameters, such as pH, electrical conductivity (E.C.), total nitrogen (T.N.), total carbon (T.C.), phosphorous (P), potassium (K), sodium (Na), calcium (Ca), magnesium (Mg), boron (B), copper (Cu), iron (Fe), zinc (Zn), and others. We evaluated the effects of fertilizer and irrigation application rates on the water quality within the root and below the root zone. Results showed the considerable impact of increasing fertilizer application rates on water quality at both levels. This field experiment and analysis will help optimize fertilizer application rate to reduce its impact on water quality.

Soil Health: Evaluation of Soil Respiration and Select Soil Properties Under Different Tillage Practices on the Eastern Shore of Maryland

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Soil respiration is an important biological indicator used to assess soil health since crops rely on soil nutrients and minerals made available by microbial nutrient cycling. This study aimed to determine the effect of agricultural land management practices and nutrient concentrations on soil respiration and other related parameters. This study collected soil samples from five to seven horizons from three excavated pedons per field site at seven different locations within the Ingleside soil series on the Eastern Shore of Maryland. Of the seven locations, three field sites were managed under no-till practices, another three were managed under minimum tillage, and a forest site served as a reference site. Collected soil samples were analyzed for physical, chemical, and biological health metrics, including heavy metal and nutrient analysis. Soil respiration for each horizon sample was conducted using a 4-day incubation method per the Cornell University Soil Health protocol. The results were used to determine correlations between soil respiration, metal

concentrations, and other soil factors, such as pH, E.C., soil moisture, and nutrient concentrations across the pedons and sites. Our study indicates that soil respiration was the highest in the Ap layers and lowest in the Bt and Bc layers across pedons. This study provides useful information on the influence of soil nutrients and management practices on soil respiration and the effect of heavy metals on the decomposition of crop residues and other soil organic matter.

Differences in Dynamic Soil Health Properties Among Agricultural Management Systems on the Eastern Shore of Maryland

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There is a necessity for consistent and replicable metrics and indicators for soil health assessments under different agricultural land use management practices in the U.S. Delmarva (Delaware, Maryland, Virginia) Peninsula. These metrics and indicators should be compatible across multiple regions, soils, and management systems. Thus, this study aimed to examine soil health metrics across benchmark soils and dominant land management systems on the Eastern Shore of Maryland. Our study collected soil samples from the Ingleside soil series under different cropland management practices, including no-till, minimum-till, and forest land use systems. Four sites were selected where each site was assessed by collecting samples from three pedons and 5-7 horizons one meter deep. The Maryland soil health card, single ring infiltration, Cornell infiltration, and soil horizon description data were collected at each pedon. Soils were analyzed for physical, chemical, and biological metrics, including bulk density, wet aggregate stability, moisture content, nutrients, metals, pH, E.C., and phospholipid fatty acids (PLFA). Data were analyzed and used to examine variation by depth within each pedon, site, and tillage practice. A forest site was used as a baseline reference. Preliminary results show distinct differences among soil horizons for bulk density, PLFA, nutrient content, and wet aggregate stability. This study provides a baseline opportunity for future collaboration among the 1890 institutions and USDA-NCRS in soil health.

Evaluation of Soybean Cultivars for their Resistance to Insect Pests in the Delmarva Peninsula

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Soybean insect pests have become a serious problem facing soybean producers in Maryland. The use of insect-resistant soybeans instead of chemical insecticides minimizes environmental risks and increases growers' profitability. Our study examined the resistance of soybean cultivars against insect pests, quantified insect population abundances, and evaluated their effect on soybean yield. Field and greenhouse replicated (n=4) experiments were conducted (2017-2019) using five soybean cultivars (SG13#53, F5-55-1#5, TGH12-1-1, TARA, and Pioneer). Insect pests were sampled using a sweep net, where the number of insects was caught, visualized, and recorded. Leaves and stems damage was determined and correlated with the number of insect species trapped in the net. A laboratory-feeding bioassay was performed using leaf cuttings from diverse soybean varieties. Beet armyworm caterpillars fed on 70%, 76%, 52%, and 56% of TGH12-1-1, Tara, SG13+53, and F5-55-1#5 leaves after three days, respectively. During soybean early growth stages (V1-V3), bean leaf beetle (B.L.B.) and Mexican bean beetle (M.B.B.) were the most abundant insects, and their populations were significantly higher in TGH12-1-1 and TARA; this was correlated with leaf area damage during V1-V3 growth stages. During V4-V6 growth stages soybean looper, beet armyworm, B.L.B., M.B.B., soybean aphid, Japanese beetle, green stink bugs, and brown-marmorated stink bug were reported. Significant leaf damage was observed in TARA and TGH12-1-1 compared to SG13#3 and F5-55-1#5. SG13#3 and F5-55-1#5 soybeans were highly resistant to insect pests. Soybean yield differed significantly among soybean cultivars, with SG13#3 having a higher yield than Tara. The antibiosis and antixenosis properties of these insect-resistant soybean cultivars need to be further investigated, and their adaptability to the Delmarva environmental conditions as well as their symbiotic competence with indigenous/introduce nitrogen-fixing bradyrhizobia need to be fully tested.

Acetic Acid is Effective as a Growth Control Agent against Amaranthus Palmeri among Developing Soybean Crop

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Amaranthus palmeri is an invasive rapid-growing plant that is typically near water and is native to the southwestern and south-central United States. It has spread to the northwestern and northeastern areas and has invaded agricultural crops. This weed is regarded as destructive and difficult to manage and control. Studies show that Amaranthus palmeri inhibits and stunts the growth of surrounding crops because it germinates first, grows faster, and thereby profits from the soil moisture, water, light, nutrients, and space first. It does not leave much for the crop that

develops later. Hence if a crop does develop, it will be smaller. Therefore, the objective of this project is to find an organic herbicide and/or treatment process for Amaranthus palmeri. It is important that the herbicide is organic because traditional herbicides are linked to developmental issues, diseases, and cancer. Oftentimes, herbicide residue is left on the desired crop, or the desired crop takes in the herbicide from the soil. An organic herbicide would have little to no effect on the desired crop health or yield. We hypothesized that using organic acetic acid as a growth control agent would allow the surrounding crops to grow to prevent Amaranthus palmeri from growing and establish a foundation in the soil, thereby giving the desired crop a better chance to grow and give the anticipated yield for the crop. Method: To test the hypothesis, we planted Amaranthus palmeri seeds and soybean seeds together and separately, recorded growth, then treated them with a 10% Acetic Acid solution to determine if it would be effective. Lastly, we recorded the changes in the plants. Amaranthus palmeri emerged from the soil within seven days of planting before the soybeans. Data show that the plants started to wither within two hours when the pots were treated on day 14 with a light 10% of acetic acid spray. This shows that the solution is effective. Because the soybeans had not emerged above the soil yet, they were not impacted by the spray.

Plant Nutrient Uptake In Response to Selected Climate Smart Agricultural Practices

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Soil organic amendments such as manures and biochar improve crop nutrient uptakes; thus, understanding how these amendments affect cropsâ€™ nutrient content has become imperative as the use of manure and biochar is increasing. A field research experiment was conducted to evaluate the impacts of soil amendments types and rates on sweet corn grown at the University Research Farm of the College of Agriculture and Human Sciences, Prairie View A&M University. The experiment setup was a factorial design with two types of manure (chicken and dairy) applied at three rates (0, 224, and 448 kg total N ha^{-1}) and two rates of biochar (2.5 and 5 t ha-1) replicated three times. The size of each plot was 3m X 2.5 m. Soil amendments were applied and mixed manually into the top 15 cm soil depth. Plant nitrogen (N), phosphorus (P), and potassium (K) contents were measured 21 days after sowing. Results showed that sweet corn N, P, and K contents were significantly affected by manure rate. P content was 424 ppm greater in biochar rate 5 t ha^{-1} compared to 2.5 t ha^{-1}. While corn K content was affected by manure type, K content was also significantly greater in dairy manure-treated plots compared to chicken manure-treated plots. The study shows that soil amendments impact nutrient uptake and also could maintain the yield.

Climate Smart Practices and Fate of Soil Carbon Under A Sweet Corn Cropping System

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Soil amendments, e.g., manures and biochar, improve the soil's physical, chemical, and biological properties and enhance soil organic matter content. Despite their positive effects on soil health and crop production, soil amendments are lost as CO_2 in gaseous and liquid formats. Thus, there is a need to study the effects of soil amendments (manure and biochar) on CO_2 emission under specific climatic conditions, soil characteristics, and crop management practices. This study investigates the effects of the application of different soil amendment types (chicken and dairy manures) at three rates (0, 224, 448 kg total N ha^{-1}) and biochar at two rates (2.5 t ha^{-1} and 5.0 t ha^{-1}) on soil carbon dioxide (CO_2) emission under a sweet corn crop. The experimental design was a factorial design with three replications and 39 experimental plots. The size of each plot is 3.04 m x 2.44 m. Soil amendment was applied and mixed manually into the top 15 cm- soil depth. Carbon dioxide fluxes were measured twice a week for the duration of the cropping season. Irrigation, rainfall, soil moisture content, and soil temperature were periodically monitored from each plot. The results showed that soil CO_2 flux was significantly affected by the manure types, rates, and their interactions. CO_2 flux increased with the increased manure application rate; the highest CO_2 was observed for double-recommended chicken manure applications. CO_2 flux was strongly correlated with soil moisture; flux decreased when soil moisture level was lower in lower amendment rates. The results of this study improve the understanding of the CO_2 emission due to amendment application and help develop environment-friendly agricultural practices.

Use of System Dynamics Approach to Discern the Lingering Role of Sediment Pond on Surface Mining Water Quality

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The ongoing legacy of mining in Central Appalachia coal fields leaves an extensive footprint that further exacerbates its environmental and societal impact. A paired-headwater study is ongoing to assess the long-term impact of mountaintop removal valley fill operations and reclamation (MTR-VF) on stream water quality 25 years after mining ended, and 15 years after completion of reclamation. In-situ stream water quality is recorded on a two-week interval at different locations along the creek, upstream and downstream from a historic sediment pond, and at the outlet of the two headwaters. Elevated levels and marked temporal variations in SC (> 500 µS/cm), far exceeding benchmark threshold levels for this ecoregion (300 µS/cm) for impaired water were observed upstream but not downstream from the sediment pond. To understand the impact of the restored sediment pond on the creek water quality, a system dynamics approach was employed. The model related different processes in the watershed, i.e., mixing proportion between the high-

SC VF base-flow and low-SC rain-fed overland flow contribution from the non-disturbed drainage area, retention volume of the pond, and studied their dynamics on the outflow water quality from the restored sediment pond. It is noteworthy that the 'removal' of such sediment ponds upon final reclamation is expected and encouraged by regulatory agencies in order to regain the pre-mining stream flow pattern. Results from this study show the invaluable, and potential long-term role of retention basins (the sediment pond in this study) in regulating MTR-FV water quality, years after concluding its perceived and intended role.

Theme 3: Water and nutrition linkages

Evaluating the Inhibition of Lippia Dulcis on Pancreatic Lipase and α-amylase Enzymes

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Obesity is a chronic disease that affects both children and adults worldwide. Obesity is strongly linked to elevated levels of lipids, cholesterol, and glucose in the blood arising from the diet. Hence delaying the digestion and absorption of fat and carbohydrates from the diet provides a path to control obesity. This can be achieved by inhibiting the fat-metabolizing enzymes such as pancreatic lipase, and carbohydrate-metabolizing enzymes such as α-amylase. The drugs that are currently on the market to inhibit these enzymes are known to have low efficiency and adverse effects limiting their use. The objective of this study is to evaluate the potential of medicinal plant extracts to inhibit the enzymes involved in the metabolism of dietary fat and carbohydrates. Medicinal plants are rich in polyphenols, which are known contributors to inhibiting digestive enzymes. Hence it was hypothesized that phytoconstituents of medicinal plant extracts will inhibit the target enzymes involved in fat and carbohydrate metabolism. During this project, the medicinal plant Phyla dulcis was screened for its inhibitory effects on target enzymes. Plants propagated in the university greenhouse were collected, freeze-dried, extracted with organic solvents, and fractionated using an XAD-7 column. The total phenolic content of the fractions was analyzed using Folin-ciocalteu method and the samples were used in enzyme assays using 96-well plates. The phytochemicals in Phyla dulcis extracts showed significant inhibitory activity towards α-amylase, which is involved in carbohydrate metabolism. This study can reveal plant extracts with potential antiobesity effects for future drug development.

Effects of Industrial Hemp Wax Coating On Postharvest Quality Of Tomatoes

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Uncoated fruits and vegetables are susceptible to spoilage during processing, transportation, and storage allowing microorganisms to get inside the products. Most commercial coats in the market are artificial and scientists attempt to create edible coats from natural materials. Here, we tested the ability of hemp (Cannabis sativa) wax, which is a byproduct of the CBD production process, to increase the shelf life of postharvest products. This wax is made up of lipids, terpenes, and traces of CBD. The objectives of this preliminary research are to 1) identify a method to liquefy and solidify hemp wax, 2) design a method to apply wax on tomatoes, and 3) test the ability of wax to enhance the shelf life of tomatoes). The ability of wax to dissolve in different solvents was tested. We found that the wax can be dissolved using solvents to some extent (e.g., ethanol, glacial acetic acid, and citric acid) and liquefy using heat. The sterilized wax was brushed on the disinfected tomatoes, which were in the initial and equal ripening stages and sizes. The positive and negative controls were set up and all experimental units were randomized and in triplicates. Then they were examined for postharvest changes (e.g., weight, color, and diseases) for 14 days. Our study showed that all fruits without coats were consistently ripened faster and showed a considerable weight loss, but all coated fruits delayed ripening and showed less weight loss. Further testing is being done to test its effectiveness on other fruits, but data showed that hemp wax contains properties to protect postharvest products.

Protective Action of Garlic Powder against Developmental Toxicity Caused by Golden Yellow Dye

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Garlic (Allium sativum) is a bulbous plant belonging to the Liliaceae family. It is a hardy bulbous perennial used for thousands of years worldwide for its medicinal and culinary values. In this study, we examined garlic powder for its protective effects against developmental toxicity caused by Golden Yellow textile dye, which is commonly used in garments, pharmaceuticals, and food industries across the globe. It is reported that Bangladesh is the second largest R.M.G. producer globally. The country has more than 4,600 garment industries. In addition, the government has 265 companies listed with the DGDA as producing medicines. The country also has around 246 medium-sized food processing industries. Due to the large number of garment industries, textile dyes are readily available in Bangladesh. Thus, the use of textile dye instead of acceptable food colors has been reported in newspapers and is a source of considerable concern because of its carcinogenic potential and harmful health effects. Artificial food colors adversely affect behavior in children, both with and without pre-existing behavioral disorders. It has also been proven that synthetic dyes have highly active compounds that cause cancer and toxicity in the brain, kidney, blood, liver, embryo, spleen, pancreas, heart, reproductive system, etc. The objective was to investigate the effect of daily supplementations of garlic powder to reduce the overproduction of

free radicals in liver cells and reduce A.D.A. activity in blood cells. In this experiment, textile dye, when added to a rat diet in three different doses with garlic powder, showed significant results in locomotor activity and anxiolytic activity. In this experiment, textile dye significantly showed garlic's protective effect on the developmental liver cell toxicity caused by Golden Yellow textile dye when added to a rat diet in three different amounts with garlic powder.

Antioxidant and Antimicrobial Activity of Cucurbitaceae Plant Leaves: A Comparative Study

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This study focuses on the potential use of the leaves of four vegetable plants from the Cucurbitaceae family namely, Bottle gourd (Lagenaria siceraria), Pumpkin (Cucurbita pepo), Bitter gourd (Momordica charantia L.), and snake gourd (Trichosanthes cucumerina) which are typically underutilized. These plants are commonly cultivated for their fruit, consumed as a vegetable, and grown across tropical regions of Africa, Asia, and Europe. The study analyzes the antioxidant and antibacterial activity of these plant leaves and compares the results. A successive extraction method was used with acetone, methanol, and ethanol as solvents to extract the compounds from the leaves. The extracts were subjected to antimicrobial susceptibility testing using the EUCAST disk diffusion method against one fungal species and three bacterial strains. The total polyphenols content was measured using the Folin-Ciocalteau method with slight modifications, while the antioxidant capacity was assessed using the ABTS method. The findings demonstrated significantly high total phenolic content and antimicrobial activity in all four plants. The ABTS and TPC results further suggest notable antioxidant activity in these plant leaves. The study also identifies pumpkin plant leaves as exhibiting the highest antimicrobial activity against bacteria and yeast. The study concludes that pumpkin plant leaves contain the most biologically active fraction due to their higher phenolic content. Therefore, those leaves are promising materials for the extraction of biologically active compounds with economic prospects in various fields, including as an antioxidant in foods and chemicals.

Observation of Antimicrobial Susceptibility Testing Against Sweet Potato Leaf Extracts (Ipomoea batata L.) and a few other Leafy Vegetable Extracts through the Disc Diffusion Method

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Sweet potato (Ipomoea batatas L.) is a global food crop, now recognized as a functional food due to several of its nutraceutical components. A need for continuous evaluation and selection of cultivars with the appropriate phytochemical composition and bioactivities is needed to explore sweet potato's medicinal value fully. Studies aimed at the isolation, characterization, and toxicological evaluation of its bioactive compounds may strengthen and confirm the possible role of sweet potatoes as a health-promoting food and an alternative remedy for chronic diseases. This study aimed to evaluate in vitro the antimicrobial susceptibility testing of various varieties of crude leave extracts. Antimicrobial action (in vitro) of different variants of sweet-potato leaves extract was analyzed with 70 % acetone against gram-negative bacteria Escherichia coli ATCC 25922, Shigella dysenteriae ATCC13313, fungi candida albicans ATCC90028. The experiment was conducted using Mac Conkey, Sabourared, and Mueller Hinton culture plates using EUCAST disc diffusion methods at different concentrations. The results revealed that 70% acetone extraction of sweet potato leaves shows low to medium antimicrobial activity against Escherichia coli, shigella spp, and candida albicans. On the other hand, crude leaf extracts from green lemon, butter squash, bell pepper, and garlic have medium to high antibacterial activity against Escherichia coli, shigella dysenteriae, and antifungal activity against candida albicans. Based on this study, it is recommended that the consumption of leafy vegetables could prevent consumers from antimicrobial infections.

Effects of Cooking Methods on the Bioactive Compounds and Physiological Functions of Sweet Potato Leaves (Ipomoea batatas L Lam)

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The cooking methods can affect the retention of vegetable nutrients and phytochemicals content, showing the need to know the best way to cook. In this study, we aimed to determine the total phenolic compounds (TPC) and antioxidant activity of 26 varieties of sweet potato leaves using two different cooking methods (stir-frying and microwaving). The total amounts of phenols and antioxidants were determined through Folin-Ciocalteu and ABTS methods, respectively. The results showed that the total phenols and antioxidant content were significantly different in all cooking techniques for sweet potato leaves, wherein: raw > micro-waving > stir-frying. Our results suggested that natural and micro-waving are preferable to maintain a good amount of phenols and antioxidant activities of sweet potato leaves. Moreover, this study also compared total phenols and antioxidants present in field-grown and greenhouse-grown sweet potato leaves. These compounds were higher in the field than in greenhouse conditions. The correlation between antioxidant activity and total polyphenol content was found to be highly positive (r^2 = 0.86, p<0.001), indicating that they are highly correlated and the variety having the highest phenols gives the highest amount of antioxidants. This study determined the total amount of minerals in

sweet potato leaves through ICP-OES. It found that sweet potato leaves are good sources of minerals according to the nutritional quality index, especially P, Ca, Al, Fe, Mn, S, and Na. To reduce malnutrition, sweet potato leaves containing several nutrients and bioactive compounds should be consumed as leafy vegetables, particularly in developing countries.

Precipitation and Temperature Influence Survival and Transfer of *Escherichia coli* to Fresh Produce in Manure-Amended Certified Organic Soils in Maryland

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Manure enhances soil health/crop productivity but harbors pathogens that may contaminate produce and result in illness. Environmental factors (precipitation, drought, temperature) influence pathogen survival. The impacts of climatic events on pathogen survival during the 90-120-day National Organic Program (NOP) manure-to-harvest wait-period for fresh produce remains unclear. A randomized complete block inoculated challenge study was conducted on Delmarva NOP-certified plots in 2017-2018 to evaluate precipitation, soil moisture, and raw manure (poultry (PL), horse, dairy (DM)) effects on survival of generic *E. coli*$^{rif\text{-}R}$ (EC) and subsequent transfer to tomato fruits, radish bulbs, and spinach leaves at 90-120 (-180)-days post-inoculation. Soil/environmental factors were measured relative to *E. coli* populations. Results showed all plots, including unamended controls, were 100% positive for EC (mean=5.85 logMPN/g) post-inoculation. Temperature, growing degree-days (GDD), and rainfall during 120-day spinach and radish trials in 2017 and 2018 were distinctive. Mean temperature was 8°C higher in 2018 than in 2017. Total precipitation was significantly ($p<0.5$) greater in 2018 (~56cm) than in 2017 (~26cm). In 2018, GDD=3254 was nearly twice that in 2017, GDD=1954. In 2017 radish soil, EC declined to 0-18% for all treatments by 90 and 120 days, yet all 240 bulbs assayed were EC positive in manured plots. In 2018, by 120 days, 8 of 12 radish plots (5 bulbs/PL or DM plot) were EC positive. In 2017 and 2018, only 2 of 12 manured plots were EC positive in 90-day tomato soils; by 120 days, 30-40% were positive in DM and PL 2017, respectively. In 2018, EC declined to 10-20% by 90 and 120 days with no transfer to tomato fruits. The EC in soil varied substantially during the 2017 spinach season, with all harvested leaves EC positive. This study indicates weather events, manure, and crop type influence EC survival in manured soil and transfers to edible crops. The use of wait-time intervals alone without accounting for environmental events in crop fields requires further evaluation to develop robust practices to reduce the likelihood of pathogen contamination of raw fresh produce.

Theme 4: Water-energy-food nexus challenges and opportunities

A Case Study of Machine Learning Aided Computational Fluid Dynamics Applications on Offshore Wind Turbines

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Background: Wind energy is one of the many available means of supplying power from a renewable resource without contributing to harmful carbon emissions and can be generated from offshore wind farms (O.W.F.). Significant challenges impact O.W.F., namely environmental hazards that reduce the overall structural integrity of wind turbine blades and result in poor performance. Additionally, the distance of the O.W.F. facilities from the shoreline further complicate the ability for technicians to make timely diagnosis and repair. Aims: Prior research has concerned itself with the applications of machine learning to measure and predict the performance of turbines within O.W.F. to reduce operations and maintenance costs. Materials and Methods: This research involves a hybrid approach combining machine learning, to be employed through the usage of TensorFlow in Python, with computational fluid dynamics (C.F.D.) to better evaluate turbine blade damage. Complicated numerical analysis through C.F.D. is highly effective, yet expensive and time-consuming, so the incorporation of machine learning may demonstrate potential to reduce such costs and deliver results in a more timely fashion. A few open source SCADA datasets collected from O.W.F. have been identified, but the selection of variables and their potential usefulness are still being determined. Results: Preliminary results are still underway as more information needs to be gathered prior to program integration. Significance: The development of a precise probabilistic model can reduce uncertainties concerning wind turbine blade damage, rendering O.W.F. to become an even more economically reliable solution for sustainability efforts and may lead to the support of various agricultural initiatives by way of clean power generation.

Effect of Zinc Oxide Nanoparticles on Mustard Plants

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Recent advancements in nanotechnology have accelerated the interest in developing desired nanoparticles for agricultural applications. Thus, this study aimed to synthesize zinc oxide nanoparticles (ZnONPs) using pecan leaf extracts and assess their effect on the morpho-physiological traits of mustard (Brassica juncea). The ZnONPs were characterized using Dynamic

Light Scattering (D.L.S.) and Scanning Electron Microscopy (S.E.M.). D.L.S. analysis displayed monodispersed ZnONPs of 84.5 nm size and highly negative zeta potential (-25.5 mV). Mustard plants were treated with 20, 40, 60, 80, 100, and 200 mg/mL of ZnONPs and control (water) under a growth chamber condition. Plant morphology (leaf area and height), physiological (tissue relative water content, chlorophyll content), and biomass were measured every two weeks. The preliminary data showed that ZnONPs overall affected growth (leaf area and height) and physiological (chlorophyll content, relative water content, and membrane stability) traits of Brassica juncea plants at the early vegetative stage.

Use of Microalgae in the Diets of Poultry

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Due to the rising cost of soybean as a protein source in animal diets, there is a dire need to find an alternative source of protein feed ingredients. This work aimed to review the published sources on algae and its utilization in poultry diets. Algae are heterogenous organisms found in freshwater and saltwater, unisexual, and simple aquatic plants. More than 25,000 species are isolated and characterized and can be categorized as eukaryotic microorganisms or prokaryotic cyanobacteria (blue-green algae). Micro- and macro-algae could serve as novel sources of nutrients and health supplements for animals. Algae are a great source of protein and carbohydrates and have a low lignin content, making them a great choice to be used as animal feed. Numerous farmed finfish, shellfish, and other economically significant aquaculture species are produced in hatcheries using cultivated microalgae. To date, many scientific advancements and commercial uses have centered on seaweed and microalgae as a feed component that provides specific beneficial characteristics and basic nutrients. Algae have been shown to enhance immune function, lipid metabolism, and gut health as well as act as antibacterial and antiviral agents, even when ingested at a low level in the diets. They are added as supplements to improve the quality of the final product (eggs or meat in poultry) or the health of the animals in normal feed compositions. Algae can be utilized in a variety of ways, such as a raw material that is fresh, frozen, or dried; an oil that is extracted from the algae; or extracts that are added as a dietary supplement. It raises the levels of short-chain fatty acids in the gut microbiome, which could assist hens in avoiding colon illnesses and maintaining the health of their intestinal mucosa. Since microalgae contain vital macromolecules, including PUFAs, carotenoids, amino acids, minerals, and vitamins that improve the nutritional content of animal products, they have enormous potential to be used as poultry feed, providing them with a sustained source of nutrients as a result.

SMAP Soil Moisture Product Validation Using In-Situ West Texas Mesonet (WTM) Data

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Soil moisture has a critical role in controlling the water balance of a catchment by influencing rainfall-runoff processes, infiltration, groundwater recharge, and evapotranspiration. Also, timely soil moisture information is required for drought monitoring, flood forecasting, and understanding vegetation dynamics. Although in-situ soil moisture data provides high measurement accuracy, spatial coverage is challenging due to several constraints, such as instrumentation, installation costs, and maintenance. Therefore, researchers rely on remote sensing-based/model-generated soil moisture information for hydrological analysis. The SMAP (Soil Moisture Active Passive) satellite launched by NASA provides global surface and sub-surface soil moisture information at a spatial resolution of 9 km. It is well-accepted in the scientific community. This study investigates the consistency of SMAP data with the observed dataset from West Texas Mesonet (WTM) weather stations. Mesonet data for each location was interpolated to a 9 km grid to compare it with the SMAP product. Linear and non-linear spatiotemporal interpolation techniques include the inverse distance weighted (IDW), nearest neighbor method, polynomial regression, kriging, and spline. Also, Artificial Intelligence (AI) based algorithms such as Artificial Neural Networks were used for spatial data interpolation. The average soil moisture inside each 9 km grid was quantified using the zonal statistics tool in ArcGIS, and the correlation strength was measured using the Pearson correlation coefficient (r). Interpolated soil moisture compared well with SMAP data.

Impact of Viticulture Production Upon USDA-MRLA 131A Southern Mississippi River Alluvial Soil

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Louisiana makes up 23% of the Southern Mississippi River Alluvial Soil USDA-NRCS MRLA 131 Region. This region resides on the Mississippi River western banks below its Ohio River junction. Region soils (70%) are prime farmland for producing soybeans and corn. These soils also have the potential for regional viticulture production. The Southern University Ag Center established viticulture research on the regional soil type of Oprairie Silt (0-1% slope). Despite showing production potential, no scientific-based information on the impact of viticulture upon Oprairie Silt is available. Therefore, the project objective is to compare the soil properties of fallow Oprairie Silt to viticulture production Opraire Silt. Soil analysis will determine physicochemical parameters (pH, C:N ratio, textural analysis), nutrient content (P, K), and trace elements (Ca, Mg,

Na, S, Cu, Zn). Project results will contribute to the body of the scientific-based information while simultaneously producing baseline information available for viticulture producers in the Southern Mississippi River Alluvial Soil USDA-NRCS MRLA 131 Region.

Genome Wide Association Studies to Dissect Root Architectural Traits in Soybean

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Effects of climate change in the global agricultural areas can cause significant reduction in crop production and threaten food security. More crop yield is essential to meet the global food demand for the rising population. Soybean is one of the major commodities in optimal human diets and animal feed because of their unique seed composition. Soybean yield significantly affected by the environmental stresses, especially by the limited water availability. As water resources for agricultural uses become more limiting, the development of drought-tolerant lines will become increasingly important. Root system architectures (RSA) are quantitative traits determined by many genes and plays vital roles in plant adaptation and productivity under water-limited environments. Deeper and proliferate root system help extract required water and nutrients under these environmental conditions. Developing a better root system is a promising strategy to improve crop productivity under optimum and stressful environments. It has been shown that the natural genetic variation for the RSA exists in soybean, but precise identification of genes or markers associated with major RSA traits utilizing a denser genomic variation matrix is lacking. We have screened a core set of the most diverse soybean germplasm in the U.S. for the RSA traits and identified several key germplasm showing variations in RSA. We have conducted a genotype-phenotype association study (GWAS) to identify genes or molecular markers associated with these traits. Genome variation matrix developed from resequencing ~1000 soybean germplasm were used for the association studies. This research provides genomic regions and molecular markers associated with the major water use efficiency traits, RSA, which can be used for molecular breeding strategies for crop improvement.

Evaluation of Water Use Efficiency, Yield Component and Seed Compositional Traits of Grain Hemp Varieties towards Developing Crop Improvement Strategies

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Industrial hemp (Cannabis sativa L.) originated from Asia with multiple uses as food, feed, and fiber. The basic biology of hemp plants remains insufficiently understood. So, genetic and genomic

investigations are essential for designing hemp crop establishment and improvement strategies. Major limiting factors to achieving the breeding goals towards developing varieties adapted for the diverse growing regions are the basic understanding of the plant performance traits and the germplasm availability. Hemp is a semi-domesticated plant that requires improvement of desirable traits, including building seed vigor, water and nutrient use efficiency traits, and seed compositional and yield component traits. We have evaluated 14 grain-type industrial hemp varieties at 2 locations in Missouri, with two replications. The plot size was 10 x 100 feet with 7.5 inches between rows. Hemp seeds were planted using the John Deere No-till drill at a rate of 40 lbs. live seeds/A for grain varieties. Several traits were evaluated, including plant height, plant stands, and water use efficiency, transpiration, photosynthesis, flowering, seed compositional, and yield component traits. Preliminary results showed significant variations in water use efficiency, root biomass, key seed yields, and compositions. This will help expedite the variety recommendations for the specific production regions and provide important trait leads for genetic improvement.

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