Wednesday, July 23, 2025

3- MINUTE PITCH

Celebrating Summer 2025
undergraduate research

KANSAS STATE
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Scholar Development and
Undergraduate Research

Welcome

Thank you for attending the 3-Minute Pitch event, celebrating undergraduate research efforts at Kansas State University in Summer 2025. This event highlights students from a variety of summer research programs; researchers include K-State students, as well as students from all over the United States. Scholar Development and Undergraduate Research is honored to host this event. We thank the funders, the mentors, the coordinators, and the students for their contributions and efforts in the creation of knowledge, the advancement of research, and the betterment of humanity.

Presenters are listed in the order they will present as well as by their research group then alphabetical order by last name. Bolded and italicized, you'll find the title of the research project, followed by their research mentor's name in italics.

Please find a glossary of research programs and coordinators below. These coordinators and programs deserve all the praise today. Again, thank you for attending.

With Gratitude,

The Scholar Development and Undergraduate Research Team

Summer Research Programs

ARISE- This multi-institutional REU is funded by the Kansas National Science Foundation Established Program to Stimulate Competitive Research, or Kansas NSF EPSCoR, emphasizes community-engaged research methodology. ARISE stands for "adaptive and resilient infrastructures driven by social equity," and has involved students from Kansas State University, The University of Kansas, and Wichita State University. The program has been centrally coordinated by Alej Martinez of KU, with support from Jason Bergtold, Ph.D. of K-State's Department of Agricultural Economics. Special thanks to Dr. Bergtold and ARISE for facilitating today's snacks.

Team Plants REU- Team Plants is a nine-week summer program in applied plant sciences that includes independent projects ranging from genetics/molecular biology to field-scale production and ecology; professional development in communications, ethics, teamwork and leadership; and field trips to view crop production and cutting-edge research methods and facilities. The program is interdisciplinary, with the 2025 mentors representing 4 departments across 3 colleges. This project is supported by the Research and Extension Experiences for Undergraduates program area priority in the Agriculture and Food Research Initiative’s Education and Workforce Development program — grant no. 2024-68018-42431 and project accession no. 1032359— from the U.S. Department of Agriculture's National Institute of Food and Agriculture.

McNair- The McNair Scholars Program is a comprehensive two-year program structured to prepare undergraduates for successful careers as graduate students, professors, and professional researchers. Funded by the U.S. Department of Education, scholars participate in social and cultural activities to gain a better understanding of academia. They form a learning community of like-minded scholars to support higher academic achievement. Over the summertime, they complete an 8-week research internship. The program is coordinated by Karina Moncayo-Michel with support from Emily Vieyra and Jefferson Storms.

ARISE

Nathan Binshtok

The Impact of Weather Disruptions on Public Transit Reliability in Kansas City

Joel Mendez, Ph.D.

The increasing frequency and severity of extreme weather events pose a significant challenge to public transportation infrastructure. Severe weather has demonstrated effects on transit infrastructure, operations, and reliability; effects which trickle down to customer behavior and individual choices. In response, transportation agencies have adopted emergency management, operational adaptability, and continuity planning approaches. The efficacy of these practices can be assessed, in part, by examining customer complaints. Previous studies have examined customer complaints as proxies for service disruptions, and found impacts on transit ridership. In order to connect the understood influence of weather events on public transit and the impact of customer complaints, this study explores the intersection of severe weather, transit operations, and rider experience using customer complaints as a diagnostic tool. Importantly, not all riders are affected equally. Socially vulnerable groups experience a disparity in the hardship caused by infrastructure service disruptions, particularly as a result of weather perturbations. Ensuring equitable service during and after extreme weather events is essential to maintaining trust and accessibility in public transit systems with respect to perceived service quality. Through understanding the implications of complaint data and other service metrics, transit agencies can take strides towards more equitable, resilient, and reliable public transportation.

Ryan Corrigan

Connecting the Community Capitals to Housing

Jason Bergtold, Ph.D.

Housing is a prerequisite for health, well-being, and economic security. Without it, the ability to invest in the future may become compromised. Housing insecurity – defined as the uncertain access to stable, safe, and affordable housing – is operationalized as the percentage of households paying more than 30% of their household income on housing costs. As a result, housing outcomes are influenced by interactions among community capitals, which encompass the assets that support a community, ranging from the social capital that connects people to the built capital that sustains them. Thus, the purpose of this study is to investigate the influence of community capitals on housing insecurity at a county level across Kansas. First, we create a dataset of indicators for the seven community capitals across the counties of Kansas from 2017 to 2022. Then, we develop community capital indices using factor analysis to reduce the dimensionality for each community capital. Finally, we estimate regressions to understand the relationship between the community capitals and housing insecurity. We expect counties with low levels of housing insecurity to exhibit high levels of built, social, and human capital. On the other hand, counties with high levels of housing insecurity, we expect to exhibit low levels of built, social, and human capital. Our findings identify the community assets that drive housing security, highlighting housing as a vital foundation of resilient communities.

Hannah Gideon

Quantifying Water Quality in Lawrence Kansas

Justin Hutchison, Ph.D., Edward Peltier, Ph.D.

Chlorinated water distribution systems are commonly used in the United States due to their disinfection capabilities. Chlorine serves as a primary disinfectant, which rapidly decays in water distribution systems. Free ammonia combines with free chlorine to form monochloramine, a secondary disinfectant which provides effective disinfection capabilities and a lower rate of decay when compared to chlorine. Limited locations to sample this information pose a challenge to the quality of water within distribution systems. Testing the

concentrations of free chlorine, monochloramine, and free ammonia can provide data to determine the water age at different locations, effectively mapping water quality across a distribution system. The data collected indicates a constant, relatively stable presence of monochloramine, free chlorine, and free ammonia in Lawrence, KS water distribution systems, but raises concern for the quality of drinking water for one location. Testing water distribution systems helps provide insight into the safety of water to help ensure the safety of drinking water in Lawrence while also leaving potential for future adaptations.

Joshua Burns

Synthetic Water Distribution network in EPANET

Edward Peltier, Ph.D., and Justin Hutchison, Ph.D.

This work proposes methodological improvements for generating synthetic water distribution networks in EPANET, focusing on adaptable solutions for rural and small town systems where infrastructure data is limited. While existing tools map pipes along road networks, key challenges remain in realistically representing variable water sources (wells, rivers, tanks) and elevation driven hydraulic behavior. This paper suggests targeted strategies to address these gaps, including: (1) rule-based source placement tied to local terrain and demand clusters, (2) elevation aware zoning to simulate pressure differences in hilly or flat regions, and (3) demand allocation methods that reflect rural settlement patterns. By decoupling deterministic pipe routing (road-following) from flexible source and elevation logic, the approach balances structural realism with scenario testing versatility. The ideas aim to guide future coding efforts, helping communities model their systems more accurately even with incomplete data. Practical applications include preliminary infrastructure planning, resilience testing, and prioritizing field data collection. Future work could formalize these strategies into open source tools or integrate them with crowd sourced elevation datasets.

Matthew Goodman

Removal of Biological and Chemical Substances within Wastewater

Belinda Sturm Ph.D., Dev Hiripitiyage, Assistant Researcher

Wastewater treatment is a crucial component of infrastructure, supporting various sectors, from agriculture to industry. Recycling wastewater is essential in regions with limited water resources. Effective treatment involves removing biological and chemical contaminants, such as E. coli and nitrogen, to protect both public health and the environment. In this study, we examine the role of stalked ciliates, which grow within and outside of granular sludge, in facilitating wastewater purification. We assess biological impact by spiking wastewater with E. coli and monitoring colony formation over time. Chemical impact is measured through changes in carbon content. These processes enhance the resilience of our communities by ensuring that wastewater remains clean and reusable for years to come.

Emily Greer

Race Against the Clock: Smart Crew Allocation Strategies for Rapid Urban Recovery

Bala Natarajan, Ph.D.

Timely restoration of critical infrastructure after natural disasters is crucial to preventing cascading system failures and limiting socioeconomic impacts. The growing frequency and intensity of natural disasters have severely disrupted interdependent urban infrastructure systems, especially power distribution networks. Traditional restoration approaches prioritize minimizing outage duration for the largest number of customers, often overlooking broader community-level needs and contributing to inequities in service recovery. Existing methods focus on crew dispatch and repair sequencing, but many fail to account for population density, crew capabilities, and complex routing logistics under certain constraints. Our approach to this is a mixed-integer linear programming (MILP) framework that optimizes crew allocation, while factoring in travel and repair

times, population weight, and minimizing the makespan. We validated our methodology through a co-simulation framework that integrates damage modeling, crew dispatch, and network restoration. This significantly reduces overall restoration time, improves fairness by minimizing delays in highly populated areas, and demonstrates scalability in cases with uneven crew-to-location ratios.

Monique Haynie

Faster Settling, Safer Cities: Enhancing Sludge Settleability to Boost Clarifier Flow Capacity

Belinda Strum, Ph.D. and Megan Wittman, Research Assistant

In the city of Lawrence, the amount of inflow into wastewater treatment plants increases every year as climate change occurs. Inflow is surface water that enters the sewer system from yards, roof and footing drains, and holes in manhole covers. As a part of the treatment process, the aeration basin holds activated sludge where microorganisms consume carbon-containing compounds for growth and energy. This effluent is sent to the secondary clarifier which is where solid-liquid separation occurs. Flocs form at the bottom and this is where several tests can be done to focus on the settleability. During storm events, the capacity of the clarifier is surpassed and some raw sewage can overflow and be bypassed into receiving water bodies. The wet weather treatment capacity needs to be expanded so that contaminated water won't get back into the cleaner water. A resilient clarifier design depends on a calculation for the peak flow and a calculation for the amount of water that settled solids need to overcome to be removed from the water known as the surface overflow rate. Based on the 2012 Wastewater Master Plan and Capital Improvements Program, the inflow was reduced by 35% from various techniques. Flow levels were monitored along with smoke testing the sewer lines to locate leaks and cracks. Many building evaluations were done to identify improper plumbing connections. Additionally, if the settling velocity is much greater than the overflow velocity then the overflow velocity can increase and more mgd(millions gallons per day)can go through the clarifier. Based on the two reactors' effluent studied, the one with the higher hydraulic residence time(HRT) had a faster settling rate as measured by the initial settling velocity. HRT is the average amount of time wastewater spends in a treatment tank. A higher HRT provides more time for particles to settle out of the clarifier leading to efficient settling of solids. The focus is to determine which reactor will have a higher capacity to hold all of the extra inflow that enters a plant during a storm. With a higher settling velocity, the initial velocity can increase and more flow can go through the secondary clarifier.

David Hipp

Enhancing community resilience through urban agriculture: an analysis of the Kansas City Metro Area

Shakil Kashem, Ph.D.

Urban agriculture is an exciting practice with the potential to increase resilience, build community, and make fresh food more accessible within cities. Urban agriculture can take many forms, including vertical farming, community gardens, and peri-urban farming, agriculture conducted on the outskirts of cities. This study examines Kansas City, Kansas and Kansas City, Missouri to evaluate their suitability for urban agriculture. To determine suitability, areas in Kansas City were scored based on slope, proximity to sites in the Toxic Release Inventory, susceptibility to flooding, and current land use. GIS was used in this study to analyze and compare these factors of suitability to determine the most viable places in Kansas City for urban agriculture. The results from this study can be used to better understand Kansas City’s suitability for urban agriculture and make informed decisions regarding the future development of urban agriculture in Kansas City.

Aneesh Kaarthik Sivakumar

System for Gas composition analysis

Garrett Peterson, Research Assistant

This project explores the use of Bosch's BME688 gas sensor to monitor atmospheric composition in agricultural environments, with the goal of facilitating the growth of a new, climate-resilient strain of corn. In the face of increasing climatic stressors, understanding the microenvironment around crops is critical for enhancing resilience in food systems. The BME688 sensor enables detection of volatile organic compounds (VOCs), along with temperature, humidity, and pressure, offering a compact and energy-efficient tool for environmental sensing. By deploying the sensor with an ESP32-based data acquisition system, this work captures high-resolution data on gas concentrations under varying field conditions. Through programmable heater profiles and selective gas sensing routines, the project aims to identify air quality signatures that correlate with improved plant health and stress tolerance. This data-driven approach contributes to adaptive agriculture by informing decisions around greenhouse gas exposure, ventilation, and crop suitability—thereby supporting a more resilient, responsive, and sustainable agricultural ecosystem.

King Nguyen

Apply cluster method on power system

Visvakumar Aravinthan, Ph.D.

Non-sequential Monte Carlo simulation method that incorporates time series clustering to improve the modeling of intermittent renewable resources and High Impact Low-Frequency (HILF) events. However, detecting temporal changes is more complex due to the sequential nature of the data and particularly for time series data. Hierarchical clustering offers a suitable solution. It typically groups data into sets in such a way that the intra-cluster similarity is maximized while the inter-cluster similarity is minimized. This enables the generation of representative system states that reduce computational complexity while maintaining accuracy. When tested on a hybrid power system comprising conventional, wind, solar, and battery resources, improved Loss of Load Probability (LOLP) estimation and faster simulation times compared to traditional methods.

Camille Taylor

Disruptions During a Severe Winter Storm: Outages and Impacts Across Kansas' Rural and Urban Communities

Jason Bergtold, Ph.D.

With the increase in the extent and severity of natural disasters and extreme weather in the past few years, it has become more important to better understand the effects of these storms on different households across communities. One example of these extreme weather events, is a winter storm event that swept across Kansas in January of 2024. The purpose of this research is to look more in depth at the effects of that winter storm on households, such as power and water outages, across rural and urban communities throughout Kansas. By using primary data from a survey conducted in 2024, we use summary statistics to show that rural and micropolitan communities were more susceptible to power and water outages and experienced them for a longer amount of time compared to more metropolitan areas. The information produced is important as it can be used to ensure that emergency response and recovery efforts are adequately addressing the needs of households across different community, as well as helping to shape policy response for future recovery efforts.

Nicholas Thompson

Replicating Evidence that Agriculture Generates Local Economic Spillovers

William Duncan, Ph.D.

The Ogallala Aquifer stretches across eight states in the Great Plains region. Following the development of improved irrigation techniques in World War II, it became possible to pump water from wells over the Ogallala Aquifer. This meant that farmers did not have to rely on surface water to irrigate their crops and thus farming became more productive, and more land could be used for farming activities. This project examines whether the advances in agriculture in these communities 'spillover' into non-agriculture sectors, or whether the benefits to the agricultural sector crowd out other areas of economic activity. To do this, the analysis constructs two sets of counties: those largely over the Ogallala Aquifer and nearby counties that do not have significant access to the aquifer. Doing this analysis replicates a study done by Richard Hornbeck and Pinar Keskin in 2015, that showed agriculture negatively affects non-agricultural sectors where the aquifer is present due to increased land prices and disamenities caused by agriculture while not providing enough benefits to offset the costs.

Joseph Schauwecker

Aridity Pathways of Communities under Similar Climate Classification: Implications for Summer Crop Production

Ikenna Onyekwelu, Ph.D., Vaishali Sharda, Ph.D.

As climate variability becomes more prevalent, building agricultural resilience becomes increasingly critical. This study explores long-term trends in the aridity index (AI) and its impacts on summer crops: corn and sorghum, in three agricultural communities in western Kansas: Ford, Finney, and Scott county. Despite sharing similar Koppen-Geiger climate classification, we hypothesized that these communities do not experience similar aridity impact on summer crop outcomes. Using climate data from NASA POWER and PRISM, we computed potential evapotranspiration using the Hargreaves-Samani method and cumulative long-term rainfall for each county from the 1984-2024 growing seasons. Temporal trends in AI and their correlation with crop yield and silage production were assessed. Results revealed no strong long-term trends in aridity, but distant impacts on crop response across the counties were observed. AI trends in Scott and Finney county revealed overlap in confidence intervals but little overlap in Ford county. Our results further showed that, in Ford County, growing season rainfall was the dominant factor influencing AI. In Scott County, both growing season rainfall and topsoil wetness were significant, while Finney County showed the most complex interactions, with solar radiation, relative humidity, growing season rainfall, and topsoil wetness having significant impacts. Overall, these results underscore the need for localized aridity assessments and community-specific adaptation strategies, even within similarly classified climate zones.

Fayrouz Zeidan

A Time Dependent Non-Sequential Monte Carlo Simulation Method for LOLP Computation Under Renewables, Battery and HILF Events

Visvakumar Aravinthan, Ph.D.

The growing integration of intermittent resources, coupled with rising occurrence of unprecedented outage events in recent years, necessitates a reassessment of traditional methods used to calculate reliability indices such as Loss of Load Probability (LOLP). Our research proposes a non-sequential Monte Carlo algorithm which can capture the intermittent behavior of renewables as well as the HILF (High Impact Low Frequency) events effectively. The proposed algorithm is tested on a system with conventional, wind, solar and battery. The sampling technique used for each resource type is performed based on their behavior in different time frames. Simulations carried out utilizing the actual data, resulted in faster computational time as well as better LOLP

values compared to the traditional sequential approach. Several test cases were performed to demonstrate this algorithm's speed and accuracy under varying generation conditions.

Break for Snacks and Conversation

McNair

Sunny O'Leary

Correlations of Doomscrolling and Cyberbullying

Christopher P. Barlett, Ph.D., Navaeh Copenhaver, Research Assistant

Cyberbullying and doomscrolling are online behaviors that research has shown to negatively affect emerging adults. Common correlations are present between these two behaviors, necessitating further research on the relationship between cyberbullying and doomscrolling and the mediating factors. We conducted correlational research with a U.S. adult sample via CloudConnect and found positive correlations between doomscrolling and cyberbullying as well as time spent online, negative social media content, FOMO, anxiety, and social media addiction. 69% of the sample reported engagement in doomscrolling, and serial mediation analysis displayed time spent online to predict cyberbullying perpetration through negative social media content and doomscrolling mediation.

Michael Reichert

Quantitative analysis of spider populations on organic farms across an urban gradient

Gregory Zolnerowich, Ph.D.

This study aims to provide quantitative data on spider populations in organic agricultural settings according to the degree of urbanization (urban, peri-urban, or rural) and seeks to highlight the difference in populations via statistical analysis. This data was collected via pitfall traps in the month of July around Kansas City on 14 farms. The specimens collected were primarily *Lycosidae* and calculated data was found to be mostly inconclusive with the exception of the family *Salticidae*.

Team Plant REU

Grace Johnson

Developing near isogenic Magnaporthe oryzae lines to evaluate genome position effects

David Cook, Ph.D., Aidan McVey, Research Assistant

The fungal pathogen *Magnaporthe oryzae* causes blast disease in numerous monocot crops, including rice and wheat, and poses a major threat to global agriculture. Changes to DNA, such as mutation, cause variation in the genome and contribute to the evolution of traits such as pathogenicity, host range, and fungicide resistance. Certain regions of the M. oryzae genome are more variable than others, which suggests some level of genome position effect where the likelihood of change varies with location. To evaluate these potential effects, near isogenic lines were created by using a CRISPR-Cas12 gene editing system to complement the selectable marker gene *URA3* at different loci into a *URA3* knockout line. A total of eleven loci were targeted to represent different genomic characteristics. Transformed colonies were phenotypically selected on media lacking uracil and uridine, which selects for lines with a working copy of *URA3*. DNA was extracted from the colonies and polymerase chain reaction (PCR) was used to identify single insertions of *URA3* at the intended loci. Genotyping has presently identified one successfully created line, while others are still in the process of being genotyped.

The near isogenic lines created by this summer project will be used for future experiments investigating genome position effects in the M. oryzae genome.

Lillian Marberg

How do plants respond to stress: Investigating the role of GIR adapter proteins in Arabidopsis

Kathrin Schrick, Ph.D.

Plants have developed many different mechanisms to adjust to changes in their environment. For Arabidopsis, the production of GIR adapter proteins in response to stressors like light signals and salinity helps the plant adapt to those stressors. The GIR adapter protein family is comprised of three proteins: GIR1, GIR2, and SIED1. Deletion mutations in the genes responsible for the proteins have led to defects in epidermal cell-type differentiation such as root hair regulation and giant cell formation in the sepal. Through the creation of the triple mutant for GIR1, GIR2, and SIED1 we were able to investigate potential functional redundancies and the effect GIR proteins have on Arabidopsis.

Mark Marchetti

Evaluation of Wild Wheat Introgression Lines in Triticum aestivum for Resistance to Puccinia graminis f. sp. tritici

Eduard Akhunov, Ph.D. and Dal-Hoe Koo, Ph.D.

Cereal rust diseases, such as wheat stem rust (Puccinia graminis f. sp. tritici), threaten global wheat production. Development of new resistant wheat varieties is the most effective and sustainable approach for mitigating the negative impact of these diseases on wheat yields. Wild wheat relatives have proven to be valuable sources of new disease resistance genes. A team of researchers at Kansas State University introgressed chromosome arms from the wild wheat relatives Aegilops speltoides and Dasypyrum villosum into Kansas adapted winter wheat. We evaluated 24 of these introgression lines – 13 involving Ae. speltoides and 11 involving D. villosum chromosome arms – against two isolates of wheat stem rust using the 0 – 4 Stakman scale. The introgression lines that had a rating between 0 – 2 are considered resistant. The chromosome regions associated with rust resistance were identified microscopically using genomic in situ hybridization (GISH) method. To facilitate tracking of wild relative introgression with resistance genes in genetic research and breeding, kompetitive allele specific PCR (KASP) markers were developed using single nucleotide polymorphisms differentiating wild relatives from wheat. Novel germplasm with resistance genes and breeder-friendly markers developed in this project will be beneficial for future breeding efforts aimed at protecting our food supply chains from disruptions imposed by agricultural pathogens.

Nicholas Sokol

SDP1 Effect on Camelina Sativa

Timothy Durrett Ph.D.

Sugar Dependent 1 Gene Effect on Growth and Oil Preservation in Camelina sativa. The sugar dependent 1 gene (SDP1) can be found in a variety of oil-rich seeds, from current understanding, it encodes for a lipase that when suppressed shows the capacity to increase harvestable seed oil by approximately 10%; however, it also plays a role in seed germination which can slow early seed growth when SDP1 is silenced (Kelly 2013). In order to see an increase in oil content, a cas-9 mediated approach to knockout the SDP1 genes in Camelina sativa was utilized with the effects of different amounts of gene knockouts on both seed oil retention and early plant growth being tested. The effectiveness of the SDP1 knockouts was primarily assessed through comprehensive DNA sequencing, germination assays, and fatty acid quantification. The general nature of this gene has been studied before, and it has been concluded that the plant makes use of a small amount of stored oil via the encoded phospholipase. These triglycerides are theorized to be used for protein development but are not essential for the

seed to germinate. Due to the effectiveness of the knockout, the SDP1 gene could prove to be a target for full or partial knockout in oil crops for increased yield.

Lilly Spade

Identifying Novel Genes Potentially Involved in Maize Ear Meristem Development through Single-Cell Transcriptomics

Sanzhen Liu, Ph.D.

Maize (Zea mays) is one of the most widely planted food crops globally, with the maize ear being harvested for both human and animal consumption. The development of the maize ear is driven by undifferentiated cells called shoot meristem cells, which are located inside developing ear shoots and are responsible for the growth of all above-ground organs. Single cell RNA sequencing (scRNA-seq) is a cutting-edge tool that can quantify transcriptional levels of genes in individual cells of a given tissue sample. This technique could help identify genes that are only expressed in meristem cells and thus would be overlooked by bulk RNA sequencing techniques. Previous research has generated scRNA-seq data from developing maize ears, including both differentiated and undifferentiated cells. We seek to use previously collected scRNA-seq data to discover unknown genes that may potentially be important for maintaining the undifferentiated status of stem cells using cluster analysis and gene co-expression networks to compare the expression of shoot meristem cells against various differentiated cells. Knowing which genes are important for undifferentiated status gives us the ability to use gene editing to change differentiated cells into meristem cells. Since meristem cells are responsible for growing all organs, this allows us to grow whole plants from that one cell and obtain seeds. Future studies would be able to genome edit any cell and then change it to be a meristem cell, greatly speeding up the time it takes to produce new strains of maize.

Jose Villanos

Soil Texture influences on bio-surfactant sorption rates

Ryan Hansen. Ph.D.

Due to anthropogenic causes, rapid environmental changes have led to droughts becoming a frequent threat. These droughts introduce stress to plants, reducing crop yields worldwide. One potential solution is increasing soil water retention (SWC) and soil wettability. Synthetic surfactants have been found to increase SWC and soil wettability; however, due to being non-biodegradable and having a high production cost, they are not sustainable. On the other hand, bio-surfactants are biodegradable and sustainable. Surfactants are molecules that decrease the surface tension of the liquid it is dissolved. This study will focus on soil textures on bio-surfactants sorption rates. Sorption rates of bio-surfactants are important because if the surfactant is not absorbed into the soil is not effective at increasing the SWC and soil wettability.

A novel colorimetric assay will be used to establish a calibration curve and to measure surfactant absorption. The calibration curve will be used to convert optical density (OD) into surfactant ppm. This method will allow measurement of bio-surfactant absorbed into the soil.

Evangeline Weiss

Characterization of the relationship between BODYGUARD2 and Abscisic Acid in response to osmotic stress

Ruth Welti, Ph.D., Zolian Zoong Lwe, Research Assistant

Plants have a cross-linked lipid matrix called the cuticle, which forms a hydrophobic protective layer that lies outside of the epidermal cells of the plant. It is primarily composed of wax and cutin and is essential for preventing water loss. In Arabidopsis thaliana, a gene called BODYGUARD2 (BDG2) has an effect on wax and cutin biosynthesis. It is a member of the BODYGAURD family that is made up of five genes. The first, called

BODYGAURD1 (BDG1), has been characterized. The mutants of BDG1 were found to have less cutin, which resulted in greater water loss and cuticle permeability. Another study found that BDG1 induces the expression of abscisic acid (ABA) biosynthesis genes under drought stress. BDG2 and BDG1 have ~80% amino acid sequence similarity, indicating that they likely have similar functions. Therefore, BDG2 mutants are being tested for ABA levels, as well as the gene expression level of a precursor gene, 9-cis-epoxycarotenoid dioxygenase (NCED), that induces ABA synthesis under drought stress. There is also evidence that ABA induces BDG2 gene expression in stomata, which suggests BDG2 may have a role in ABA induced stomata closure. Plants will be grown on Agar, with Mannitol to mimic drought stress. ABA levels will be tested using Liquid Chromatography Mass Spectrometry (LC-MS). The gene expression level of NCED will be measured using Reverse Transcription Quantitative Polymerase Chain Reaction (RT-qPCR). Stomata closure will be measured in Wild type and mutant plants treated with ABA. Results from these experiments will create progress in the characterization of the BDG2 gene.

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