Research and the State

GRADUATE STUDENT POSTER SESSION

Program Booklet

Thursday, November 8, 2018
Fiedler Atrium, Engineering Complex

Sponsored by:
Graduate Student Council
Graduate School
Offices of the President and Provost

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Program Schedule

POSTER PRESENTATIONS AND JUDGING

1:00 pm to 3:00 pm
Fiedler Atrium, Engineering Complex

Research posters will be presented by approximately 50 K-State graduate students representing five academic colleges and 25 graduate programs. The top 10 presenters will be selected by K-State faculty and post-doc judges to participate in the Capitol Graduate Research Summit (CGRS) being held in Topeka in February.

AWARDS CEREMONY

4:00 pm
Engineering Lecture Hall (DUE 1109)

The top 10 graduate student poster presenters selected to represent K-State by presenting their posters at the 16th annual Capitol Graduate Research Summit (CGRS) in February 2019 will be announced at the awards ceremony. These 10 students will be presented with a monetary award to recognize their achievement.

About the GRS

The CGRS is an annual showcase of research conducted by graduate students from Emporia State University, Fort Hays State University, Kansas State University, Pittsburg State University, the University of Kansas, the University of Kansas Medical Center, and Wichita State University. Participants have the opportunity to present their research posters and discuss the important implications their research has for issues in the state of Kansas with state legislators, the governor, and the Board of Regents. Academic and industry representatives serve as judges to select the top presenters from each institution to receive scholarship awards.

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Poster Abstracts

GROUP 1

1

ALTERED METABOLISM IN TRIM32 DEFICIENT MUSCLE

Simran Bawa[1], David S. Brooks[1], Brian V. Geisbrecht[1], Jason M. Tennessen[2], and Erika R. Geisbrecht[1]

Department of Biochemistry and Molecular Biophysics, College of Arts and Sciences; [2]Division of Biology, Indiana University

BACKGROUND AND PURPOSE. The E3 ubiquitin ligase TRIM32 is a member of tripartite motif (TRIM) family of proteins involved in various processes including differentiation, cell growth, muscle regeneration and cancer. The N-terminus of this protein is characterized by a RING domain, B-box domain, and Coiled-Coil region, while the C-terminus contains six NHL repeats. In humans, mutations that cluster in the NHL domains of TRIM32 result in the muscle disorders Limb-Girdle Muscular Dystrophy type 2H and Sarcotubular Myopathy. The model organism Drosophila melanogaster possesses a TRIM32 homolog, encoded by the thin (tn) gene, that is highly expressed in muscle tissue. We previously showed that TRIM32 is required for myofibril stability. Muscles form correctly in tn mutants but exhibit a degenerative muscle phenotype once contraction ensues. It is predicted that mutations in the NHL domain either affect protein structure or are involved in protein-protein interactions. However, the molecular mechanism by which these mutations affect the interaction properties of TRIM32 is not understood. **METHOD:** We utilized biochemical pulldown assays using TRIM32-NHL as bait to identify TRIM32 binding proteins in larval muscle tissue. **RESULTS/FINDINGS:** Many key glycolytic enzymes were present in the TRIM32 pulldowns and not in control experiments. **CONCLUSION:** Our biochemical binding assays show a direct interaction between TRIM32 and the glycolytic proteins Aldolase and Phosphoglycerate mutase. Moreover, metabolomic studies revealed metabolites involved in glycolysis and amino acid metabolism were altered. These data together suggest a role for TRIM32 in coordinating glycolytic enzyme function, possibly for localized ATP production or to maintain muscle mass via glycolytic intermediates.

Relevance of Research to State-Related Topic(s)

In United States each year 300-400 newborn males are diagnosed with Muscular Dystrophy (Duchenne,Becker). Currently, there is no cure for inherited muscular dystrophies, characterized by progressive muscle weakness and loss of muscle strength. Individuals with low muscle mass have poor stress response. Cancer, cardiac failure, cachexia, sarcopenia are often associated with alteration in muscle metabolic pathways. Progressive degeneration of the muscle affects the quality of life and survivability. Therefore, understanding the factors that influence muscle metabolic pathways and genes that are altered during stress, chronic illness will provide new targets for clinical studies.

2

LIQUID BIOPSY: THE SIMPLEST TECHNIQUE FOR PANCREATITIS AND PANCREATIC CANCER DETECTION

Obdulia Covarrubias-Zambrano[1], Madumali Kalubowilage[1], Sebastian O. Wendel[2], Deryl L. Troyer[2], Anup Kasi[3], and Stefan H. Bossmann[1]

[1]Department of Chemistry, College of Arts and Sciences; [2]Department of Anatomy & Physiology, College of Veterinary Medicine; [3]School of Medicine - Cancer Center, University of Kansas

BACKGROUND AND PURPOSE: Pancreatic cancer has an 8% five-year survival rate for a person after the first diagnosis, which makes it one of the deadliest cancer types. This disease is known as the "silent killer", because early detection is nearly impossible due to the deep location of the pancreas in the body and the misleading symptoms that appear once cancer has spread to surrounding organs. The purpose of this project is to develop a simple detection technology (nanobiosensor) that could identify the presence of specific pancreatic cancer proteases in blood serum samples, which could lead to an early stage detection and subsequent treatment of pancreatic cancer patients. Previous studies identified proteases overexpressed in cancer patients due to important roles they play for cancer survival and invasion. **METHOD:** For this study, the Gene Expression Omnibus (GEO) web tool was used to identify eight proteases differentially expressed: arginase, MMP1, 3, and 9, cathepsin B, and E, urokinase plasminogen activator, and neutrophil elastase. The nanobiosensor developed contains dopamine coated Fe/Fe_3O_4 nanoparticles, cyanine 5.5, and a peptide sequence linked to TCPP (a fluorescent dye). The cleavage of the peptide-TCPP occurs in the presence of a protease, which leads to fluorescence signal detection using a plate reader. **RESULTS/FINDINGS:** Eight proteases were identified with significant fluorescence signals between tumor and healthy samples among four types of pancreatic cancer. Also, five demonstrated significant differences between pancreatitis and healthy samples. **CONCLUSION:** This study identified eight protease candidates for pancreatic cancer detection, and two as potential markers to differentiate pancreatitis from pancreatic cancer.

Relevance of Research to State-Related Topic(s)

Cancer is the second leading cause of death in the world. For 2018, 1.7 million new cases of cancer were expected to arise in the U.S. only, from which over 600,000 resulted in deaths. According to the Center of Disease Control and prevention (CDC), in 2016 the state of Kansas had a mortality of 5,500 due to cancer, and it was number 18th in the nation with higher diagnosis rate. Cancer is a disease that doesn't discrimate and anyone is at risk. Pancreatic cancer has a low survival rate because it is usually diagnosed at a late stage due to the lack of an efficient detection technique. Currently, detection techniques include MRI, CT, and PET scans, which not only expose patients to radiation but are very expensive. In my study, I propose the development of a nanobiosensor for early pancreatic cancer detection by means of a simple blood test.

3

CONSERVED MECHANISMS GOVERNING COLLECTIVE CELL MIGRATION IN *DROSOPHILA* OVARY: ITS IMPLICATIONS IN TUMOR SPREADING

Nirupama Kotian [1], Kristen Hylen[1], Justin Lathia[2], Jocelyn A McDonald[1]
[1]*Division of Biology, College of Arts and Sciences;*
[2]*Department of Cellular and Molecular Medicine, Lerner Research Institute, Cleveland Clinic*

BACKGROUND AND PURPOSE: Many cells migrate collectively or in groups in our body, which contributes to embryonic development, wound healing and immune response. However, it is also known to drive tumor invasiveness in cancers. Our lab focusses on understanding how these groups of cells break away from the epithelium and continue migrating as a single unit, thereby maintaining their cell-cell contacts. We use *Drosophila* border cells as our model system to study in vivo collective cell migration. Recently, in collaboration with the Lathia lab, we demonstrated that patient-derived glioblastoma cells can undergo collective cell invasion. We are using Drosophila border cells to identify novel molecular regulators of collective tumor cell invasion in human glioblastoma. **METHOD:** An RNAi screen (knocking down the genes) in border cells was designed to target novel conserved cell junction genes associated with glioblastoma patient survival. We are using a two prong approach, where we first test these genes in flies and then in the larval tumor models and human cancer cell lines. **RESULTS:** With this screen, we identified five genes- alpha-Catenin, Dachsous, Lachesin, Roughest and Symplekin, that are essential for collective cell migration. Further, we focused on alpha-catenin which showed the strongest migration defect and splitting of the cluster along the path of migration. **FUTURE DIRECTION:** Our current work involves testing the mutant alleles of the candidate genes to confirm the phenotypes observed in the screen. We will further test these genes on *Drosophila* larval tumor models and human cancer cell lines to study their role in invasiveness.

Relevance of Research to State-Related Topic(s)

McDonald Lab at Kansas State University focusses on studying the mechanisms that govern the movement of groups of cells in the tissues using border cells from *Drosophila* ovary. Our objective is to identify novel regulators of collective cell invasiveness in glioblastomas in this project. Glioblastoma is a common primary malignant brain tumor, with a very poor prognosis. Cancers of this type are known to be very aggressive because of its ability to invade in the surrounding tissues even after rigorous, targeted therapies. Knowing the factors that participate in this process to keep these cells together and travel through the tissues to disperse the tumor cells, will help us find better targets. Further, we can look at how these factors could affect survival in pre-clinical models which could affect the prognosis in glioblastoma patients. Better, targeted therapies to reduce cell invasiveness in these tumors might lead to less chances of relapse for these patients.

4

FLUORESCENCE HIGH-THROUGHPUT SCREENING (FLHTS) AGAINST TonB DEPENDENT TRANSPORT IN *Klebsiella pneumoniae*

Ashish Kumar, Somnath Chakvarorty, Taihao Yang, Aritri Majumdar, Salete Newton and Phillip E. Klebba

Department of Biochemistry and Molecular Biophysics, College of Arts and Sciences

BACKGROUND AND PURPOSE: The increasing antibiotic resistance of bacteria calls for enhanced efforts to find novel chemical agents against new microbial targets. *Klebsiella pneumoniae* is noteworthy because of its propensity to become multi-drug resistant. In search for new antibiotics, pathways of bacterial iron acquisition and metabolism are relevant. Iron is vital for bacteria, as it plays a central role in energy production, intermediate metabolism etc. Bacteria secrete siderophores that specifically chelate iron. Pathogenic *K. pneumonia* produces four different siderophores: enterobactin, Salmochelin, yersiniabactin, and aerobactin. To survive in hosts, bacteria obtain iron with TonB dependent ferric siderophore transport systems. The outer membrane protein FepA actively transports the iron complex ferric enterobactin (FeEnt) into the bacterial cell, and the inner membrane protein TonB provides the energy for this uptake. We developed a fluorescence high throughput screening (FLHTS) approach to observe, real-time FeEnt uptake through FepA, and its inhibition, in living *Escherichia coli*. **METHOD:** The FLHTS method monitors the binding of FeEnt to fluorescently labeled FepA. Binding quenches the fluorescence, but fluorescence recovers as the bacteria transport, and deplete the ferric siderophore. Hence, inhibitors of TonB, that block the active transport of the siderophore, prevent fluorescence recovery. The FLHTS assay quantitatively measures this parameter. **RESULTS AND CONCLUSION:** We found three active FepA homologs for *K. pneumoniae* strain Kp52.145 and genetically modified them to attach fluorescent probes. Each FeEnt transporters function in the FLHTS assay. The next stage of the research involves screening against TonB-dependent FeEnt transport by *K. pneumoniae,* to find compounds that can block the TonB dependent transport mechanism.

Relevance of Research to State-Related Topic(s)

ESKAPE pathogens (***E****nterobacter*, ***S****taphylococcus*, ***K****lebsiella*, ***A****cinetobacter*, ***P****seudomonas* and ***E****scherichia*) are the leading cause for the nosocomial infections around the globe. According to the centers for diseases control and prevention (CDC), there were an estimated 722,000 hospital acquired infections in United States acute care hospital in 2011. *K. pneumoniae* is a common opportunistic pathogen, that is the third leading cause of hospital-acquired infections in the United States. *K. pneumoniae* causes serious extra-intestinal infections including pneumonia, urinary tract and bloodstream infections, cystitis, surgical wound infections, endocarditis and septicemia. The bacterium may also produce community associated infections, like pyogenic liver abscesses, necrotizing pneumonia and endogenous endophthalmitis. My research investigates the adaptation of FLHTS to *K. pneumoniae,* to discover novel compounds that inhibit TonB action. Chemicals that block TonB action may prevent iron acquisition in humans and animals and thereby thwart pathogenesis. Such chemicals may act as novel therapeutics against bacterial infectious diseases.

5

BICEPS FEMORIS PENNATION ANGLE IS NEGATIVELY CORRELATED WITH PASSIVE STIFFNESS OF THE HAMSTRINGS

Lauren E. Pacinelli[1], Ty B. Palmer[2], John P. Vardiman[1], and Ryan M. Thiele[1]
[1]Department of Food, Nutrition, Dietetics, and Health, College of Human Ecology; [2]Department of Kinesiology and Sport Management, Texas Tech University

BACKGROUND AND PURPOSE: The angle of pennation within muscle has been shown to be associated with muscular strength and force performance. This study examined the relationship between static ultrasonographic (US) measurements of biceps femoris (BF) pennation angle (PA) and passive musculotendinous stiffness (MTS) of the hamstrings measured during a straight-leg raise (SLR) assessment. **METHODS:** Twelve college-aged females (mean±SD: age=22±2 years, mass=65±9 kg, height=165±5cm) volunteered for this investigation. Participants were in a prone position and the US probe was aligned with the long axis of the BF at 50% of the distance between the greater trochanter and the lateral joint line of the knee. Passive hamstrings MTS was quantified during a SLR to the right leg, consisting of the investigator applying passive resistance against a load cell positioned at the posterior heel. This was performed to the point of discomfort, not pain, as indicated by the participant. An electrogoniometer assessed hip joint angle and MTS was calculated as the tangential slope of the passive angle-torque curve ($Nm \cdot deg^{-1}$). Pearson product-moment correlation coefficients (*r*) were used to examine the relationships between passive MTS and mean PA. **RESULTS:** A significant negative relationship ($r = -0.647$; $R^2 = 0.419$; $p = 0.023$) was observed between PA ($15.22° \pm 2.47°$) and MTS (0.75 ± 0.26 $Nm \cdot deg^{-1}$). **CONCLUSION:** The present study showed that BF PA is negatively correlated to passive stiffness of the hamstrings, which may be influenced by variations in fascicle alignment throughout the BF or the passive SLR being a global stiffness assessment of all three major hamstring muscles.

Relevance of Research to State-Related Topic(s)

Investigations into the relationship between muscle structure and muscle performance are advantageous for programs and initiatives such as the Kansas Governor's Council on Fitness, Get Active Kansas, and the Capital City Wellness Project. These programs are founded in healthcare research and strife to increase daily physical activity among Kansans in order to promote and support the health of the community. Therefore, my research aims to inform professionals who assist in developing initiatives and policies pertaining to Kansans' activity. This work offers healthcare and exercise science professionals valuable, cost efficient information pertaining to the structure and performance of the human body. Understanding how the body works allows strategies to be developed that optimize performance and reduce the risk of injury in an active population.

6

SURVIVAL OF AFRICAN SWINE FEVER VIRUS (ASFV) IN FEED INGREDIENTS UNDER TRANSBOUNDARY SHIPPING CONDITIONS

Ana M.M. Stoian[1], Vlad Petrovan[1], Maureen A. Sheahan[1], Scott A. Dee[2], Diego G. Diel[3], Cassandra Jones[4], Raymond R.R. Rowland[1], and Megan C. Niederwerder[1]

[1]Department of Diagnostic Medicine/Pathobiology, College of Veterinary Medicine; [2]Pipestone Applied Research, Pipestone Veterinary Services, Pipestone, MN; [3]Animal Disease Research and Diagnostic Laboratory, South Dakota State University; [4]Department of Animal Sciences and Industry, College of Agriculture

BACKGROUND AND PURPOSE: African swine fever virus (ASFV) causes a highly contagious disease in swine that threatens the pork industry worldwide. Since 2007, ASFV has been detected in Europe, the Caucus region, and most recently China, increasing the risk of spread globally. The goal of this study was to evaluate the survival of ASFV in animal feed ingredients that are imported daily into the U.S. under simulated transboundary shipping conditions. **METHODS:** Virus survival was evaluated using a Trans-Atlantic transboundary model involving 11 representative feed ingredients, transport times and environmental conditions, with samples tested by polymerase chain reaction (PCR), virus isolation (VI) and/or swine bioassay. Controls included complete feed (positive and negative controls) and a stock virus positive control (virus only, no feed matrix). Briefly, 5g of each ingredient were inoculated with 10^5 $TCID_{50}$ of the contemporary strain, ASFV Georgia/07. **RESULTS:** The PCR data showed consistent inoculation and nucleic acid stability across all inoculated feed ingredients during the 30-day transboundary model. Viable ASFV was detected by VI at 30 days post-inoculation (DPI) in 8 tested ingredients as well as both positive controls, with mean titers between 10^2 and 10^3 $TCID_{50}$. Both VI and swine bioassay failed to demonstrate infectivity of ASFV in 3 ingredients, including dried distillers' grains, lysine and vitamin D. **CONCLUSION:** Our data shows that ASFV maintains viability in varying environmental conditions, even in the absence of a protective feed matrix. This study provides additional information supporting the hypothesis that feed ingredients may play a role in the transboundary movement of foreign animal diseases, such as ASFV.

Relevance of Research to State-Related Topic(s)

Kansas ranks 10th nationwide in pork production with a market value of approximately $460 million. There are 1.93 million pigs in Kansas that contribute to supplying an important protein source locally and throughout the country. If introduced into the U.S. and onto Kansas swine farms, the highly contagious disease caused by ASFV would cause devastating losses to animal health and the state's economy. Contaminated feed has been recognized as a vehicle for introducing animal pathogens onto swine operations since the introduction of PEDV into the U.S. Nonetheless, the potential for introducing ASFV through contaminated feed ingredients has not been well defined. This study demonstrates that ASFV can survive in feed ingredients, supporting the potential role that feed may play in the spread of this virus. Our data support the concept of global feed biosecurity and provide important information on a potential route for introduction and transmission of this emerging virus.

7

COOPERATIVITY IN PROTEASOME CORE PARTICLE AUTOCATALYTIC PROCESSING

Anjana Suppahia[1], Pushpa Ityagi[2, 3], Mi Faith Kim[1], Alex Vontz[1], Alicia Burris[1], Eric Deeds[2, 3, 4,] and Jeroen Roelofs[1]

[1]Division of Biology, College of Arts and Sciences; [2]Center for Bioinformatics, University of Kansas; [3]Department of Molecular Biosciences, University of Kansas; [4] Santa Fe Institute, Santa Fe, NM

BACKGROUND AND PURPOSE: The maintenance of cellular homeostasis requires the degradation of unwanted or misfolded proteins. Found in all three domains of life, proteasomes are multimeric proteases that degrades majority of such intracellular proteins and have been shown to be attractive drug targets. They consists of a functionally conserved, barrel shaped catalytic core particle (CP) that has 14 α and [Symbol] subunits. The [Symbol] subunits contain N-terminal propeptides region that need to be auto-catalytically removed to confer proteolytic activity to the proteasome. However, the [Symbol]-propeptides themselves assist in the assembly of CP, suggesting their potential role as a chaperone. Our research aims to further investigate the chaperone-like functions of [Symbol]-propeptide and the coordination with it's cleavage during CP assembly process. **METHOD:** We used *in vitro* reconstitution approach to study the bacterial CP assembly of *Rhodococcus erythropolis*. We introduced mutations and truncations in the [Symbol]-propeptide region that enabled us to gain insights into the role of [Symbol]-propeptide in CP assembly and activation. **RESULTS/FINDINGS:** We identified three different regions on the propeptide region each having distinct roles in the CP assembly. We captured a previously unseen pre-holoproteasome complex, consisting of alpha and unprocessed beta subunits, indicating that CP assembly and activation are distinct processes. We also showed how the processing of beta subunits is not exclusively autocatalytic and involves cross-processing by other active beta subunits present in the CP. **CONCLUSION:** Our data indicate that the propeptides inhibit certain assembly steps and that there is cooperation mechanism in propeptides processing to ensures all propeptides are cleaved simultaneously.

Relevance of Research to State-Related Topic(s)

Understanding the potential role of bacterial propeptides as chaperones is important from evolutionary point of view which may suggest their analogous relationship with eukaryotic chaperones. Bortezomib, an inhibitor of proteasomes has been effective in cancer treatment, a better understanding of the bacterial CP assembly will also reveal differences in the process that might be exploited to develop drugs specific against bacterial CP. This will be revolutionary in designing therapeutics against multi-drug-resistant bacteria *Mycobacterium tuberculosis*. Half of the nearly 40 cases of TB reported in KS in 2016, were diagnosed incidentally where TB was not suspected in patients (http://www.kdheks.gov). Since TB can be transferred among individuals through the air, delay in diagnosis and treatment means increasing the risks on the health of other individuals. With the continual growth in diversity of Kansas population, it is more crucial than ever to continue research that assists drug development to ensure sound public health.

8

PROTEASOME ABUNDANCE AND LOCALIZATION ARE ALTERED UPON NUTRIENT LIMITATION

Kenrick Waite[1], Gabrielle Vontz[1], Angelica Lang[2], and Jeroen Roelofs[1]
[1]Division of Biology, College of Arts and Sciences; [2]Manhattan High School

BACKGROUND AND PURPOSE: Proteasomes are complexes in the cell that selectively recognizes and degrade many proteins. A failure in this proces is often detrimental and improper proteasome function has been linked to human diseases such as cancer and neurodegeneration. We set out to understand how cells control proteasome levels . We hypothesized that nutrient limitation would result in a cellular response affecting proteasome abundance and localization. **METHOD:** We used the eukaryotic model system *Saccharomyces cerevisiae*. Here, we genetically introduced green fluorescent protein (GFP) to proteasome subunits allowing us to monitor microscopically as well as biochemically how proteasomes respond to different physiological stresses. **RESULTS/FINDINGS:** We have found that proteasomes are degraded upon nitrogen starvation or the treatment with certain drugs by a process termed autophagy. However, not all autophagy inducing stimuli cause proteasome autophagy. Some stimuli caused proteasome re-localization from cell nuclei to the cytoplasm, potentialy affecting normal proteasome function. Further, proteasome inhibitors, which are used in cancer treatments, affect proteasome localization upon starvation. **CONCLUSION:** Our observations that inhibited proteasomes undergo different fates depending on the physiological stress or drugs the cells are exposed to, suggests that proteasome activity and substrate processing can dramatically change under certain conditions. For example, our data suggest that the cancer drug bortezomib alters proteasome localization. This, if replicated in human cells, could imply unanticipated effects of these drugs that will be important in evaluation of their efficacy.

Relevance of Research to State-Related Topic(s)

Proteasomes are an essential cellular complex that degrade many different proteins. Proteasome activity is required for the survival of certain cancer cell types. Thus, proteasome inhibitors are an increasingly important tool in the fight against cancer. As cancers become increasingly resistant to these inhibitors, new strategies will need to be developed to manipulate proteasome activity. Our research provides insight into how this might be accomplished by understanding the basic biology of how cells naturally control proteasomes. As cancer diagnoses climb, not only in Kansas but nation and worldwide, we must seek further methods of potential treatment.

9

THE EFFECTS OF PASSIVE, SHORT DURATION CONSTANT-TENSION STRETCHING ON BALANCE PERFORMANCE

Jeffrey A. Williams[1], Ty B. Palmer[2], and Ryan M. Thiele[1]

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BACKGROUND: We are aware of no previous studies that have investigated the changes in stability after shorter-term (1 min) stretching in this population**. PURPOSE:** To examine the influence of four, 15-s passive straight-leg raise (SLR) constant-tension (CT) stretches on PS characteristics (Anterior/Posterior Index; API and Medial/Lateral Index; MLI) in young adults. **METHODS:** Thirteen healthy females (age = 22±2 years) performed 2 unilateral balance tests (20-s/trial) on a commercially-designed balance testing unit, before (Pre) and at 0 (Post 0), 10 (Post 10), and 20 (Post 20) minutes following a passive SLR constant-tension stretching protocol. For each stretch, participants laid in a supine position on a cushioned table, with the knee braced in full-extension, and the ankle immobilized in a neutral 90° position. All stretches were performed on the right leg to the point of discomfort, indicated by the participant. The tension measured at this point was kept constant throughout the 15-s stretches. Participants completed four, 15-s bouts of (CT) stretching, with a 15-s rest period between bouts. Separate one-way repeated measures analyses of variance (ANOVAs) were used to analyze the API and MLI data across time. **RESULTS:** API was significantly lower at Post 20 (0.28 ± 0.06) compared to Pre (0.38 ± 0.14; $p = 0.036$) and Post 0 (0.35 ± 0.07; $p = 0.040$). No time course differences were observed for MLI ($p= 0.471$). **CONCLUSION:** A short, practical bout of CT stretching may be effective for improving unilateral balance performance over the course of a 20-min period in young adults.

Relevance of Research to State-Related Topic(s)

Changes in musculosteletal contractile and non-contractile tissue, as result of disuse, injury, or neuromuscular disease may affect a variety of populations across the age span. Specifically, limited joint range of motion and decreased flexibility of the lower extremity may be prevelent in older adults (≥ 65 yrs). Due to changes in tissue elasticity during the aging process, older adults may be at a greater risk of fall-related injuries and ultimately the related healthcare express. In order to offset tissue-related balance performance deficits, short duration constant-tension stretching may have a profound effect on tissue quality and as a result, balance performance. The implementation of short duration stretching may provide an efficient way of improving balance performance in aging populations. This technique may be useful for practitioners and healthcare providers in the state of Kansas to improve balance performance and reduce the risk of fall-related injuries in their patients within rural communities.

GROUP 2

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CLIMATE PATTERNS DRIVE PLANT AND SOIL PROCESSES IN TALLGRASS PRAIRIE

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BACKGROUND AND PURPOSE: Understanding how climate variability affects ecosystem processes in tallgrass prairie, such as plant productivity, carbon storage, and soil fertility, is critical for maintaining healthy prairie ecosystems. Using long-term manipulations of rainfall, we aim to document how and when these processes respond to altered precipitation patterns. This can aid predictions about the future of tallgrass prairie as a carbon sink and as highly productive, nutrient-rich rangelands. **METHOD:** We measured productivity and nutrient pools and cycles on a long-term irrigation experiment on Konza Prairie, in which growing-season precipitation has been augmented by 33% since 1991. New treatments established in 2017– reversals of historic irrigation and additional drought treatments– allowed us to assess how climate history affects prairie responses to global change. Within these precipitation treatments, we quantified key ecosystem characteristics and processes such as plant primary production, soil respiration, stocks and production rates of inorganic N, and microbial biomass C. **RESULTS/FINDINGS:** Pools and processes in tallgrass prairie respond differently in time and magnitude to altered climate regimes. While microbial C stores and inorganic N supply rates change with current precipitation, soil carbon efflux depended on both historic and current precipitation patterns. Substantial productivity responses to rainfall changes only developed after extended manipulation. **CONCLUSION:** This research provides insights into the processes most sensitive to precipitation changes in prairie. Further work in this system will document how these ecosystem responses change through time. By studying productivity and nutrient cycling as influenced by climate, we can manage for these key processes in tallgrass prairie under future climate regimes.

Relevance of Research to State-Related Topic(s)

Most tallgrass prairie is privately owned and used for cattle grazing, and landowners depend on the continued quantity and quality of prairie forage grasses. Since Kansas is anticipated to experience more frequent and severe droughts, it is critical to consider how global change may alter these grazing systems. Additionally, prairies are a large sink of belowground carbon, capturing atmospheric CO_2 and creating fertile soils. If we can identify how plant production, nitrogen supply and carbon storage respond to short- and long-term precipitation patterns, we can examine what land management practices can shape these processes in beneficial ways. By combining cutting-edge research from long-term climate studies with land use considerations and policy directions, we can design prairie management regimes that will ensure ecological and economic benefits from Kansas tallgrass prairie now and in the future.

11

PLANT-SOIL HISTORY HAS LASTING EFFECTS ON SOIL ORGANIC MATTER DECOMPOSITION

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BACKGROUND AND PURPOSE: Through their root inputs, plants modulate the soil microbial communities around them. This process is called soil conditioning. Different plant species select for unique microbial communities when they condition soils. The carbon that plants allocate belowground gives soil microbes the energy they need to "mine" for nutrients contained within soil organic matter (SOM). This process results in a flux of CO2 from the soil to the atmosphere. We wanted to know if an invasive plant species could affect SOM decomposition even after they are removed from the system, and 2) if there are detectable legacy effects of an invasive plant on soil microbial community characteristics. **METHOD:** In a greenhouse, two C3 grass species (a native or an invasive) conditioned the same field-collected soil for 20 weeks. After that, each plant species was either grown in "invaded" soils or "native" soils for 6 months. Once a month, belowground CO2 flux and bacterial community composition were assessed. **RESULTS/FINDINGS:** Throughout the experiment, SOM-derived CO2 production rates were significantly higher in invaded soils, regardless of the identity of the plant growing in the soil at the time of measurement. The soil bacterial community composition was affected by both soil history and the current plant growing in the soil. However, the current plant did not significantly influence community composition until late in the experiment. **CONCLUSION:** Invasive plants can have long lasting effects on SOM decomposition. This is potentially because the changes that invasive plants make to soil microbial community properties can persist for months after their removal.

Relevance of Research to State-Related Topic(s)

My research is relevant to the state of Kansas in two ways. First, Kansas is home to the largest preserves of tallgrass prairie, one of the most endangered ecosystems on the planet. Invasive plants threaten the natural biodiversity contained within this unique ecosytem. It is important to understand the ecosystem-level impacts of plant invasions. Second, because of its importance for plant productivity, soil organic matter is one of Kansas's most precious natural resources. Understanding the links between soil microbial communities and soil organic matter decomposition is crucial for managing soil organic matter stocks as well as predicting future carbon emissions from soils.

12

SOIL MOISTURE INFORMATION AND SOIL PHYSICAL PROPERTIES TO IMPROVE IRRIGATION SCHEDULING IN TURFGRASS

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BACKGROUND AND PURPOSE: A critical challenge facing the turfgrass industry is the increasingly limited water for irrigation. Current irrigation strategies used by golf courses and athletic fields often rely on calendar schedules or deficit irrigation strategies that completely ignore soil moisture conditions. Integrating information from soil moisture sensors (SMS) to existing irrigation techniques has the potential to substantially improve the timing and amount of each irrigation event. We propose to develop an innovative approach that integrates components of the soil-plant-atmosphere continuum to generate turfgrass irrigation decisions. We hypothesize that combining real-time soil moisture information, evapotranspiration (ET), and turfgrass canopy condition will improve irrigation scheduling and reduce total water use relative to calendar schedules. **METHOD:** We analyzed site-specific soil properties by utilizing a HYPROP instrument which uses an innovative system of precision mini-tensiometers for automated measurements of soil moisture release curves. We will compare SMS-based irrigation scheduling, traditional irrigation, and ET-based irrigation scheduling by comparing turf canopy responses and differences in soil/water relation within the soil profile. **RESULTS/FINDINGS:** Field-determined saturation point from the SMS occurred at 40% to 45% volumetric water content. Anticipated results will allow us to set proper thresholds for initiating irrigation based on soil moisture, soil physical properties, and forecasted reference evapotranspiration (FRET). **CONCLUSION:** Our approach will leverage a new nation-wide FRET product released by the National Weather Service by combining soil moisture information, forecasted reference ET, short-term precipitation forecasts, and turfgrass health into the decision-making process for irrigation scheduling.

Relevance of Research to State-Related Topic(s)

With thousands of turfgrass systems being utilized throughout the state of Kansas, proper irrigation techniques are critical to continuing sustainability. Even though the state of Kansas may not be experiencing water restrictions/quality issues to the extent of other states like AZ, CA, or TX, water is rapidly becoming more precious to the state. A GCSAA article published in 2015, states that 25% of all golf courses in the U.S. now use recycled water, up from 14.7% in 2005. In many cases, facilities are forced to find alternative sources of irrigation water due to water restrictions being imposed on the facility. This trend is expected to increase throughout the U.S. and will affect many states and regions that once had little concern about such issues. This study will significantly benefit an industry that is being increasingly scrutinized for its use of water for irrigating turfgrass systems.

13

SOIL MICROBIAL COMMUNITY SHIFTS DUE TO DIFFERENT FIRE SEVERITIES

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BACKGROUND AND PURPOSE: Wildfires burn large areas of forested land annually, and they are projected to increase in frequency and intensity. These wildfires are not uniform; rather, they burn in patches that vary in severity. We compared experimental fires of different severities mimicking landscape mosaics created by a wildfire with patches analogous to whole log combustion within a background burn. The primary aim was to improve our understanding of soil fungal community trajectories following varying fire severities. **METHOD:** We established ten pairs of plots in the Pringle Falls Experimental Forest in Oregon, USA. For each pair, one plot served as a background control), whereas another included logs piled in 1.5m x 8m x 1m structure for intense whole log combustion. The soils were sampled from 0-10cm depth within each plot before the burn, one weeks after the burn, as well as 2 and 4 years after the burn. DNA was extracted from these soil samples, Illumina MiSeq sequenced to compare community richness, diversity, and composition among the severity treatments and over time. **RESULTS/FINDINGS:** The data show that the fungal communities rapidly change in response to fire, and the recovery time depends on the fire severity. Following a high severity fire, the fungal communities follow trajectories distinct from those in low severity fires, although neither has fully recovered to communities resembling pre-fire conditions. **CONCLUSION:** Wildfires can have a lasting impact on organisms above ground; our research shows that high intensity disturbances cause a long-term impact on microbial communities.

Relevance of Research to State-Related Topic(s)

Wildfires cause huge economic and ecological losses. Understanding the microbial dynamics in the soil could lead to restoration of wildfire areas. In 2017, hundreds of thousands of acres were impacted by wildfire in Kansas. As of September 2017, there is a projected statistic of the fire season in the West being 105 days longer than usual due to increasingly dry conditions. Understanding the soil microbial communities could aid in forest management practices and restoration of burned sites.

14

THE FUTURE OF WOODY PLANTS IN THE GREAT PLAINS

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BACKGROUND AND PURPOSE: Current climate projection of the Great Plains region predicts increased carbon dioxide concentrations [CO_2] and altered precipitation regimes that, in the southern Plains, reduce soil moisture. These climate predictions will likely favor deep-rooted woody plants over shallow-rooted warm season grasses and exacerbate woody encroachment. **METHOD:** To test this hypothesis, we conducted a greenhouse study to determine how 4 woody seedling species (*Cornus drummondii*, *Rhus glabra*, *Gleditsia tricanthos* and *Juniperus osteosperma*) would grow under elevated [CO_2] and decreased soil moisture. We measured leaf gas exchange, leaf fluorescence and a suite of plant functional traits. **RESULTS AND CONCLUSION:** After 5 months of monitoring we found that all species increased water use efficiency and increased their root growth under elevated [CO_2] and lower soil moisture. We found each woody species had a different physiological strategy to cope with the different environmental conditions. Broadly, elevated [CO_2] did ameliorate the stress of decreased soil moisture for the seedlings, suggesting that woody plant seedlings will be able to cope with the projected climate scenarios for the Great Plains region.

Relevance of Research to State-Related Topic(s)

Predicted increases carbon dioxide concentration and temperature, changes in rainfall occurrence, decreases in soil moisture and increased urbanization Kansas' grasslands are in trouble. We as a state rely heavily on our grasslands for cattle grazing but they are diminishing due to woody plant encroachment and are projected to continue to decrease. My research looks at several woody plant species that are impacting grasslands in the Great Plains and especially the tallgrass prairie under predicted climate change of elevated carbon dioxide and decreased soil moisture. Ultimately if we do not change how we are managing our grasslands we will lose them to woody plants.

15

PREDICTION OF MISSING PRECIPITATION EVENTS USING IN-SITU SOIL MOISTURE INFORMATION

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BACKGROUND AND PURPOSE: Missing precipitation is a recurring problem in monitoring stations that rely on tipping bucket rain gauges. Missing precipitation records are often replaced with records from nearby monitoring stations, which can be inaccurate due to the high spatial variability of precipitation. We propose an alternative and potentially more accurate method of estimating missing precipitation records using existing in-situ soil moisture information. **METHOD:** Hourly precipitation and soil moisture data from mid-August 2017 to mid-September 2018 were taken from the Kansas Mesonet stations having soil moisture sensors installed at depths from 5 to 50 cm. Missing precipitation at a given location was estimated as the change in profile soil moisture storage between an hour before and after the storm. The in-situ soil moisture-derived missing precipitation and that from a nearby station were evaluated using linear correlation. **RESULTS AND CONCLUSION:** Better missing precipitation estimation using soil moisture (average R = 0.90, RMSE = 6.3 mm) than using nearby stations data (average R = 0.73, RMSE = 8.1 mm). Occasionally, our proposed method underestimated precipitation in storm events more than 50 mm due to high preceding soil moisture conditions. Our preliminary results suggest that missing precipitation estimation using soil moisture information is more accurate than using precipitation data from nearby stations.

Relevance of Research to State-Related Topic(s)

Accurate measurement of precipitation is very important in agriculture, hydrology, and environmental monitoring networks such as the Kansas Mesonet. Our researh seek to improve missing precipitation estimation by proposing a potentially more accurate method. Our approach could be used in quality control procedures to flag missing precipitation events.

16

HISTORICAL CHANGES OF HEAT WAVE IN KANSAS AND THE MISSISSIPPI RIVER BASIN

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BACKGROUND AND PURPOSE: Exposure to high temperature conditions is a human, animal, and plant health threat that is expected to rise with climate change and global warming. Hot extremes often lead to high damage to agricultural production and have significant economic, social, and environmental impacts. Severe influences arise when hot conditions last longer and form heat waves (HWs). This study analyzes historical changes of HW in Kansas and the Mississippi River Basin (MRB) for 1948–2017. **METHOD:** A HW was defined as two or more consecutive days when maximum temperature was higher than the 90th percentile threshold. Annual frequency of HWs was computed for warm season (May through September) and each grid cell in the MRB. Mann-Kendall trend analysis and Pettitt change point tests were applied to capture temporal and spatial changes in the frequency of HWs. **RESULTS AND CONCLUSION:** The west, north-west, and north regions of MRB were specified as the hot-spots with upward trends in the frequency of HW. Eastern MRB is among the low risk regions. For Kansas, the pattern is different in east and west. Western parts of Kansas with higher distribution of croplands are more vulnerable to hot condition if temperature continue to increase. Findings of this study help to adapt to and mitigate the increases in the frequency of HW in the MRB and to improve sustainable water manage management by considering the hotspots of hot extremes and recent trends in the HW frequency.

Relevance of Research to State-Related Topic(s)

Our results indicated that western Kansas is a vulnerable area to HW particularly if temperature rises continue. Human and animal mortality rates increase during HWs predominantly in infants, elderly, and people with respiratory and cardiovascular disease. Kansas is one of the main agricultural states. The upward trends in the frequency of HWs will impact agricultural production, crop yield, food security, and economy in the state. More frequent HWs increases plant water demand and will necessitate more efficient irrigation scheduling. More sustainable water management strategies will be required to adapt to the new climate conditions in the state. Being informed about the historical changes and trends of HWs in Kansas will encourage finding solutions for challenges including human health, water shortage, and heat stress on crop and livestock. Outdoor agricultural activities should be managed to adapt to increases in hot extremes and mitigate the risk of HWs.

17

DEMOGRAPHY OF *CORNUS DRUMMONDII* IN TALLGRASS PRAIRIE

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BACKGROUND AND PURPOSE: The expansion of woody species into grasslands alters the community structure and ecosystem function of grasslands worldwide. This leads to a loss of forage for livestock and time intensive and expensive removal practices. Clonal shrubs are of particular management concern because of their ability to resprout after fire and brush removal. Although fire and herbivory are known to be important drivers of grassland systems, the effects of herbivory on the growth and demographics of woody species are not well understood. **METHODS:** We quantified the growth rate and demographic characteristics of the main clonal shrub encroaching this region, *Cornus drummondii*, in response to fire frequency (4-yr, unburned), grazing (bison), and browsing (simulated). Transects were established within each shrub and stems were monitored throughout the growing season to measure mortality, natality, reproduction, and growth. **RESULTS AND CONCLUSION:** Growth rates were low across all treatments in response to extreme drought during summer 2018. Browsing reduced and nearly eliminated sexual reproduction in browsed shrubs, but vegetative reproduction did not differ between treatments. Fire increased stem densities likely in response to a pulse in resource availability and reduced aboveground competition with grasses. Grazing was not found to have effects on either the growth or demographics of established shrubs. These results highlight mechanisms of woody expansion in response to disturbance and may be used for the development of future management techniques to delay or reverse the process of woody encroachment.

Relevance of Research to State-Related Topic(s)

Over 16 million acres of Kansas land are used for grazing animals. The increase of woody cover can result in a decrease of grass cover livestock use to forage. This ecosystem change threatens livestock production by decreasing stocking capacity of rangelands and productivity of grass-fed cattle. Thus, the loss of grasslands due to woody expansion is a hazard to personal, county, and state income. Understanding the mechanisms and growth characteristics of expanding woody species is important in developing effective and cost-efficient management techniques as well as better predicting future land-cover change. For example, including browsers in rangelands may reduce seed production in shrubs and lead to reduced spread and establishment of new shrubs. Maintaining grasslands is important for private landowners, the economy, and all Kansans who are dependent on grasslands for food, jobs, or livelihood.

GROUP 3

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COW-CALF PROFITABILITY: WHERE TO FOCUS MANAGEMENT FOR SUCCESS

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BACKGROUND AND PURPOSE: Cow-calf production profitability varies greatly from year to year, with Kansas farmers experiencing record high returns in 2014 and record low returns in 2015. The average annual net return for Kansas Farm Management Association cow-calf producer members from was a loss of $100 from 1975-2017. Many cow-calf farms are profitable even in "hard" years, and certain factors common amongst these farms may suggest qualities of good management. By understanding factors that both improve profitability and can be persistently managed, Kansas cow-calf producers can better allocate resources to improve returns. **METHOD:** This research was divided into two parts intended to identify common traits amongst cow-calf enterprises exhibiting high profitability and to identify using OLS regression the main factors driving profitability. **RESULTS/FINDINGS:** The first study used 2013-2017 KFMA cow-calf enterprise data to divide farms into high-, mid-, and low-profit groups based on net return. Results showed total cost and gross income each accounted for approximately half of the differences in net return between the high- and low-profit groups. Amongst the differences in cost, 55% could be attributed to differences in feed costs. The second study used OLS regressions of 2002-2017 KFMA cow-calf production data to determine the main drivers of net return, production, and total cost. Total variable cost, enterprise size, production, price, and farm diversification were statistically significant, with total variable cost having the greatest impact. **CONCLUSION:** Understanding factors driving cow-calf enterprise profitability can strengthen rural communities, guide allocation of Extension educational resources, and direct farm policy to greatest impact Kansas farm success.

Relevance of Research to State-Related Topic(s)

Where Kansas agriculture and cow-calf production thrive, the community prospers. According to the Kansas Department of Agriculture's Farm Facts (2017), every Kansas county raised cattle in 2016. When Kansas cow-calf enterprises succeed, rural communities in every corner of the state reap the benefits of job creation and economic development. In 2017, beef production in Kansas was the largest agricultural employer and accounted for approximately $8.9 trillion and 42,000 jobs (Kansas Agriculture's Economic Impact, 2017). With Kansas ranked third nationally for cow-calf production (Kansas Agriculture's Economic Impact, 2017), on-farm success of cow-calf producers attracts national agribusiness attention, bolsters Kansas' leading role as part of the Animal Health Corridor and paves the way for even greater business development and job growth. Consumers across Kansas and the nation ultimately reap the true benefits of a safe, high-quality, and affordable food supply. The success of Kansas cow-calf producers is the success of all Kansans.

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FINDING THE RIGHT PERFUME TO ATTRACT POST-HARVEST PEST INSECTS TO THEIR DEMISE

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BACKGROUND: Every year, producers in Kansas lose 10-30% of their crop yields to insects. Indeed, much of this loss happens after harvest as Kansas's cash crops are stored, transported, processed, and marketed to end consumers around the world. Insects live in a world of smell, and their behavior (and thus damage) can be manipulated by a large suite of perfumes, consisting of pheromones, food odors, and other cues. One of the issues in post-harvest protection of food is that there are over 100 species of insects that attack food facilities. With such high levels of diversity, the more species that we can manipulate with a single odor source, the more advantageous an odor will be in protecting our food after harvest. **METHODS:** In the first objective of the study, we tested 8 experimental odor lures from Trécé, Inc. and 4 commercially available lures for attraction of the cigarette beetle, *Lasioderma serricorne* (Fabricius) (Coleoptera: Anobiidae), in wind tunnel assays. Based on the most attractive lures from this first objective, our goal was to determine how broadly attractive these lures were to a suite of other stored product pests, which together can cause rapid and extensive damage to food facilities. Experimental lures from Trécé were used in timed laboratory wind tunnel assays to assess their attractiveness to these species. **RESULTS AND CONCLUSION:** Our results suggest that attraction to these experimental lures have a wider application than just to *L. serricorne* and could be utilized in the development of more effective stored product pest monitoring or management tools.

Relevance of Research to State-Related Topic(s)

Producers in Kansas lose between 10-30% of their post-harvest crop yields to insects every year. The majority of this loss occurs when crops are being transported, stored, processed, and marketed to consumers. There are more than 100 species of insects that attack food storage facilities and one major issue in the post-harvest protection of stored food is trying to minimize the damage caused by this wide variety of pest insects. Our goal was to determine the attractiveness of experimental insect lures from Trécé, Inc. to a suite of stored product pest insects in an attempt to find the best combination of lures for use in storage facilities across Kansas.

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EFFECT OF MATE AVAILABILITY AND SUGAR SOURCES ON SOYBEAN PODWORM, HELICOVERPA ZEA (LEPIDOPTERA: NOCTUIDAE), FECUNDITY

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BACKGROUND AND PURPOSE: The soybean podworm is responsible for most of the chewing damage to Kansan soybeans, resulting in millions of dollars in damaged product each year. This experiment was planned to better understand this major pest and what affects its egg load and longevity. **METHOD:** Adult female *H. zea* were tested under laboratory conditions to determine if fecundity differed with mating and sugar type feeding. Four different sugar solutions of 10% were tested (corn syrup, hummingbird nectar, high fructose corn syrup, and honey), and a control using only water. Two variables for mating were tested, mated versus unmated female moths. Laboratory-reared pupae were obtained, sexed, separated, and allowed to enclose prior to inclusion in each experiment. Moths were placed in 3.78-liter plastic jars for 24 hours after exclusion for the duration of the experiment, which ended when all females were found dead. Each day adults were fed solutions *ad libitum* and any eggs laid were collected, counted and recorded per female. Each treatment was replicated five times. **RESULTS/FINDINGS:** This study showed that *H. zea* will live longer and lay more eggs when provided a sugar source compared to water alone. When mates became available, females laid more eggs post copulation than prior to copulation. Results were analyzed using ANOVA tests. **CONCLUSION:** Results from this experiment will be used to better understand ecological interactions of this moth within soybean fields throughout Kansas. These results may be used to limit the populations of adults and/or field populations of larvae.

Relevance of Research to State-Related Topic(s)

The research I've conducted has high relevance to topics of interest to the Kansas state legislature because it helps us understand how we can manage a major crop pest to prevent millions of dollars in lost/damaged product. The soybean podworm feeds directly on the marketable product in this crop. If seeds are damaged, then less is harvested and sold, leading to less income. With a soybean harvest worth $1.7 billion in 2017, protecting the product pre-harvest has become an important, state-wide issue. By conducting research on the soybean podworm, we can better understand what new practices will help Kansan soybean farmers protect their beans until harvest.

21

DECIPHERING THE GENETIC BASIS OF HYDROXYPHENYLPYRUVATE DIOXYGENASE (HPPD)-INHIBITOR TOLERANCE IN GRAIN SORGHUM

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BACKGROUND AND PURPOSE: Grain sorghum is one of the most versatile crops, which can produce high yield under limited water and other inputs. Weed control, especially annual grass weeds in grain sorghum is a major challenge across the US. Herbicides such as mesotrione or tembotrione are effective in post-emergence control of a wide-spectrum of weeds including some grass weeds in crops such as corn but are not registered for use in sorghum because of crop injury. We recently identified four HPPD-inhibitor-tolerant sorghum genotypes from a diversity panel, two each, tolerant to mesotrione (G-1, G-10) or tembotrione (G-200 and G-350). **METHOD:** To study the genetic control of mesotrione tolerance, crosses using mesotrione-tolerant (#G1, #G10, #G200 and #G350) and -sensitive (#S1) genotypes of sorghum were performed, and the F_1 seed were generated. The F_1 progeny were evaluated in a mesotrione dose-response (0 to 8x of mesotrione; where x is 105 g ai ha^{-1}, 0 to 4x of tembotrione where x is 92 g ai ha^{-1}, which are the field used dose) assay. **RESULTS:** Dose-response assay indicated F_1 progeny show same level of tolerance as tolerant parent. **CONCLUSION:** These results suggest that the mesotrione and tembotrione tolerance is genotype is controlled by single or multiple dominant gene(s). We will generate F_2 progeny that will be used to determine the genetic basis as well as map the genes controlling tolerance. We intend to use bulk segregation analysis combined with RNA-Seq (BSR-seq) to rapidly and efficiently map genes.

Relevance of Research to State-Related Topic(s)

This research is related to "Plant and animal health" topic of focus in Kansas legislature. If not controlled weeds can cause more than 50% yield loss which is a great economic loss to the famer and to the state. One of the biggest challenges faced by sorghum farmers is availability of herbicide options to control post emergent grass weeds. Kansas is the largest producer of Grain Sorghum in the United States hence it is important to alleviate the challenges faced by sorghum farmers. This research will help breeders to develop herbicide tolerant sorghum varieties which enables the farmers to use herbicides to control grass weeds in sorghum.

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THE VALUE OF SOCIAL CAPITAL IN FARMLAND LEASING RELATIONSHIPS

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BACKGROUND AND PURPOSE: Social capital is important in many business relationships, the agricultural sector especially. Social capital in this paper can be thought of as the idea that a person's relationships can impact economic outcomes. The goal of this study is to find the impact of social capital on farmland leasing relationships in Kansas, using data from a survey sent to both producers and landowners. **METHOD:** A survey was sent to members of the Kansas Farm Management Association (KFMA) in late January, with the receiving period ending in mid-May. The survey provided data on the rental rate of farmland, characteristics of the lease, the land and the relationship between the producer and landowner. A second survey was provided for the producer to send to the landowner of their largest lease with intention of collecting a database of matched pairs. An OLS regression was run on producer data determining the impact of producer characteristics, landowner characteristics and land characteristics on cash rental rates. **RESULTS/FINDINGS:** Preliminary findings show that factors such as lease length, a family relationship between producer and landowner, productivity of the land, whether the landowner inherited the land and the location of the land (using NASS agricultural districts) impact the rental rate paid to the landowner in a cash rent lease. This supports the hypothesis that longer leasing relationships, those with higher social capital, have a negative impact on rental rate paid to the landowner. **CONCLUSION**: This study will help determine the power of social capital and the role it plays in farmland leasing relationships.

Relevance of Research to State-Related Topic(s)

Beyond the benefits to those in the Kansas Farm Management Association, this study has potential impacts for many residents of Kansas. Approximately 40% of farmland in Kansas is currently leased to producers. Based on our survey, each producer interacts with as many as seven landowners. This means that producers could be interacting with multiple rural residents such as widows or retired farmers. Furthermore, this rental agreement could be a major source of income for the residents in these rural communities. Finding out which characteristics drive the rental rate, may be a step in the right direction for helping these residents ensure they are getting a fair cash rent and have a healthy relationship with their tenants.

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ASSESSING A VISUAL ATTRACT-AND-KILL DEVICE AS AN ALTERNATIVE MANAGEMENT TACTIC FOR POST-HARVEST INSECTS IN FOOD FACILITIES

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BACKGROUND: Every year 10-30% of our food is lost to insects after harvest as our food is stored, transported, processed, and marketed to consumers. With the rise of insecticide resistance, it is imperative to utilize tactics that preserve the effectiveness of chemically-based tools. One alternative tactic is called attract-and-kill, whereby pests are attracted to an area and removed from the foraging population. Many insects are attracted to light, which may provide an excellent cue for bringing in post-harvest insects to a trap. Recently, research has demonstrated that long-lasting insecticide incorporated netting (LLIN) have a dramatic effect on the survival and behavior of post-harvest insects. In this study, we combined light and LLIN in a single device to test its ability to control insects in pilot-scale warehouses. **METHODS:** We tested the effectiveness of a trap with light and LLIN to kill post-harvest beetles, and moths in pilot-scale warehouses. In comparison, we used a warehouse with the trap and LLIN without light. We performed repeated releases of insects, left them for 24 h each release, and measured the mortality of insects, distance of recapture from the trap, and tracked recovery over a week. **RESULTS:** The light-based attract-and-kill device annihilated the post-harvest beetles but needed some optimization for the moths. There was little to no recovery after exposure to the trap. **CONCLUSION:** Results suggest that light-based attract-and-kill is a very promising technique for control of post-harvest insects and may provide food facilities with another tactic to diversify their integrated pest management programs to protect our food supply.

Relevance of Research to State-Related Topic(s)

Agriculture in Kansas is worth $47.9 billion, and the post-harvest industry is a huge part of this. With the phase-out of the most effective fumigant (methyl bromide), and a stark rise in global resistance to the primary remaining fumigant (phosphine), it is critical to develop diversified pest management programs for the post-harvest supply chain. Our novel use of LLIN, whose main utility was as bed nets to stop the spread of malaria in Africa, combined with light as an attractant, opens up a novel tactic to save the few tools left in the toolbox for food facilities. Our results may help to establish LLIN as a safe, cost effective method of pest control with less need for fumigants and other pesticides. This technology may ultimately help Kansas, which is the breadbasket of the world, continue to play a vibrant role in feeding our society's growing population for decades to come.

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MAPPING QUANTITATIVE TRAIT LOCI FOR FUSARIUM HEAD BLIGHT IN WHEAT RIL POPULATION DERIVED FROM HARD WINTER WHEAT EVEREST × OVERLAND

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BACKGROUND AND PURPOSE: Fusarium head blight (FHB), caused by *Fusarium graminearum* (Schw), is one of the most important fungal diseases of wheat. FHB drastically reduces not only grain yield but also grain quality due to mycotoxins, in particular deoxynivalenol (DON), that is produced by the pathogen during infection. Consumption of DON contaminated grain is a major health concern for animal and human. Host resistance is the most effective way to combat the disease. Exotic sources of FHB resistance are available for breeding, but poor agronomic traits in those sources prevent direct use of them as parents in breeding. So, the objective of this study is to Identify native quantitative trait loci (QTLs) associated with FHB resistance in US hard winter wheat cultivars using genotyping-by-sequencing (GBS) markers and a recombinant inbred line (RIL) population. **METHOD:** In this study, we used an $F_{6:7}$ RIL population developed from a cross between Overland and Everest. Overland is moderately resistant, and Everest is moderately susceptible to FHB. The RIL population and parents were evaluated for FHB type-II resistance in the one field and three greenhouse experiments using randomized complete block design with two replications. The RIL population and parents were genotyped using genotyping-by-sequencing (GBS) markers. **RESULTS/FINDINGS:** Composite interval mapping (CIM) identified three QTLs for resistance to FHB spread within a spike on the chromosome arms 7AS, 3BS and 4BS from Everest and four QTLs on 5AL, 4BS, 4AS and 2DS from Overland. The QTL on the chromosome arm 4BS consistently significant in the three experiments and showed significant association with a reduced plant height gene. **CONCLUSION:** In view of breeding wheat for challenging environmental conditions, critical single nucleotide polymorphism (SNPs) markers tightly linked with QTLs were identified and will be converted into breeder-friendly Kbioscience competitive allelic specific PCR (KASP) assays to be used in marker-assisted breeding in wheat.

Relevance of Research to State-related Topic(s)

Among the major diseases of wheat, Frusarium head bligth (FHB), also known as scab, has received much attention in past years due to severe epidamics occured in Kansas in 1982, 1990, 1993 and 1995. Higher rainfall during heading and presence of corn residues increase the risk of scab epidamics annually in approximately one million acres of wheat grwoing area in eastern part of Kansas. Apart from losses in grain yield and reduction in seed quality for milling and baking, the major concern is the contamination of the crop with toxic fungal metabolites known as mycotoxin which pose serious threat to food security. Thus, the current research seeks to develop scab resistant hard winter wheat cultivars in Kansas which will have good adaptiblity, higher yield and qulity perfomanace in challanging environmental conditions. More so, the research is useful for pyramiding identified resistant QTLs for durable resistance in wheat.

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ANALYSIS OF KANSAS CROP FARM MANAGEMENT: REVENUE AND COST MANAGEMENT

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BACKGROUND AND PURPOSE: Many factors at the farm and macroeconomic level influence the profitability of crop producers. Uncontrollable factors such as interest rates, trade policies, and government programs impact profitability. However, individual producers do have some control when making farm-level management decisions. In the agriculture industry, relative profitability dictates which producers remain in operation. Therefore, identifying which management and farm characteristics (i.e. prices, yields, etc) determine relative farm profitability is beneficial. **METHOD:** Kansas Farm Management Association (KFMA) enterprise budgets for the years 2015- 2017 were aggregated and divided into profitability groups (i.e. high, middle, and low), based on the 3- year average per acre return to management. The enterprises (number of farms) included in this analysis were corn (69), irrigated-corn (26), grain sorghum (57), full- season soybean (83), double- crop soybean (37), and wheat (106). An OLS regression was utilized to identify significant farm characteristics/management decisions that impact profitability and determine if management should be revenue or cost oriented. **RESULTS/FINDINGS:** High- profit farms most often had the largest acres devoted to that enterprise, suggesting that larger operations are more profitable. For all enterprises examined, high- profit farms had the highest revenue, mostly due to higher yields, but high- profit farms never had the highest cost. Additionally, machinery costs ranged from $183.41 per acre for irrigated corn to $61.93 for double-crop soybeans. Thus, machinery management significantly impacts relative profitability. **CONCLUSION:** The results suggest there are large differences in profitability across producers at a point in time (2015- 2017) and that shifting between revenue management and cost management approaches is important across time.

Relevance of Research to State-Related Topic(s)

Agricultural production accounts for 49% of the Kansas economy. Kansas ranked 6th in agricultural sales in 2012, behind the geographically larger states of Texas and California. This high dependency on agriculture within the state, coupled with a recent trend of decreasing net farm income, places an increasing level of importance on farm-level production decisions. Kansas is diverse in its agricultural production with nearly 46 million acres utilized in the production of wheat, corn, soybeans, and sorghum (USDA-NASS 2017). The variability in agriculture across Kansas coupled with the variability in agricultural markets further emphasizes the need for farm management research to aid producers in making profit maximizing decisions. Most often, decision tools come from private consulting firms or from Research and Extension programs stemming from Land Grant Institutions like Kansas State. Providing these services to the producers is a vital part of agricultural production in Kansas.

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RAPID METABOLISM OF 2,4-D INCREASES THE RESISTANCE IN COMMON WATERHEMP (*AMARANTHUS TUBERCULATUS) UNDER HIGH TEMPERATURE*

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BACKGROUND AND PURPOSE: Common waterhemp emergence in the mid-western states of the US has a broader range from low average diurnal temperatures early in the season to high temperatures in late season. 2,4-D has been widely used to manage common waterhemp in this region. Temperature is considered one of the crucial factors affecting the post-emergence herbicide efficacy. The objective of this research was to investigate the effect of temperature on 2,4-D efficacy to control 2,4-D-resistant (WHR) and susceptible common waterhemp (WHS) populations. **METHOD:** 2,4-D dose-response studies of WHR and WHS were conducted at two temperature regimes including high (HT; 34/20 ^{o}C, d/n) and low (LT; 24/10 ^{o}C, d/n) temperature regimes. Additionally, the uptake, translocation, and metabolism of ^{14}C 2,4-D were also determined. Further, to confirm the role of cytochrome P-450 monooxygenases in 2,4-D metabolism, dose-response was performed with malathion pre-treatment. **RESULTS/FINDINGS:** Results indicated increased resistance and decreased sensitivity of both WHR and WHS population to 2,4-D at HT compared to LT. GR_{50} of WHR and WHS at HT were 3696 and 176 g ae ha^{-1}, while at LT these values were 1001 and 107 g ae ha^{-1}, respectively. Different growth temperatures did not affect 2,4-D absorption or translocation. However, rapid ^{14}C 2,4-D metabolism was observed in both WHR and WHS at HT compared to LT. Furthermore, pre-treatment of malathion significantly lowered 2,4-D resistance in WHR at both HT and LT. **CONCLUSION:** Application of 2,4-D early in the season when temperatures are cooler, can improve control of 2,4-D resistant common waterhemp.

Relevance of Research to State-Related Topic(s)

Weeds are one of the most important biotic stresses affecting grain crop production significantly. Use of herbicides is the most reliable and economical weed control option available to growers. Over-reliance on chemical weed control increased selection pressure, resulting in the evolution of resistance to herbicides in weed species leading to reduced weed control. Common waterhemp is one of the most troublesome weeds in the US, causing significant crop-yield loss. Understanding the effect of changing temperature regimes on post-emergence herbicide efficacy on controlling herbicide-resistant common waterhemp is vital to address the issue sub-optimal weed control. Studies show that sub-optimal weed control not only causes reduced crop yields but also result in further selection of herbicide resistance. Thus, this research can help formulate weed control strategies with respect to differential herbicide application timings, leading to reduced production costs, increased crop yields and finally ensuring better food security and safety for growers.

GROUP 4

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DESCRIPTIVE ANALYSIS AND CONSUMER ACCEPTABILITY OF LOCALLY GROWN AND COMMERCIALLY GROWN SPINACH

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BACKGROUND AND PURPOSE: The consumer demand for locally grown fresh produce is continuously increasing in the United States. High tunnel systems are utilized frequently, by Midwestern growers for local vegetable production. A common perception is that locally grown product tastes better than non-local. However, there is not much evidence for supporting this claim. The objective of this study was to identify consumer acceptability and the sensory characteristics/differences of locally grown spinach in open field or in high tunnel and non-local commercially grown spinach. **METHOD:** A consumer study (n=205) was conducted at Kansas State University, Olathe campus, and a descriptive sensory analysis was conducted by a highly trained descriptive analysis panel in the Center for Sensory Analysis and Consumer Behavior at K-State, in spring 2017. For these studies, spinach, *Spinacia oleracea* cv. "Corvair" was grown in open field and in high tunnel at K-State Olathe Horticulture Research and Extension Center and the commercially grown spinach was purchased at a local retail store. **RESULTS AND CONCLUSION:** The consumer test showed that high tunnel spinach scored significantly higher in overall liking, flavor liking and texture liking when compared to open field and store purchased spinach. The descriptive analysis showed that locally grown spinach had higher intensity of attributes that indicate premium quality, such as green color and green/spinach flavors. Our results show that locally grown spinach is preferred from the consumers for its high organoleptic characteristics. This indicates that marketing strategies for locally grown spinach should aim specifically to the consumer niche that is seeking products of superior organoleptic quality.

Relevance of Research to State-Related Topic(s)

This research project is supporting local vegetable production in the State of Kansas. Strengthening local organic fruit and vegetable production in Kansas is supporting the efforts of building a resilient & sustainable local food system in this state. Especially for Kansas, fruit and vegetable production is negligible, and the dietary needs for produce are currently met through the import of products that are shipped from thousands of miles away. By boosting the production of high-quality local food, farmers achieve better prices per acre, new job opportunities are created, and there is general economic growth since capital stays in the state. Finally, supporting local agriculture help increase availability and access to fresh and nutritious food, especially for underserved communities in the area. Local agriculture has already been recognized as a strategy for economic revival, public health and nutrition improvement, and community development.

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UNDERGRADUATE RESEARCH PERCEPTIONS IN AGRICULTURAL COMMUNICATIONS

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BACKGROUND AND PURPOSE: This study examined the advantages accrued by students who have participated in undergraduate research opportunities through the Department of Agricultural Communications and Education. The objective of this study is to understand how undergraduate students perceive these opportunities and the skills gained. In order to improve the course, meet student expectations and needs, and better improve undergraduate research experience, there needs to be an understanding of the students' perspectives. The benefits of undergraduate research experience (URE) identified in previous work are critical thinking skills, research skills, oral communication skills, and developing closer relationships with instructors (Ishiyama, 2002; Kurland & Rawicz, 2002). There was limited literature on the benefits for students in communication, education, or other humanity fields (Ishiyama, 2002). The following are the research questions:

Q1: What benefits did you receive from your undergraduate research course?
Q2: What makes undergraduate research a successful experience?

METHOD: The census sample for this study consisted of students who previously completed an URE in AGCOM at KSU (N = 26). They were asked to participate in the survey and data was collected through Qualtrics Survey Software. **RESULTS/FINDINGS:** Participants who responded (n = 16) indicated they received many benefits including being involved in undergraduate research experiences including improved communication skills, critical thinking skills, and relationships with professors. The number one answer for making a successful research experience, is dedicating enough time to the research experience. **CONCLUSION:** In conclusion, students have gained many skills through their own perspectives making it an invaluable experience.

Relevance of Research to State-Related Topic(s)

Undergraduate research has been identified as a priority in the K-State 2025 Plan. Literature has identified several benefits to undergraduate research opportunities. These experiences encourage students to pursue higher levels of education as well as prepare students for their respective careers more than a lecture-based classes (Sabatini, 1997). Data on undergraduate research experiences related to agriculture were unfounded, however, studies on critical thinking skills in agricultural capstone or case study classes were available. UREs have been proven to be beneficial to students, instructors, and the university and thus should continue to be enhanced upon and offered to students to enrich their learning experiences. This study observes ways in which URE opportunities can be expanded and improved through perceptions of students who have completed courses in Agricultural Communication. These findings can be applied to other courses within the department as well as throughout the university and state.

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"WOULD YOU STAY IN KANSAS?" AN ANALYSIS OF COLLEGE STUDENTS' ATTACHMENT TO KANSAS

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BACKGROUND AND PURPOSE: Wide eyes, a face of surprise, hesitantly asking: "why Kansas?" This is a typical reaction to new international students who come to study in Kansas. Stereotypical images have made Kansas just a fly-over state to many people and a surprising destination when chosen for study or travel. Even for some of those who are from Kansas, finding better job opportunities and more diverse options for living have been convincing enough to plan to move to other states. This paper investigates the concept of place attachment in Kansas. **METHOD:** Interviews with thirty-seven college students studying in Kansas, as well as follow-up reflection papers were analyzed to evaluate the extent of attachment to the state. **RESULTS/FINDINGS:** Findings show that less than a quarter of participants are proud of Kansas to a great extent. Also, despite individuals' emotional bonds to certain aspects of the state, most notably the communal aspect, most intend to leave to seek opportunities elsewhere. Only 11% (4 out of 37) of the participants have tied attachment to Kansas and claim to definitely want to stay in Kansas after graduation. However, about 70% of them refer to their attachment to be mobile as "*Kansas would always have a place in their hearts"* but they do not necessarily want to stay in Kansas in long-term. **CONCLUSION:** This study not only unfolds the community attachment factors to an agricultural area but also identifies that even though younger generation may not have tied attachment to their home places, they feel a strong mobile attachment to them.

Relevance of Research to State-Related Topic(s)

This study highlights the existence of the different types of attachment to Kansas to be considered by planners and local leaders in systematic efforts to shape the future of Kansas communities particularly those facing growing rural-out migration. Strengthening the attachment between citizens and places will play an important role in Kansas' future. Individuals with strong attachments can also be identified and engaged in the future of rural agricultural-based communities. State planners and policymakers can invest in children and the younger generation, to give them the opportunity to rethink the unique aspects that the state has offered them growing up and help them "*get a better idea of Kansas and what it means"* to them. Simple short programs can be designed to make young Kansans *"to take a step back"* and ask themselves what they like about the state, and alternatively what they might desire to change and improve for an enhanced quality of life.

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PRETEND PLAY AND EARLY LITERACY AMONG PRESCHOOL CHILDREN: A META-ANALYSIS

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BACKGROUND: High quality early learning experiences are important for children's later school success. Recent educational trends give more weight to the academic components of curricula while decreasing the proportion of play. However, research has shown that play-based learning sets children up for successful school readiness. Pretend play is considered a strong medium for language development by providing enriched environments to use and develop language skills. Vygotskian theory states that through pretend play, children learn abstraction and symbolism via creating an imaginary situation, followed by transformation of the socially learned information into internal states for structuring language. Previous reviews have discovered inconsistencies across findings by examining the associations between pretend play and literacy but lacked systematic methodology to further investigate the discrepancies among research, suggesting the need for further thorough evidence. **PURPOSE:** To provide evidence for inclusion of pretend play in learning contexts in preschool classrooms by systematically investigating the existing empirical literature. **METHOD:** The current meta-analysis systematically investigated and analyzed 25 existing empirical studies that had examined the associations between pretend play and emergent literacy among young children. **RESULTS:** Results showed an overall magnitude of the association to be .36, and also showed that several factors such as the types of adult involvement tended to impact the association. **CONCLUSION:** This study has provided evidence for the strength of the research foundation supporting pretend play as a critical learning context for emergent literacy development in preschool classrooms and has charted future directions on the pretend play-early literacy in the early childhood education field.

Relevance of Research to State-Related Topic(s)

The Kansas State Board of Education has identified Kindergarten readiness as an essential building block for academic success, which is an important element in the Board's new vision that "Kansas leads the world in the success of each student." Two major data-based, research-informed programs are The Kansas Preschool Program (KPP) and State Pre-Kindergarten, aiming to provide high quality early learning experiences for young children. The current meta-analysis provides strong evidence that children benefit from being educated in a play-based early learning environment for their early literacy development. The results provide guidance for creating child-focused pretend play experiences important for early literacy, which in turn leads to successful school readiness and later learning in schools. In conclusion, the current study will provide guidance for early learning professionals that enhance and support their abilities to create experiences that promote early learning opportunities for children to serve them for the transition to schools.

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US AID AND SUBSTITUTION OF RIGHTS VIOLATION IN AUTOCRCAIES

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BACKGROUND AND PURPOSE: This paper asks the question of how U.S. aid affect the human rights abuses. Particularly, it examines the relationship between U.S. aid and rights violation in authoritarian regimes. The main argument is that as a rational actor, the autocratic leader does not want to lose aid, and at the same time cannot completely stop violation of rights because such leaders come into power through force. In such a situation, leader act strategically by substituting the visible rights violation to invisible ones (killings to forced disappearances). However, substitution behavior depends on the strategic nature of relationship between the U.S. and the recipient. If the recipient is strategically unimportant then we expect substitution, otherwise substitution of rights violation may not exist, thus making autocratic regimes to violate all rights irrespective of their type. Further, when donor is under intense pressure from its public or international community to act against the recipient that is strategically important then the donor may choose to punish recipient by cutting economic aid rather than military aid. **METHOD:** I test these hypotheses by using logit regression on cross sectional and time series data on U.S. aid and human rights from 1980 to 2010. **RESULTS:** Using logit model, the findings suggest that upon receiving aid recipient substitute rights violation from visible to invisible human rights. However, there is no substitution effect in strategically important countries. I also found that recipient receiving economic aid are more likely to be substitute rights violations than military aid recipient. **CONCLUSION:** The findings suggest that US aid causes substation effect in improvement of rights violation, as autocratic regimes substitute visible rights to invisible one. However, such a substitution effect is absent for strategically important countries

Relevance of Research to State-Related Topic(s)

The paper is relevant to Kansas Legislature since it focuses on how US Aid (taxpayer money) affects the rights violations. US as a donor expect aid recipients particularly the autocratic regimes to improve human rights violation, however most of aid recipient uses that aid for their survival. This is an important issue both from the state and public perceptive since this is the tax payer money that is been allocated to recipient for economic or military purposes, and US expects the improvement of rights. However, improvement of rights does not occur in all cases.

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DESIGNING HOME GOODS FOR SOCIALLY RESPONSIBLE PRODUCTION. A LIONS IN FOUR SPONSORED PROJECT FOR MANUFACTURE BY MULTI-SKILL LEVEL ARTISANS IN KERLALA, INDIA.

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PURPOSE: The purpose of this project was to create socially responsible home goods for a U.S. contemporary luxury market. Dickson and Eckman (2006) acknowledge that social responsibility involves multiple stakeholders including, "…the environment, its people, the apparel/textile products made and consumed, and the systematic impact of production, marketing, and consumption of these products…" (p. 188). In view of this definition, this project aimed (1) to design products that use natural dyes that can be grown at the women's training center (WTC), (2) to design products that foster the brands' aim to generate emotional value in the home by appealing to multiple generations, and (3) that can be accomplished by WTC workers with a variety of skill levels. **METHOD:** Research through practice was the framework for the project (Bye, 2010). Our contextual review and client interview informed initial design decisions while our practice of sampling generated viable options for the clients' review. Multiple iterations of product prototypes were presented to the client. The final prototypes were a table runner, table ribbon, placemats, and napkins. **RESULTS:** The product prototypes and specifications packet met the client's need for naturally-dyed home products that reflect the brand's global image and consumers' family values while providing production options for multi-skilled workers. **CONCLUSION:** The project allowed us to apply socially responsible decision making in the use of natural dyes that will be harvested and dyed within the same location of production by women with differing abilities who are paid a fair wage.

Relevance of Research to State-Related Topic(s)

This project was in conjunction with the Lions in Four (LIF) foundation, an ethical fashion and lifestyle company that aims to advance the well-being of women and children in Kerala, India. The LIF foundation is owned and operated by Julie Martin of Overland Park, Kansas. Through the production of ethical products, the WTC offers skill training and fair wages to those in need, including women with disabilities. The revenue from the sale of these products contributes to the economy in the State of Kansas and fosters ethical and sustainable dialogue in the community.

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AN EVALUATION OF CURRENT PUBLIC HEALTH PRACTICE WORKFORCE SKILLS IN KANSAS

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BACKGROUND AND PURPOSE: In order to better understand skills that students should possess to be successful in a career in public health sectors, this study evaluated skills for public health practice. The Master of Public Health (MPH) program at Kansas State University is an interdepartmental program that trains individuals to be successful within a career in public health. As a part of graduate educational training, a public health practice experience is incorporated so that students can practice what they have learned and gain practical workforce skills within the field. The goals for this project were to determine necessary workforce skills, needs, and gaps in Kansas, while also fostering collaborations with local health departments and Extension agencies. **METHODS:** To achieve these goals, a survey was created and given to past field experience preceptors and possible employers. Following the survey, face-to-face meetings were set to collect qualitative data and to develop practice-academic relationships. **RESULTS/FINDINGS:** Data from these surveys and meetings were analyzed for themes related to workforce development and career preparedness. The most important skills for a public health practitioner to possess were found to be: communication, social, teamwork, grant writing, computer literacy, and networking/collaboration skills. All past preceptors felt that the students they mentored possessed at least some skills necessary to be ready for the workforce. **CONCLUSIONS:** Feedback from this project allows for improvement of career preparedness and development for the public health workforce. Relationships built with local health department directors and Extension agents can later be used to facilitate outreach to employers and communities' agencies.

Relevance of Research to State-Related Topic(s)

Public health practitioners play an important role in Kansas. This research focuses to strengthen the development of the public health workforce. A stronger public health workforce will impact the health of Kansans. Public health practitioners play an important role in decreasing the risk of diseases such as obesity, diabetes, and food-borne illness. Public health provides health education, improves quality of life in rural communities, assists individuals with access to health care, and provides many other services to the public. Through the development of a stronger workforce, this project will long-term have an important contribution to Kansas.

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SOY PROTEIN IS AN EFFICACIOUS ALTERNATIVE TO WHEY PROTEIN IN FORTIFIED BLENDED FOODS

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BACKGROUND: Previously we found that extruded sorghum-soy blend (SSB) and corn-soy blend (CSB) fortified blended foods (FBFs) containing whey protein concentrate (WPC) are equally nutritious food aid products. WPC is commonly added to FBFs as a high-quality protein source, however, it is the most expensive component of FBFs. The primary objective of this study was to determine if soy protein may serve as an alternative to WPC in FBFs. **METHODS:** Nine extruded FBFs were formulated; one SSB and one CSB FBF both containing 9.5% WPC and 15% sugar served as comparison FBFs. Four additional SSB and three CSB FBFs were developed containing no WPC with increased soy flour to meet protein requirements and sugar content from 0 to 15%. Male, weanling Sprague Dawley rats were individually housed and divided into ten diet groups (n = 10) which consumed either AIN-93G, a standardized rat diet, or one of the FBFs for 28 days. Results were analyzed using one-way ANOVA with Tukey's test. **RESULTS:** There were no significant differences in food intake or final body weights. The CSB-WPC group had significantly lower food intake compared to SSB-0% and AIN-93G groups and significantly lower body weight compared to the SSB-0% group. There were no significant differences in hemoglobin concentrations; liver iron concentrations were significantly higher in all FBF groups compared to the AIN-93G group and the CSB-5% group was significantly higher than the SSB-15% group. **CONCLUSION:** Our results suggest that extruded SSB and CSB FBFs with soy protein are an efficacious and cost-effective alternative to WPC-containing FBFs.

Relevance of Research to State-Related Topic(s)

Increases in global demand for sorghum creates more opportunity for Kansas producers, the United States' top-producing sorghum state. As climate change impacts crop yields, demand for drought-tolerant, high-yielding grains, such as sorghum, are anticipated to rise. In addition, sorghum is not genetically modified which makes it appealing to countries that do not allow genetically modified products. Soy, one of Kansas' top five commodities, is one of very few plant-based complete proteins, which means that it contains all nine essential amino acids. This project highlights sorghum and soy in a nutritious, plant-based food aid product which can generate increased demand and an additional market for Kansas producers. Overall, our research has found that sorghum-soy food aid products are at least equivalent, if not a better option, than corn-soy food aid products.

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VETERINARY HOSPITAL EVALUATION AND SUGGESTIONS TO MAXIMIZE USABILITY FOR CLIENTS WITH MOBILITY DISABILITIES

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BACKGROUND AND PURPOSE: Many veterinary hospitals have structural limitations which can cause accessibility challenges for pet owners with mobility disabilities. The goals of this study were to establish baseline data on usability of veterinary hospitals for clients with mobility disabilities via survey and veterinary hospital visits, increase awareness of this potential problem, and provide suggestions for improvement. It was hypothesized that hospital accessibility problems would be identified, but that veterinarians would be receptive to learning how they could improve their ability to serve clients with disabilities. **METHODS:** A survey (N=59) was distributed to Kansas veterinarians online and at a local conference, and two researchers were certified by Community Health Environment Checklist for Mobility (CHEC-M) and evaluated 10 veterinary hospitals in Kansas. After each visit, an individualized report was created for each hospital describing strengths as well as short and long-term suggestions for areas of improvement. **RESULTS:** Ninety-three percent (55/59) of surveyed veterinarians reported having clients with mobility disabilities, and 92% (54/59) were receptive to further education on ways to best serve clients with disabilities. Veterinary hospital evaluations paralleled self-identified barriers in accessibility from the survey, including challenges with entranceways (heavy doors, parking spaces), high reception desks, and small restrooms. Veterinarians found the reports helpful and implemented some short-term suggestions right away. **CONCLUSION:** Improving awareness of client needs in addition to providing practice-specific suggestions for improving and maintaining accessible veterinary hospitals is a positive step towards allowing clients to fully participate in their pet's veterinary care.

Relevance of Research to State-Related Topic(s)

The principles of this research and awareness project apply not solely to veterinary hospitals but have the potential to encourage other businesses in Kansas as well to become more mindful of usability and accessibility, ultimately improving service to clients with mobility disabilities. The Kansas Disability and Health Program collaborates with many partners to promote health for people with disabilities and strives to incorporate disability awareness into state and local public health agendas. This study was a joint collaborative effort with KSU, KU, the Kansas Disability and Health Program, and Kansas veterinarians, exemplifying efforts to improve accessibility to veterinary healthcare and impacting the lives of people with disabilities throughout our state. Through education, the Kansas veterinary community can become more cognizant of potential physical barriers to people with mobility-related disabilities and can make action plans for short and long-term modifications to their hospitals to remove barriers and improve access for all.

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SENSORY AND VOLATILE COMPOUND ANALYSIS OF EXTRUDED SORGHUM PET FOOD

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BACKGROUND AND PURPOSE: The grain-based pet food took the majority position in USA markets. Only a limited number of brands of pet food use sorghum in formulation. This research focused on the sensory attributes of sorghum and volatile compounds in 7 extruded dog food samples with a primary purpose of developing a more sustainable pet food by using sorghum as the main carbohydrate source. **METHOD:** Descriptive analysis was used to determine appearance and aroma attributes. Total of 5 highly trained panelists evaluated 10g pet food for each sample by using a 15 points scale. Gas chromatography was used for studying the volatile aroma compounds extracted using the headspace-solid phase microextraction method. **RESULTS/FINDINGS:**12 of 16 sensory attributes were detected significant differences among these 7 samples. Appearance attributes Brown, Porous, Fibrous, Color presented differences among these 7 samples, and aroma attributes Vitamin, Barnyard, Liver, Carboard, Hay-like and Toasted were different among these 7 samples. Total 20 volatile compounds were detected, and 7 of them could be found in all these 7 samples. These volatile compounds were Butanedial, Pentanal, Hexanal, 5-methyl hexanal, 2-pentyl furan, and Propanoic acid. The other 13 volatile compounds were variated among these 7 samples, which were 3-Carene, 1-Butanol, 3-methyl-, 1-Octen-3-ol, tetrahydrofuran, 2-Butanone, 2-methylbutanal, Butanoic acid, 3-Furaldehyde, Pentanol, 2,3-Octanedione, Acetic acid, and Furfural. **CONCLUSION:** This research helps understand the sensory and volatile properties of extruded pet food and indicates potential ways to improve the sorghum formulation. Further research should help determine whether more sustainable formulations provide similar digestive and nutritional quality to animals.

Relevance of Research to State-Related Topic(s)

This topic helped to determine whether the sorghum-based pet food could replace the corn-based pet food in sensory field. The sorghum-based pet food had high fiber, high diets and low carbohydrates for dogs to compare with corn-based pet food. Also, the sustainable production system applied in sorghum-based pet food, which significantly decreased energy input compared to produce corn-based pet food.

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EFFECT OF FAT AND OIL COATING ON DRY CAT FOOD AROMA PROPERTIES

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BACKGROUND AND PURPOSE: Fats and oils are commonly used to coat extruded pet food, including cat foods. The effects of different fats and oils on the aromatics of cat food are largely unknown. The objective of this study was to understand the sensory aroma characteristics of dry cat food coated with fats and oils. **METHOD**: In this study total of 28 dry cat food kibble samples produced with four different main grain ingredients (rice, corn, red sorghum and white sorghum) were coated with seven sources of fats (Chicken fat with antioxidants, Chicken fat without antioxidants, Sunflower oil, Salmon oil, Fish oil, Butter and Lard). Descriptive sensory analysis using highly trained panelists and gas-chromatograph-mass spectrometer (GC-MS) analysis were applied. **RESULTS/FINDINGS:** Principal Components Analysis (PCA) of the descriptive sensory data showed that coating with fish and salmon oil dominantly separated the coated cat food samples from other samples by higher intensity in aroma attributes of oxidized oil, hay-like and fish notes. From GC-MS analysis, 43 volatile compounds were tentatively identified. Specific volatiles with fishy odor, such as (E, E)-2,4-Heptadienal and 1-Penten-3-ol could explain the Fish note found in fish and salmon oil samples. Volatiles of Nonadecane, (E,Z)-3,5-Octadien-2-one could explain the Oxidized oil aroma and the Hay-like aroma, respectively. **CONCLUSION:** Overall, coating fat could change the aroma impression of the coated cat food to a degree. Further research is needed to address fat interaction with kibble and added flavoring, which could be useful for predicting preference of cats.

Relevance of Research to State-Related Topic(s)

This study was the second part of the research we collaborated with Department of Grain Science, with the purpose to encourage sorghum usage in pet food production. In the first part of the study, manufactory`s concern of using sorghum replacing grain ingredients of rice and corn would bring negative sensory properties to extruded cat food was addressed by showing no significant differences among bitterness and astringency level. In this study, research was to build up the knowledge on impact of oil/fat coating to aroma properties of the extruded cat food. It would be helpful for smart sourcing of the fat and oil ingredient in manufactory production. Considering Kansas is the largest grower of sorghum in USA, authors consider this study is relevant to present here.

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PRINTING AND MAILING FOR THE BRAND: AN EXPLORATORY QUALITATIVE STUDY SEEKING TO UNDERSTAND INTERNAL BRANDING AND MARKETING WITHIN UNIVERSITY AND EXTENSION COMMUNICATION SERVICES UNITS

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BACKGROUND AND PURPOSE: Investment of employees in a brand can lead to greater public understanding and positive impressions of a brand by external stakeholders. However, this can be challenging in public organizations with multiple brand segments and a large number of employees spread across great distance with limited funds for marketing. While previous work has looked at Extension agents, faculty, and volunteers' brand perceptions, no studies have looked at communication services employees' investment in the brand. **METHOD:** The purpose of this qualitative study was to discover how well employees in a university and Extension printing and mail entity understood the Extension brand and their investment in the brand. Research questions that guided this study were: 1) how invested are communication services employees in the [University] Extension brand? And 2) what are employees' perceptions of the organization's branding and marketing efforts? Each of the 18 interviews included a series of questions focusing on employees' story related to Extension and employees' thoughts on branding and marketing efforts. **RESULTS:** Results in this study with communication services employees indicate these employees are not invested in the brand with the majority having little to no understanding of the mission of Extension. This contradicts previous research with employees in other brand segments of Extension. **CONCLUSION:** Implications of this work include a need for training on the Extension mission for communication services employees, a shift in culture to encourage investment in the brand, and inclusion of all Extension employees in the mission of Extension.

Relevance of Research to State-Related Topic(s)

Over the past 30 years, legislators and the general public have had a vague understanding of the land-grant mission and its funding structure, which has created challenges for communicators within land-grant institutions. One of these challenges is using cost-effective strategies and tactics in the limited marketing and promotional budgets available to Extension employees to exhibit significance. Previous strategies and tactics have focused on assessing and improving Extension's public relations link to the media. However, there is an underdeveloped tie to the public in the employees and the story they portray to the public. Employee investment in a brand can be a powerful resource or a detriment to a service-oriented business or organization. When employees believe in the brand, understand its position in the marketplace, and communicate about it effectively, this can carry over to greater public understanding of the brand and more positive associations with the brand.

Group 5

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HIGHWAY OVERHEAD SIGN AND SUPPORT STRUCTURE FATIGUE LIFE EVALUATION AND ESTIMATING THE REMAINING LIFE SPAN

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BACKGROUND AND PURPOSE: Overhead highway signs, luminaires, and traffic signals fatigue evaluation has recently become an issue due to the fact that most of State Department of Transportations do not perform routine fatigue inspections, which increase the possibility of having fatigue cracking in multiple locations within the structures that may go unnoticed. Furthermore, most of these support structures have been in service for over 30-45 years, as well as, the geometry of these sings and signals sometimes result in significant cyclic loading due to wind gusts. **METHOD:** A software is developed called Fatigue Life simulator Software (FLSS) to evaluate the ratio of consumed fatigue cycles to ultimate fatigue cycles using Minor Rule. If this ratio is close to zero after 45 years, the member is expected to have infinite life. If the ratio is closer to one after 45 years, the member is expected to be at the end of its life. **RESULTS AND CONCLUSION:** The software (FLSS) helps inspectors to look for critical spots that may have developed fatigue cracks that otherwise would have been harder to detect.

Relevance of Research to State-Related Topic(s)

This research is extremely important to the citizens of the State of Kansas and the nation as well because it is safety related issue. Kansas Department of Transportation (KDOT) does not have the workforce neither the flexibility of time to inspect every signal overhead highway structure's component throughout the State. Therefore, the Fatigue Life Simulator Software (FLSS) is developed to assist expediting the time and reducing the effort in evaluating the structures' conditions. The software is capable of identifying the severity of the structures' components and predicting the remaining life span. Thus, KDOT's engineering can select any city throughout the chosen 8 cities mentioned previously and select a specific overhead structure to analyze, then the software can estimate the life spans of its components. According to the color code and actual magnitude the software that are displayed, inspectors can make a trip to that specific structure and inspect it physically to verify its condition.

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FARM CONSOLIDATION REDUCES GROUNDWATER IRRIGATION INTENSITY: EMPIRICAL EVIDENCE FROM THE KANSAS HIGH PLAINS AQUIFER REGION

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BACKGROUND AND PURPOSE: Ubiquitous trend of consolidation of cropland has been going on in the United States for decades. Despite the observation of this trend, there is limited research on how this affects our use of natural resources; knowledge on its relation to freshwater use is especially lacking. In the High Plains Aquifer Region, groundwater sustains 89% of the irrigated cropland but groundwater storage in parts of the aquifer continues to decrease over the years due to overdraft and insufficient recharge. Our main research question is: what is the direct effect of irrigated cropland consolidation on irrigation water use in Kansas? **METHOD:** We use a field-level longitudinal dataset of groundwater irrigation withdrawals among Kansas farmers during 1991-2014 with an econometric method to answer this question. We identified climate and farming practice variables available in the dataset to reduce potential biases. **RESULTS/FINDINGS:** We estimate that, with everything else unchanged, consolidation process that results in doubling the size of an average irrigated farm's irrigated acres will reduce annual groundwater irrigation depth by 0.9 ft on average, or 8%. This reduction effect varies slightly among farms of different initial irrigated acreage category. **CONCLUSION:** Our study demonstrates positive unintended impact associated with farm consolidation that could be exploited to slow groundwater withdrawal without direct water policies like quotas on irrigation volumes.

Relevance of Research to State-Related Topic(s)

Groundwater irrigated agriculture is crucial to Kansas economy and the knowledge on the well-being (or the lack thereof) of the aquifer specifically that in relation to farming activities is needed to inform state-level policymaking. Most of the irrigation in Western Kansas solely relies on groundwater withdrawn from Ogallala Aquifer, which is part of the High Plains Aquifer, and it has been so for a long time. Certain areas of the aquifer have suffered from depletion over the last couple of decades, despite local and state efforts of implementing water efficient irrigation technology and adopting conservation practices. We leverage a unique field-level longitudinal dataset from Kansas and discovered an unexpected reduction effect of cropland consolidation on irrigation water use intensity. This "side effect" of land consolidation, if incorporated wisely into agricultural policies, will allow Kansas to slow down the depletion of groundwater storage without hurting the economic production and without explicit and rigid intervention on farmers' water rights.

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POTENTIAL OF SOY PROTEIN AS ALTERNATIVE SEED LUBRICANT IN ROW CROP PLANTERS

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BACKGROUND AND PURPOSE: Seed lubricants play a crucial role in proper seed singulation by ensuring the seeds flow smoothly through the metering unit. However, the harmful chemicals inadvertently expelled along with the air during the seed metering process have raised concerns regarding the negative effects of these lubricants to the environment. An alternative has been developed from soy-protein which biodegrades into aminoacids, however no knowledge exists regarding its suitability as a potential seed lubricant to achieve desired seed singulation. Therefore, this study was designed to assess the seed flowability by quantifying seed singulation of corn and soybeans. METHOD: Two planter row units was used to simulate planting at 5 mph with a target population of 89,000 and 370,000 seeds per hectare for corn and soybean, respectively. For each seed, three levels of seed size and four levels of seed lubricant were arranged in 3x4 factorial in CRD. A computer program was written to record row unit electric motor rpm and seed tube data. RESULTS AND CONCLUSION: Results indicate that seed lubricant and seed size could potentially affect seed flowability in soybeans. Medium size soybeans applied with soy protein and fluency agent achieved the highest singulation. In corn, large seeds singulates best irrespective of type of seed lubricant. In summary, soy protein seed lubricant provided singulation equivalent to existing commercial products, thus exhibiting potential to provide equivalent seed flowability. Its usage cost is 52% lower compared to other commercially available seed lubricants and no detrimental effect on environment.

Relevance of Research to State-Related Topic(s)

The use of seed lubricants on pneumatic planters has been a standard practice for growers. Seed lubricants reduce friction and improve seed flow ensuring proper seed movement during planting. Commonly used seed lubricants are talc and graphite. However, research suggests that some of the insecticide on seed coatings attach with the seed lubricants as it comes out of the planter during planting and is dispersed into the atmosphere. When settled, these chemicals contaminate vegetation and is harmful to these pollinators during foraging. Recently, a potential seed lubricant alternative had been developed. Soy protein has been extensively used in many industrial applications due to its environment friendly properties and has the potential to reduce the level of N fertilizer application. However, no evidence exists to show that soy protein could improve proper seed flow. Thus, it is important to evaluate its capability to effectively singulate seeds and determine its potential as an alternative to commercially available seed lubricants.

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HIGH THROUGHPUT SCREENING OF MICROBIAL INTERACTIONS WITH MICROWELL ARRAYS

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BACKGROUND AND PURPOSE: The dynamic and diverse microbial communities are shaped by factors such as microbe-microbe interactions, species abundance, structural organization and environmental cues. To address the knowledge gap of understanding critical microbe-microbe interactions that impact the function of specific organisms, microwell array is developed as a new tool to rapidly uncover critical pair-wise or microbial interaction networks that effect the function of a species of interest. Using microwell arrays thousands of unique interaction networks can be screened to identify those that influence focal species function. **METHOD:** In this study a focal species Agrobacterium tumefaciens was randomly combined with a controlled number of microbiome isolates where each well will become compositionally unique in terms of the combination of species present. Motile bacteria cells were trapped in wells during co-culture using a crosslinked, photo-degradable polyethylene glycol hydrogel membrane and then removed from wells of interest using a patterned light source. Later, 16S rRNA sequencing and other molecular characterizations can be applied to identify and characterize interacting bacteria. **RESULTS AND CONCLUSION:** Several microbes were extracted from random plant roots collected from Konza Prairie. We have also discovered an antgonistic relationship between Agrobacterium tumefaciens and Agrobacterium radiobacter K84. The results will inform more about robust and reliable soil inoculants for biocontrol applications and assist in mapping higher-order interaction networks that can be combined with metagenomic data to provide an improved, systems-level understanding of microbial community structure and function in a variety of different ecosystems.

Relevance of Research to State-Related Topic(s)

Crown Gall Disease have been seen affecting various trees and shrubs here in Kansas. With microwell arrays, we are screening plant root microbiome members collected from sunflower plants at Konza Prairie against *Agrobacterium tumefaciens*, the cause of Crown Gall Disease. *A. tumefaciens* produces phytohormones that causes tumor growth because of Crown Gall disease. Therefore, we intend to search for microbes that inhibit its growth or quorum activation. Since, Kansas is an agricultural state, findings from our research can be implemented in order to improve plant health and productivity.

WITHDREW

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EVAPORATION FROM SIMULATED SOILS: EFFECTS OF MIXED WETTABILITY

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BACKGROUND AND PURPOSE: Reduction of water use, such as irrigation, is one of the most challenging issues in the food-water-energy nexus. Globally, agriculture accounts for two-thirds of water withdrawals. The Ogallala Aquifer is the primary water source for food production in Kansas and is responsible for providing water for over 20% of food production in the U.S. Reduction of water evaporation from soil decreases the need for irrigation and thus water can be conserved in Kansas. **METHOD:** In this study, evaporation fundamentals were studied by evaporating sessile, 4-μL water droplets from single pores created using three hydrophilic glass, hydrophobic (Teflon) or mixed beads (i.e. 2 Glass 1 Teflon and 2 Teflon 1 Glass). Experiments were conducted at the same temperature (20ºC), RH (60%), and pressure (1 atm). The time to fully evaporate the droplets was recorded and the transport phenomenon was captured using a high-speed camera. **RESULTS AND CONCLUSIONS:** Due to the higher wettability of glass surface, the droplets were more stretched on the glass beads and therefore, the evaporation times were lower (i.e., approximately 34 minutes) than Teflon. The Teflon surface is hydrophobic, for which the water droplets were more pronounced, thus the evaporation was delayed (i.e., approximately 42 minutes). For mixed cases, the evaporation time was higher (~33 minutes) in hydrophobic-dominant combination than the hydrophilic-dominant one (~25 minutes). Liquid bridge formation, droplet contact lengths and contact angles were analyzed for better understanding. Further investigation on evaporation dynamics could inform more about agricultural practices to reduce soil evaporation.

Relevance of Research to State-Related Topic(s)

The production of food requires sufficient supply of fresh water and sustainable production of food is a challenge of the food-water-energy nexus. Water sources like ponds, rivers, canals can mitigate the need of irrigation but that can cause drought. The annual average rainfall in western Kansas is only 12-14 inches which is inadequate for some crop growth. As a result, there are 1.5 million acres irrigated farmland in the southwestern Kansas and the Ogallala Aquifer provides 90% of the water for irrigation. Reduction in soil evaporation rates will diminish irrigation demands and overall water consumption for crops production, thereby conserving water in the Ogallala Aquifer. The main aim of this study is to find a suitable pore combination and evaporation mechanism that can help reducing evaporation from soil through natural soil additives and thus conserving the soil water level.

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CALIBRATING THE HSM CRASH PREDICTION MODELS FOR URBAN THREE-LEGGED SIGNALIZED INTERSECTIONS IN KANSAS

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BACKGROUND AND PURPOSE: The crash prediction models provided in the Highway Safety Manual (HSM) predict crashes using traffic and geometric data for various roadway facilities, which are incorporated through Safety Performance Functions (SPFs) and Crash Modification Factors (CMFs). The calibration of the HSM crash prediction models would increase the accuracy of crash prediction for Kansas since the SPFs in the HSM were developed using data from the states of Minnesota and North Carolina for urban 3-leg signalized intersections. **METHOD:** In this study, 89 3-legged signalized intersections are used to calculate the calibration factor. Out of the 89 intersections, 68 had actual AADT for minor approach, and multiple regression model with natural log transformation of continuous variables, was developed to estimate minor AADT for the remaining 21 intersections. The R-squared value for the developed model is 0.5314, indicating the model was acceptable. **RESULTS:** A calibration factor of 0.64 was estimated when considering all crashes, and 0.52 when considering only fatal-and-injury crashes, showing that the HSM methodology overpredicted the crashes for both cases. The reliability of the calibration factors is checked with the help of Cumulative Residual (CURE) plots and coefficient of variation (CV). To increase the reliability further, calibration functions were developed, and reliability of the calibration functions were examined. **CONCLUSIONS:** The results show that the HSM predictive methodology overpredicted the number of crashes for Kansas. Furthermore, the results also showed that the calibration functions have a better reliability as compared to calibration factors.

Relevance of Research to State-Related Topic(s)

This research aids in the prediction of crashes at urban three-legged signalized intersections (3SG) in Kansas. The accurate prediction of crashes helps in selecting and applying suitable countermeasures to reduce the number of crashes. Since budgeting is a key factor, all the facilities and the problems associated with them cannot be addressed. The calibration of HSM predictive methodology helps to predict crashes at 3SG, which helps to prioritize intersections based on the probability of occurrence of crashes. The prioritization, in turn, helps to focus the limited budget to focus on more critical intersections. The reduction of crashes helps save lives, as well as the costs that are associated with a crash, and fatalities.

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QUANTIFYING NOZZLE FLOWRATE AND PRESSURE USING PULSE WIDTH MODULATION (PWM) TECHNOLOGY IN AGRICULTURAL SPRAYER

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BACKGROUND AND PURPOSE: Various pesticides amounting to 1.1B pounds that cost $10.6B were used in the US. Majority of them contaminates ground and surface waters. PWM is an application technology that applies chemicals at constant pressure by varying the duty cycle to maintain the application rate. Limited studies are available that show how the PWM system perform during operation. The study aimed to evaluate the pressure drop and flowrate variations of the PWM system during application. **METHOD:** Capstan Pinpoint and John Deere ExactApply PWM nozzle control modules were evaluated. Nozzle pressure, boom pressure, and flowrate were recorded at 1kHz using a LabView program and a cRIO data acquisition system. **RESULT:** For 12, 20 and 40GPA application rate and 40psi application pressure**,** Capstan Pinpoint exhibited a pressure drop of 6.0, 8.4 and 25.3psi and flowrate per nozzle of 0.6, 0.7 and 1.2GPM while John Deere ExactApply indicated a pressure drop of 2.2, 3.6, and 17.9psi and flowrate per nozzle of 0.4, 0.5 and 0.9GPM. Application pressure of 65psi increased the pressure drop for Capstan Pinpoint while John Deere ExactApply had the same pressure drop equivalent to 40psi application pressure. Flowrate for both systems was nearly similar to the 40psi application pressure. **CONCLUSION:** Capstan Pinpoint and John Deere ExactApply PWM nozzle control modules showed different responses to application rates and pressures. Knowledge on pressure drop and flowrate using either system will help producers to select nozzle tips, application rates and configure their spray systems to maintain the correct application rate thus, maximizing pest control and minimizing environmental effects.

Relevance of Research to State-Related Topic(s)

Concerns exist about pesticide application technologies regarding the actual percentage of pesticides deposited on the target, off-target application, pesticide resistance, environmental contamination as well as the development of application control strategies for field operation. Usually, off-target pesticide resistance, additional production cost and non-point source environmental contamination are results of inadequate and inaccurate chemical application. PWM system is a new technology that is being implemented in pesticide application. However, limited studies are available about its system response and control strategies to make an informed decision for its adoption and implementation. This study will provide recommendations and advance knowledge to convey through educational and extension activities to the producers to help them make decisions on technology selection. In addition, this will also help improve the economic and social sustainability of growers, sustain the economic viability of agricultural operations and enhance the economies and quality of life in rural communities.

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SAFETY EFFECTIVENESS OF HIGH-SPEED RURAL ROUNDABOUTS IN KANSAS

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BACKGROUND AND PURPOSE: Transportation Agencies are looking for long-term solutions to reduce crashes at intersections. Past studies on the operational performance of urban and suburban roundabouts have revealed that the severity of crashes is reduced in roundabouts due to their circular geometry. At present, there are 126 roundabouts in Kansas with 26 located on the state highway system, and eight of the 26 roundabouts are on rural high-speed roadways (45+ mph). Drivers need to pay extra attention to roundabouts on high-speed roadways, as they need to slow down to enter and circulate the roundabout. To date, there has been very little research reported on the safety effectiveness of rural high-speed roundabouts in the United States. **METHOD:** This study aims to investigate the safety effectiveness of rural high-speed roundabouts in Kansas using the Empirical Bayes (EB) before-after method provided in the Highway Safety Manual. Due to lack of adequate crash data, only five roundabouts were employed for the analysis. **RESULTS/CONCLUSION:** The results indicated a reduction of 40% and 48% in total crashes, fatal and injury crashes respectively. Further, the safety treatment of converting two-way stop-controlled intersections to roundabouts were significant at 90% confidence level. The findings of this research reveal significant safety benefits of rural high-speed roundabouts as what is documented for safety benefits of urban and suburban roundabouts in the past. The results of this study do not represent the entire population of two-way rural stop-controlled intersections in the United States, however the results are considered comparable to intersections with similar traffic volumes and crash histories.

Relevance of Research to State-Related Topic(s)

In 2013, crash related death cost in Kansas was $449 million. One fatal crash approximately cost $4.6 million. The results of this analysis revealed that installing roundabouts at rural high-speed locations reduced fatal and injury crashes by 48% and total crashes by 40% in Kansas, thereby saving a huge amount of money to the state. Furthermore, the findings support the Kanas Department of Transportation professionals to make positive decisions on upcoming roundabouts at rural high-speed locations and delivers as added evidence that safety benefits of rural high-speed roundabouts are similar to urban and suburban roundabouts.

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ALGORITHM TO DIFFERENTIATE THE PULSE RATES OF TWO INDIVIDUALS THAT SHARE A SENSOR-LADEN BED

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BACKGROUND AND PURPOSE: A Kansas State University team has developed a sensor-based bed that can track sleep quality in a child with severe disabilities by analyzing their ballistocardiograms (BCGs): cardiac seismic signals acquired using four electromechanical film sensors aligned under the mattress. While the extraction of BCG-based health parameters (e.g., pulse and breathing rates) has proved successful when a single subject sleeps on the bed, these algorithms perform poorly when two people share the bed – a common scenario when this monitoring technique is extended to other populations. **METHOD:** This effort seeks to create an algorithm to extract individual pulse signals from mixed parent signals obtained with the bed sensors, where one component of the algorithm employs a form of "blind source separation:" a technique originally designed to separate mixed audio signals. BCG signals differ in character from audio signals and therefore present unique challenges. For this application, the mixed signals must not only be separated, but one must also then extract pulse rate information from the separated signals. To that end, a frequency-domain, peak-scoring algorithm was also developed to determine the most likely fundamental frequency (i.e., pulse rate) associated with the signal component that corresponds to each person. **RESULTS:** Preliminary results indicate success for both the source-separation and pulse-rate-estimation methods, where relative pulse-rate-estimation errors for pairs of individuals were within [Symbol]3% of the true values obtained simultaneously from electrocardiograms and photoplethysmograms. **CONCLUSION:** Individuals' pulse rates can be estimated using both methods even when these rates are close in frequency.

Relevance of Research to State-Related Topic(s)

Unobtrusive monitoring of sleep quality has received increased attention in recent years given established linkages between sleep quality and daytime well-being. The intrusive nature of a standard polysomnograph, as used in most clinical sleep studies, renders such a system unusable over long periods of time, as the numerous wires and electrodes are both uncomfortable and unwieldy. Though the bed-based sensor bed developed by the Kansas State University team successfully extracts health parameters when a subject is alone on the bed, many practical situations dictate that the bed will be shared by two people. The extraction of a person's pulse rate given the presence of a second person remains an underexplored problem, the solution to which would lead to potential increases in the use of in-home sleep monitoring systems that augment health care options available to populations such as the elderly, likely reducing health care costs while increasing quality of life.

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SHORT-TERM FORECAST AND DUAL STATE-PARAMETER ESTIMATION FOR JAPANESE ENCEPHALITIS TRANSMISSION USING ENSEMBLE KALMAN FILTER

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BACKGROUND AND PURPOSE: Mathematical modeling of infectious diseases propagation has gained popularity because of advances in control systems research and in computational power which allow for data driven simulations of real-life stochastic processes and the forecasting of their evolution. These models are comprised of several state variables and parameters (transmission, infection, and recovery). Transmission parameters, in particular, can be dependent on other variables (weather, population density, etc.), and consequently can vary with time. Estimating the dynamic values of these parameters is crucial for modeling past epidemics and for forecasting future outbreaks. In this paper, we propose to forecast the evolution of Japanese encephalitis (JE), vector-borne infection, and test it using real incidence data for transmission in the taiwan. **METHOD:** We formulate an ensemble Kalman filter (EnKF) that provides dual state-parameter estimates for the transmission of Japanese Encephalitis (JE). A short- and mid-term forecast is done to explore the predictive horizon--- the predictive accuracy of the future time steps. **RESULTS/FINDINGS:** Parameter estimates from EnKF show temporal variability while short to mid-term forecast match the reported incidences in Taiwan. However, the forecast accuracy deteriorates with distant time steps. We also demonstrate the effectiveness of control measures on the epidemic by simulating various vector population abundance. **CONCLUSION:** EnKF method for forecasting vector-borne disease spread should only be used for two to four time steps, i.e. real-time forecast during an outbreak when new incidence data available continuously. Our method can be used by public health personnel in taking necessary steps according to the severity of an epidemic.

Relevance of Research to State-Related Topic(s)

We have developed our method using the human incidence data in Taiwan, however, our method has the adaptability to be used for forecasting any infectious diseases. Once disease outbreak is detected, our method can be used to predict the number of infected individuals with time. This will help the public health people in taking proper step according the total number of infections, allocating more resources to check/reduce the spread of more widespread disease outbreaks. Therefore, our method can be useful for plant, human, and animal health.

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IMPACT OF CAMERA LENS ANGLE AND SUAS FLYING ALTITUDE ON SPATIAL CROP CANOPY TEMPERATURE EVALUATION

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BACKGROUND: Thermal image quality is critical to accurately quantify spatial and temporal growth and stress patterns of field crops. Often times, thermal sensor selection is based upon price or already owned sensor. Metrics are available to select flight altitude based on thermal sensor for desired ground resolution, however no study have been conducted to provide relative difference in image quality and efficiency of generating a thermal orthomosaic. Therefore, this study was conducted with a goal to compare accuracy of canopy temperature quantification and assess the quality of thermal orthomosaic when using thermal sensor of different focal length and image acquisition at varying flying altitudes of a sUAS. **METHOD:** Three thermal infrared cameras were selected with focal lengths 9mm, 13mm, and 19mm. All three cameras were flown at altitudes 20m, 50m, and 80m, to collect aerial imagery of 7,000 m2 soybean field. The cameras were mounted on a quadcopter. All flights were conducted at 3 m/s flying speed, and 1 second shutter trigger. A ground reference system provided ground truth data for thermometric transformations. Imagery data was compared to assess differences in number of images collected, percentage overlap required for 1 second shutter trigger, quality of orthomosaic and accuracy of canopy temperatures. **RESULTS:** Results show that 13 mm focal length and 50 m altitude result in a finer resolution orthomosaic. The canopy temperatures were quantified accurately regardless of altitude and focal length. **CONCLUSIONS:** In conclusion, for thermal aerial imagery a sensor of 13 mm focal length flown at 50 m provides good quality data for soybeans.

Relevance of Research to State-Related Topic(s)

Kansas has 15000 soybean farms and in 2017 Kansas farmers harvested 5.1 million acres of soybean. Each year there are efforts by Kansas Soybean Commission to help farmers increase their soybean yields. For this they are funding research for HYV and drought resistant soybean seeds. Kansas Soybean Commission is also promoting remote sensing as a tool to evaluate and phenotype various varieties. Thermal imagery is an important tool for used for phenotyping various crops. This technology is still in development stage so there is need for research related to thermal imagery to help scientist develop better varieties to increase the soybean yield by the state.

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