Research and the State

GRADUATE STUDENT POSTER SESSION

Program Booklet

Thursday, October 31, 2019
Union Courtyard

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
K-State Student Union Courtyard

Research posters will be presented by 43 K-State graduate students and 1 K-State Veterinary Research Scholar representing five academic colleges and 28 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
Big 12 Room (K-State Student Union 2nd Floor)

The top 10 graduate student poster presenters selected to represent K-State by presenting their posters at the 17th annual Capitol Graduate Research Summit (CGRS) in February 2020 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

HOW LONG DROUGHT CAN ZOYSIAGRASS TOLERATE IN KANSAS?

Manoj Chhetri, Jack Fry, and Dale Bremer
Department of Horticulture and Natural Resources, College of Agriculture

BACKGROUND AND PURPOSE: In Kansas zoysiagrass is widely used in golf course fairways and lawns. With increasing restrictions in water use, demand for turf requiring less water that maintains acceptable quality is high. We conducted a study to evaluate the effectiveness of four different irrigation-triggering methods to understand how long drought can 'Innovation' zoysiagrass tolerate. METHOD: A poly-house rainout shelter was constructed to avoid natural precipitation that housed 12 plots, each plot measured 10' x 6'. We applied four different irrigation based on four different triggering thresholds: 1) 1.2 inches per week applied three times in a week; 2) 60% deficit evapotranspiration (ET) applied three times in a week; 3) ~15% soil water content; 4) ~10% soil water content. We collected visual turf quality and normalized difference vegetation indices ratings, and image analysis in each plot once a week to evaluate the treatment differences. The longest drying period was of seven weeks and recovery was assessed with same parameters for four week thereafter. **RESULTS/FINDINGS:** When irrigated at ~15% soil water content, turf quality and coverage were above the minimal acceptable level throughout the study period, while at ~10% soil water content, ratings were acceptable until three weeks and declined thereafter. We found that cumulative water use rate was the highest in 1.2 inches treatment and the lowest in ~10% soil water content threshold. **CONCLUSION:** This study demonstrated evidence to show that irrigation scheduling on zoysiagrass if based on soil water content can significantly save water while maintaining the acceptable quality.

Relevance of Research to State-Related Topic(s)

In turf industry, managers are hungry for water saving measures, which has in fact inspired our study. We were motivated by the fact that if we can save just 1 gal water in our 60 sq. ft plot in one irrigation time, we can save about 700 gal of water in one acre. To no surprise, this will translate to cutting about 150 thousand gallons of water in one year in one 30-acre golf course fairways. There is no doubt that in near future, restriction on water use rate will be harsher and turf industry will be one of the earliest ones to be hard hit with the changes. Therefore, the research work towards developing water conservation strategies while maintaining the functional quality of turf is warranted. We are hopeful that our findings will help turf mangers to re-visit their irrigation routines and save irrigation water.

2

INTEGRATING MOBILE INFRASTRUCTURE AND CYBER-PHYSICAL TECHNOLOGY TO IMPOSE HIGH NIGHT-TIME TEMPERATURE STRESS ON WINTER WHEAT

Nathan Hein[1], Dan Wagner[2], Raju Bheemanahalli[1], Carlos Bustamante[1], Troy Ostmeyer[1], Mitchell Nielsen[2], S. V. Krishna Jagadish[1]

[1]Department of Agronomy, College of Agriculture; [2]Department of Computer Science, Carl R. Ice College of Engineering

BACKGROUND: High night-time temperature (HNT) stress occurring during the grain-filling period is known to result in grain yield and quality losses in wheat. Currently there is no approach that allows scientists to impose HNT stress on crops under field conditions involving a large diverse panel of genotypes with the ability to maintain a dynamic temperature differential. For proof of concept, smaller scale custom heat tents utilizing a custom cyber-physical system were able to impose an average stress of 3.2 °C at night compared to the outside ambient temperature on 12 genotypes which resulted in a reduction in yield and biomass. **METHOD:** In order to impose HNT stress on a panel of over 320 accessions, custom heat tents were constructed with the ability to maintain an ambient daytime environment while still retaining the capability to impose HNT stress. Stress was imposed via an upgraded cyber-physical system and heaters after flowering and completed at physiological maturity. **RESULTS:** The experiment was successful in imposing an average HNT stress of approximately 3.8 °C which resulted in an average reduction of the grain-filling duration by 7.6% with a maximum reduction of 17%. Central sections were harvested at physiological maturity to quantify yield and yield components including harvest index, 1000 grain weight, and seed size. **CONCLUSION:** The imposition of HNT stress during grain-filling significantly reduces the duration of the grain-filling period and results in both yield and quality losses. More studies must be completed to identify tolerant genotypes in order to bolster the HNT tolerance of future wheat varieties.

Relevance of Research to State-Related Topic(s)

The importance of wheat to the state of Kansas could not be underestimated. Kansas produces almost one-fifth of all wheat grown in the United States of America and about a third of all farmers in the state raise wheat. Our research is not based in some hypothetical that has very little chance of happening. The conditions that were tested are already being seen in the American South. As these conditions slowly become prevalent in our region, our research shows that Kansas yield, with current varieties, would decrease by 5% for every 1 °C that the temperature increases overnight. This decrease in yield will first affect Kansas farmer's but, when combined with the reduced quality of the grain, the baking and brewing industries will also be directly affected.

3

GRAIN SORGHUM AS A PRIMARY FEED INGREDINT USED IN EXTRUDED CAT FOOD

Eric Maichel[1], Sajid Alavi[1], and Aulus Carciofi[2]

[1]Department of Grain Science and Industry, College of Agriculture; [2]Sao Paulo State University (UNESP), Sao Paulo State University, Jaboticabal, Brazil

BACKGROUND AND PURPOSE: Pet food production around the world is growing at a rapid pace. Along with that growth, alternative sources of main ingredients is being actively researched for a variety of reasons. One of the options for replacing corn and rice is grain sorghum. Factors such planting acres competition and public bias are two main challenges that are currently impeding the further use of sorghum in the U.S. This study seeks to replace the use of corn and rice with grain sorghum in the production of a premium extruded cat food. **METHOD:** Two different types of sorghum (red and white) at three different grind sizes (0.5 mm, 1.0 mm, 1.5 mm) were substituted into developed premium diets and were extruded with a single screw extruder (Wenger X20/E325) to produce dry expanded cat food. The diets were evaluated for physical-chemical characteristics, palatability and in vitro digestibility. **RESULTS/FINDINGS:** Expansion results indicate a trend of 1.0 mm grind having the greatest expansion and the 1.6 mm grind to have the least. Texture data shows an increasing trend in hardness as the particle size increases between the two sorghums with no real trend as compared to corn and rice. The palatability results concluded that the sorghum-based diets showed a preference towards the sorghum and to the 1.0 mm grind size; most likely due to the hardness of the kibble and the relative lack of expansion. **CONCLUSION:** Grain sorghum is a suitable replacement for corn and rice in premium extruded cat diets with little negative and numerous positive effects.

Relevance of Research to State-Related Topic(s)

Grain sorghum is already grown in Kansas, so the processing, transportation and infrastructure is currently in place. Due to its ability to grow in arid regions, the use of less water to grow is a great advantage for decreasing the total water usage and stabilizing the water tables in Kansas. The continued use of sorghum as an animal feed is positive, but increasing the use for human foods as new methods of cooking and food preparation become available increase the value of the crop. The use in pet foods varied use of sorghum as human food, animal feed and for energy (biofuels) also makes sorghum a great source of solutions to many tough issues facing Kansas in the future and helping Kansas to continue to help people and animals lead better lives.

4

FUNCTIONAL STARCH PROPERTIES OF EXTRUSION PRE-COOKED CHICKPEA FLOURS

Randall Martin[1], Mehreen Iftikhar[2], Yong Chen Shi[1], Hulya Dogan[1], and Sajid Alavi[1]

[1]Department of Grain Science, College of Agriculture; [2]Department of Microbiology, University of Kirachi, Pakistan

BACKGROUND AND PURPOSE: Chickpeas and pulses are rapidly becoming a popular ingredient in today's food industry. Chickpeas provide many benefits including being nutritious and sustainable. Some drawbacks to chickpeas include a poor functionality in baked products. Extrusion processing was proposed to pre-cook the starch and remove volatile and anti-nutritional compounds. Different varieties processing conditions were tested to create a pre-cooked flour that was then analyzed. Milling flow sheets were previously developed to produce a meal (300-750microns) from whole and split chickpeas. **METHOD:** Two varieties of chickpeas, D and K, were milled at Hal Ross flour mill to produce a de-hulled chickpea meal that was then extruded using a pilot scale twin screw extruder, dried, and then milled back into a flour (<150 microns). Flours were evaluated on degree of starch cook, damage, and functionality in baked crackers. A commercial pre-cooked chickpea flour was used for comparison. **RESULTS/FINDINGS:** Varietal differences led to different specific mechanical energy trend and cooking that lead to appearance and shape differences in intermediate extruded products. Varying extrusion processes lead to differences in color, water absorption, paste viscosity, and cracker texture than raw or commercial samples. Extruded chickpea flours (ECPF) have a higher cold paste viscosity than both raw and commercial chickpea flours. Crackers baked with ECPF sheet better than raw flours showing enhanced functionality. **CONCLUSION:** ECPF has better cold paste functionality than raw or commercial flours. Extrusion provides a sustainable low water method to enhance the properties and characteristics of chickpeas.

Relevance of Research to State-Related Topic(s)

Chickpeas popularity has great potential for Kansas's economy and agriculture. Chickpeas need less water to grow than staple crops like corn. They are also nitrogen fixers that do not require any additional fertilizer to grow. Chickpeas can be a new alternative rotation crop between harvests replacing nitrogen back into the soil. The popularity increase in chickpea could also lead to higher commodity prices and provide additional income to Kansas farmers and businesses. Processing of chickpeas can be done local as well as previous work has shown with minimal changes many wheat mills can efficiently process chickpeas. This research and previous research (unpublished) lead to several patentable processes for converting chickpeas into a higher value ingredient, such as milling flow sheets and extrusion processes. The patents would provide additional revenue to Kansas State University and the company sponsoring the project.

5

UNDERSTANDING *LISTERIA MONOCYTOGENES* BIOFILM SUSCEPTIBILITY TO SANITATION BY USING NOVEL HURDLE TECHNOLOGIES

Ellen Mendez[1], Brian Tande[2], and Valentina Trinetta[1]

[1]Food Science Institute, College of Agriculture; [2]College of Engineering and Mines, University of North Dakota

INTRODUCTION: In the food industry, inadequately cleaned equipment represents a potential source for *Listeria monocytogenes* contamination. This pathogen has shown niche adaptation to food processing facilities and its ability to form biofilm is a hurdle for food safety. Even if good sanitation practices can minimize the pathogen survival, difficult-to-clean sites in plants are still high risk areas. The combination of sanitizers with UV light might represent an effective way to control pathogen growth. **PURPOSE:** The objective was to evaluate the effect of UV-C light and sanitizers (alone or in combination) on *L. monocytogenes* biofilm-forming ability on stainless steel. **METHODS:** A Center for Disease Control and Prevention (CDC) Biofilm Reactor was used to grow 4-days-old multi-strain *L. monocytogenes* biofilms at 30 °C with Tryptic Soy Broth + 0.6%Yeast Extract as the media source. Hurdle technologies were evaluated: UV-C light (254nm) for 15 or 30min, and sanitizers for 10min: lactic acid (4%), quaternary ammonium (400ppm) or peracid (200ppm). Combinations between UV-C light and sanitizer were evaluated. Biofilms with no exposure to hurdle technologies were used as a control. **RESULTS:** *L. monocytogenes* biofilm cells ranged from 5.5 to 6 LogCFU/cm^2 for control samples. UV-C light reduced the biofilm in 1.5-1.8 LogCFU/cm^2 (P<0.05). Peracid sanitizer reduced biofilms in 4.20 LogCFU/cm^2 and quaternary ammonium in 2.7 LogCFU/cm^2 reduction. A synergistic effect was observed between lactic acid and UV-C light (P<0.05). **CONCLUSION:** A possible synergistic effect was observed between lactic acid and UV-C light. These hurdle technologies might help control *L. monocytogenes* biofilm formation.

Relevance of Research to State-Related Topic(s)

Foodborne outbreaks can cause serious diseases on the population. *Listeria monocytogenes* is a high-concerning foodborne pathogen that cause around 260 deaths each year according to the CDC. This bacterium has the ability to grow at refrigeration temperature and show a high biofilm-forming ability making it a hurdle for food safety. My research is focused in studying the susceptibility of *L. monocytogenes* biofilms to hurdle technologies such as UV-C light, sanitizers and the combination of both to understand how to control its growth and therefore reduce the incidence of food contamination.

6

EFFICACY OF NOVEL, REDUCED-RISK INSECTICIDES AS AN ALTERNATIVE MANAGEMENT TACTIC FOR POST-HARVEST INSECTS IN FOOD FACILITIES

Hannah Quellhorst[1], Frank H. Arthur, and W.R. Morrison III[2]

[1]Department of Entomology, College of Agriculture; [2]USDA-ARS, Stored Product Insect and Engineering Unit, Manhattan, KS

BACKGROUND: One fifth of all wheat grown in the United States is grown in Kansas. Kansas stores more wheat than any other state. Kansas's farmers produced 645 million bushels of corn in 2018, ranking 5th in the country for corn acreage planted. However, every year, 10-30% of cereal crops such as corn and wheat, are lost to insects after harvest. The most important stored products insect pests of corn and wheat are the maize weevil (*Sitophilus zeamais*) and the invasive larger grain borer (*Prostephanus truncatus*). Weight loss in corn grains due to these insects is about 10–20% and 34–40%, respectively. Given the importance of these global staple crops, and their particular relevance to Kansas's agriculture, it is therefore imperative to develop and utilize new management tools to protect these commodities from post-harvest insect pests. **METHODS:** In this study, we investigated the efficacy of a new insecticide, the insect growth regulator combined with the pyrethroid deltamethrin and the synergist piperonyl butoxide (Central Life Science), at inducing mortality and causing sublethal changes in movement for adult *P. truncatus* and *S. zeamais* exposed on a treated concrete surface for varying periods. **RESULTS:** We were able to induce significant mortality and reduced movement for individuals exposed to the new compound compared to controls. **CONCLUSION:** Overall, these results suggest that this new insecticide combination is a very promising tool for controlling these insects in warehouses where bagged corn is stored, and could be incorporated in integrated pest management programs to protect stored maize.

Relevance of Research to State-Related Topic(s)

Agriculture in Kansas is worth $47.9 billion, and the post-harvest industry is a large 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 use of reduced-risk insecticides opens up an opportunity for alternative tactics to combat the loss of fumigants, which also pose a lower threat to human, animal, and environmental health when used in food storage facilities. Our results may help to establish a safe, and cost-effective method of pest control with less need for fumigants and other more toxic pesticides. This technology may ultimately help Kansas, rightly known as the breadbasket of the world, while helping it continue to play a vibrant role in feeding our society's growing population for decades to come.

GROUP 2

7

KANSAS SOIL HEALTH PARTNERSHIP

Carlos Bonini Pires, William Davis, Marcos Sarto, Dorivar Ruiz Diaz, Ignacio Ciampitti, and Charles W. Rice
Department of Agronomy, College of Agriculture

BACKGROUND AND PURPOSE: The goal of this project is to measure and communicate the environmental benefits of different agricultural practices and provide a set of regionally specific data-driven recommendations that farmers can use to improve the productivity and sustainability of their farms. To achieve this goal, two farmers in Kansas were accepted into the program to conduct on-farm comparison of a standard farm practice and an improved practice. **METHOD:** The first site was located near Glen Elder with a Harney silt loam soil. The improved practice involved advanced N management in a long-term no-till sorghum-corn rotation with a mix of cover crops. The second site was located near Bucyrus with a Grundy silt loam. At this site, the improved practice was the incorporation of cover crops into a long-term no-till corn-soybean rotation. The experimental design was four replicated strips of the farmer standard practice and the improved practice. Soil samples were taken on GPS coordinated grid at three soil depths: 0-5, 5-15, and 15-30 cm. Soil health indicators including standard nutrient analysis, soil organic matter, phospholipid fatty acid (PLFA), and enzyme activity were measured. Baseline data was analyzed and interpolated maps were created using ArcGIS and R software to verify correlations between soil health indicators and between indicators and crop yield. **RESULTS AND CONCLUSION:** Significant ($P < 0.0001$) correlation were found between all PLFA biomarkers (total microbial biomass, gram-negative bacteria, gram-positive bacteria, arbuscular mycorrhizal fungi, saprophytic fungi, and fungal: bacteria ratio) and soil organic matter. Results suggest soil organic matter may drive soil health in agroecosystems.

Relevance of Research to State-Related Topic(s)

Soil health is defined as the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans. Soil health is a concept that encloses ecological soil attributes chiefly associated with the soil microbiome and the range of functions it performs. The goal of the project is to measure and communicate both the economic and environmental benefits of different agricultural practices. The research aim is to generate recommendations that farmers can use to improve the productivity and sustainability of their farms through soil health. It is crucial having a better understating of how soil health is interacting with crop productivity and how soil health management strategies can address the issues that compromise the sustainability of croplands for future generations in Kansas.

8

SIMPLE SEQUENCE REPEATS (SSR) AS MARKERS FOR *RATHAYIBACTER TOXICUS* EVOLUTIONARY HISTORY

Kseniya Chumachenko, Jarred Yasuhara-Bell, and James P. Stack
Department of Plant Pathology, College of Agriculture

BACKGROUND AND PURPOSE*: Rathayibacter toxicus* is a plant pathogenic bacterium that can infect several grass species and is vectored by *Anguina species* (nematodes). *R. toxicus* forms bacterial galls in developing grass ovules where it produces tunicamycin, a lethal neurotoxin. Grazing animals that consume toxic galls containing tunicamycin develop convulsions and staggers, often resulting in death. *R. toxicus* is indigenous to Australia, but concern for global spread and potential impact to livestock industries resulted in its U.S. Select Agent designation. Several studies support genomic subpopulation groupings and have identified a newly emerged population (RT-I) in South Australia, but its unique attributes preclude determination of its origin. Determining evolutionary heritage is important for understanding how and from where the bacterium emerged. **METHOD**: Simple Sequence Repeats (SSRs) are short tandem nucleotide repeats that vary in size and number of repeats among and within genomes; they generally have fast mutation rates, which may aid in phylogenetic and phylogeographic analyses. SSRs may also be used as diagnostic markers. **RESULTS/FINDINGS**: Whole genome sequences of 16 strains of *R. toxicus* were used for SSR discovery and analysis. Individual SSRs varied across strains within previously established populations; hence, phylogenetic trees showed conflicting results. Therefore, caution is needed when using SSRs for evolutionary dynamics studies. For *R. toxicus* diagnostics, individual SSRs show a spectrum of specificity from species to strain level. The individual SSRs tested in this study varied with respect to level of discrimination within and among genetic populations; some SSRs were unable to discriminate among all populations.

Relevance of Research to State-Related Topic(s)

If *Rathayibacter toxicus* arrived here in Kansas and the U.S., it could potentially survive on multiple grass species, creating a lethal toxin which would be dangerous for grazing animals. Therefore, it is important to study *R. toxicus* for both plant and animal health concern. Animal agriculture is a large part of the U.S. economy and way of life. Such a potential threat should not be overlooked even if it does not currently exist in the U.S. Increased globalization has caused increased trade of countless agricultural products, so not only are these products moving across the world, but so are the pathogens that may be traveling with them, and it is not always possible to contain them in time. Currently, *R. toxicus* is present across multiple states in Australia, with some reports in South Africa. We want to better understand this pathogen and determine its evolutionary trajectory by studying its genetics.

9

LAND USE EFFECT ON SOIL MICROBIAL COMMUNITY COMPOSITION ACROSS A PRECIPITATION GRADIENT OF KANSAS

James Lin, Marcos V. M. Sarto, Carlos A. B. Pires, and Charles W. Rice
Department of Agronomy, College of Agriculture

BACKGROUND AND PURPOSE: The precipitation gradient across Kansas increases from less than 400 mm in the west to over 1000 mm in the east. Diverse land uses (native prairie and cropland) coupled with a changing precipitation gradient effects the soil microbial community composition and soil health. The land uses were investigated at four different precipitation regimes across the State of Kansas (Tribune, Hays, Manhattan, and Welda, KS). Similar soil measurements with slightly different methods were compare between private and public institutions to determine the most effective soil test method. Thus, the soil health across Kansas and the diverse soil health procedures are evaluated in progression. **METHOD**: Microbial biomass and composition were analyzed by phospholipid fatty acid analysis (PLFA). Other soil health measurements included microbial biomass C and N (MBC, MBN), water stable aggregates, soil respiration, soil C and N, and infiltration. **RESULTS AND CONCLUSION**: Total PLFA was greatest in native prairie followed by cropland. Total PLFA increased as precipitation increased (Welda> Manhattan> Hays> Tribune). Total bacterial community (gram negative, gram positive, and actinomycetes) increased in native prairie as precipitation gradient increased (Welda> Manhattan> Hays> Tribune). Arbuscular mycorrhizal fungi was highest under the greatest precipitation regime in all land use (Welda). Soil macroaggregates (>2000 mm) were higher in native prairie then cropland. Soil C and N increased with increasing precipitation and was higher in native prairie.

Relevance of Research to State-Related Topic(s)

Human health and wellness is dependent on proper maintenance of soil for agricultural productivity and ecosystem services. A set of biological, chemical, and physical soil health indicators can provide a holistic overview and comparison for understanding different soil systems and functions. My research reflects the difference in soil quality of native prairie, conventional agriculture, and enhanced agriculture across the Kansas precipitation gradient. The overall dataset also reflects different methods and measurements of soil health used diversely between private and public institutions.

10

DIFFERNTIAL RECOVERY OF NITROGEN CYCLING SOIL MICROBIAL FUNCTIONAL GROUPS FOLLOWING CESSATION OF CHRONIC FERTILIZATION

Matthew Nieland, Priscilla Moley, Janaye Hanschu, and Lydia H. Zeglin
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BACKGROUND AND PURPOSE: Globally, nitrogen (N) availability has increased, primarily through atmospheric deposition and N fertilization. Changes to fire disturbance have also resulted in altered N dynamics, with fire suppression allowing for N accumulation. Augmented N availability typically changes the composition of soil microbial communities and promotes the loss of N from ecosystems, yet how microbial communities and N processing respond to fertilizer cessation remains unclear. N-reliant functional groups were expected to recover from chronic fertilization more quickly than the whole microbial community. **METHOD:** Soils were collected montly from April-September 2017 from a 30-y plot-scale experiment at Konza Prairie that manipulated available N through annual burning (or no burning) and annual N fertilizer application until 2017 when fertilization ended. The population size of N-cycling microbial functional groups, N processing, and microbial community composition were measured. **RESULTS/FINDINGS:** During the first growing season without N fertilization in 30 years, total inorganic N available for plants and microbes declined with NH_4^+ concentrations similar to reference control soils. Ammonia-oxidizing bacteria had recovered fully, while the archaea did not, and the denitrifying bacterial populations had contrasting responses. Nitrification potentials dropped to reference controls, and the denitrification potentials fell, albeit remained high. Fertilizer cessation did not change the microbial community composition. **CONCLUSION:** How microorganisms recover from long-term fertilization appears to depend on how directly the organisms' metabolism relies on supplemental N, yet functionally-similar populations recover differently. Fire aids minimally to microbial recovery during the first year of fertilizer cessation, but soil N loss is driven by both denitrification and burning aboveground biomass.

Relevance of Research to State-Related Topic(s)

Sustaining plant growth for either animal or crop production is a critical aspect for land management. Most land ecosystems are limited in nitrogen (N), and available N is influenced by several practices, such as fertilization and prescribed burns. In the Flint Hills of Kansas, which support one of the largest remnants of the tallgrass prairie, the combination of N enrichment and fire suppression impacts grassland biodiversity and ecosystem services. Further, long-term fertilization can also support elevated soil N loss even after fertilizer application has ceased. Soil microorganisms drive nutrient cycling, such as N, and could impact the recovery of ecosystems and distinctively managed lands. Therefore, the legacy of chronic fertilization needs to be taken into considerable context, along with the role of soil microorganisms, for land management.

11

OPTIMAL SITING OF SOIL MOISTURE SENSORS IN IRRIGATED PRODUCTION FIELDS

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BACKGROUND AND PURPOSE: The rapidly growing need for improved water conservation has propelled the adoption of soil moisture sensors (SMS). As a result, there is a growing concern among producers, irrigation managers, and scientists about the optimal placement of a limited number of sensors across irrigated fields. In this study, we investigated a new method to guide the placement of SMS based on the underlying soil moisture spatial patterns. Our hypothesis is that large production fields exhibit temporally stable soil moisture patterns that can be used to guide the permanent siting of soil moisture sensors. **METHOD:** The study was conducted in 2018 in an irrigated corn field (115 acres) near Hutchinson, KS and during 2019 in an irrigated corn field (54 acres) near Moundridge, KS. In each field, we collected over 250 georeferenced soil moisture observations in the top 12 cm of the soil profile using a hand-held sensor. Measurements were taken during the fallow period in different soil moisture conditions. Time stability analysis and the k-means clustering technique were used to delineate field management zones based on soil moisture patterns. The optimal location of SMS was defined by finding the most centralized and the least variable location within each management zone. **RESULTS AND CONCLUSIONS:** Preliminary results confirm the presence of distinct and temporally-stable soil moisture patterns that can be effectively used to inform the siting of a limited number of SMS. Ongoing work is aimed at better understanding the underlying of soil physical properties governing the distinct soil moisture patterns of the fields.

Relevance of Research to State-Related Topic(s)

Water scarcity and depletion of the groundwater reservoirs threaten the sustainability of food production in many areas of the High Plains. Our project is focused on developing a protocol to determine the optimal location of soil moisture sensors in irrigated fields to enhance water irrigation management crop production. This project will help farmers, managers and scientists to have a quantitative protocol to deploy the soil moisture sensors looking to improve water use efficiency, reduce soil erosion causing by run-off and water pollution caused by lixiviation from agriculture systems.

12

HARNESSING THE WILD SIDE TO IMPROVE WHEAT CURL MITE RESISTANCE

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BACKGROUND AND PURPOSE: Genetic diversity is the foundation for crop breeding. When genetic diversity is scarce, we can return to the source of origin to explore wild relatives as donors of novel sources of diversity. *Aegilops tauschii* is the donor of the D genome of the cultivated bread wheat. It has been used as a valuable source of novel genes for many economically important traits such as pest and disease resistance. Wheat curl mite (WCM) is a threating pest for wheat, mainly because of vectoring wheat streak mosaic virus. The objective of this study was to characterize a diverse panel of *Ae. tauschii* accessions against WCM and identify genomic region associated with resistance that can be used to breed wheat against WCM. **MATERIAL AND METHOD:** We tested 234 accessions (109 from lineage 1 and 125 from lineage 2). WCM infestation was performed under controlled conditions and the plants were tested 14 days after infestation. Phenotypic response to WCM was recorded using a 0 to 4 scale, where 0 was resistant (R) and 1-4 different levels of susceptibility (S). Genotyping-by-sequencing data was used to map genomic regions associated with WCM resistance. **RESULTS:** The diverse panel resulted in 190 S and 44 R accessions. Strong population structure was identified within the accessions, consistent with the lineages. Mapping analysis resulted in a major genomic region on chromosome 6S. **CONCLUSION:** This study identified genomic regions involved in resistance to WCM in wild wheat. Further analysis of these regions will reveal if they are novel or already present in cultivated wheat varieties.

Relevance of Research to State-Related Topic(s)

Kansas is the wheat state, producing about a fifth of the nation's crop each year and exporting roughly 50% of the crop. Every year the state production is threatened by many biotic factors. Genetic resistance is the most environmentally friendly and cost-effective management solution to fight biotic threats. One of the most prevalent and damaging disease for wheat in Kansas is the viral disease wheat streak mosaic virus (WSMV) transmitted by the wheat curl mite (WCM). Therefore, wheat resistance to WCM also helps control WSMV, and preventing yield losses. To date, only four resistant genes against WCM have been named, all of them derived from wild relatives of wheat. My research explores new sources of genetic resistance to WCM in the wild donor of the D genome of wheat, Aegilops tauschii. Moreover, Kansas holds the bigger collection of this grass in a unique germplasm bank at the wheat genetics resource center at Kansas State University. Our results may help in the deployment of new wheat varieties with new and fine-tuned resistance to WCM that farmers can proudly grow in Kansas and all over the country to reduce insecticide application without compromising the final yield.

13

SEASONAL EFFECTS OF COVER CROPS AND PHOSPHORUS FERTILIZER MANAGEMENT ON SOIL HEALTH PARAMETERS IN A NO-TILL CORN-SOYBEAN CROPPING SYSTEM IN NORTH EASTERN KANSAS

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BACKGROUND AND PURPOSE: Changes in cover crop and P fertilizer management can affect the soil thus changing nutrient cycling potential. The objective of this research was to document the effects of cover crops, P fertilizer management, and season on soil health metrics related to nutrient cycling, microbial activity, and available carbon. **METHOD:** A no-till, corn-soybean rotation was established in 2014 and divided into 18 plots. The experimental design was a randomized complete block designed with a 2*3 factorial treatment structure: two cover crop treatments [fall-sown cover crop (CC)/no cover crop (NCC)] and three phosphorus (P) fertilizer treatments [27 kg P^{-1} ha fall broadcast (FB), spring injected (SI), or no P application (NP)]. Samples were analyzed for nutrient turnover (enzyme activity), microbial metabolic activity (soil respiration), and labile carbon (potassium permanganate oxidized carbon). **RESULTS/FINDINGS:** Carbon, nitrogen, and phosphorus cycling enzyme activity was greater in cover crop treatments versus no cover crop ($p<0.01$). Soil respiration was 38% greater in the cover crop treatments in spring 2018 ($p=0.02$) but not in fall 2018 or spring 2019. The addition of cover crop increased labile carbon, 22% and 16% compared to the no cover crop treatment in spring 2018 and 2019, respectively ($p< 0.05$), but was not significant in fall 2018. **CONCLUSION:** These results suggest that cover crops in no-till have a positive effect on soil health metrics that persist for several months after termination. Measurements of enzyme potential appear to be more sensitive to treatment effects over seasons while estimates of labile carbon and soil respiration are more variable.

Relevance of Research to State-Related Topic(s)

Conservation agriculture is important to Kansas as it has been shown to protect water quality, reduce erosion, and conserve topsoil. Unfortunately, many of the effects from these management practices are not captured by traditional soil tests. Additionally, it is unclear if adding two conservation practices, such as cover cropping and no-till, will provide improved conservation benefits. This research is relevant to state conservation goals by testing the sensitivity and accuracy of soil health metrics and by using these measurements to quantify the additional soil health benefit of implementing cover crops in no-till systems. Improving the measurement of soil health and optimizing the implementation of conservation techniques will help maximize our cropping systems and minimize negative environmental outcomes.

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SEASONAL EFFECTS OF COVER CROPS AND PHOSPHORUS FERTILIZER MANAGEMENT ON PLFA AND MICROBIAL BIOMASS IN A NO-TILL CORN-SOYBEAN CROPPING SYSTEM IN NORTH EASTERN KANSAS

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BACKGROUND AND PURPOSE: Soil microorganisms are integral to soil health, specifically in their contribution to nutrient cycling. Soil management techniques have been shown to impact the community structure of soil microorganisms. To better understand the interaction between crop management and soil microorganism composition, this study explored the effect of cover crop and phosphorus (P) fertilizer management on microbial community structure. **METHOD:** Soil samples were collected from the Kansas Agricultural Watershed Field Laboratory to assess microbial community composition and size at one soil depth (0-5 cm) in spring 2018 and at three soil depths (0-5, 5-10, and 10-15 cm) in fall 2018. The experiment has a 2 by 3 factorial treatment structure with two levels of cover crop (with and without) and three levels of P fertilizer management (control, fall broadcast, and spring injected) in a randomized complete block design with three replicates of each treatment combination (18 plots total). Soil samples were analyzed for Phospholipid fatty acid (PLFA) and microbial biomass C and N. **RESULTS/FINDINGS:** At the 0-5 cm depth, microbial biomass from PLFA analysis was significantly higher across cover crop treatments than in non-cover crop treatments, regardless of fertilizer treatment. The presence or absence of cover crops did not change the ratio of microbial composition in any category of the PLFA analysis which included a breakdown of fungi, bacteria, and eukaryotes. P fertilizer management was found to have a minimal impact on microbial biomass and PLFA analysis. **CONCLUSION:** This work further contributes to understanding how microbial communities respond to cover crop and P fertilizer management.

Relevance of Research to State-Related Topic(s)

Agriculture matters to the people of Kansas; as of 2018 agriculture contributes roughly 14% of the state GRP (according to Kansas Dept of Ag 2018). This research examines how farming practices reduce water use, improve yield, and impact the quality of the soil. A better understanding of how the soil is impacted by these practices could lead to reduced cost to growers while maximizing sustainability and yield. Soil microbes are responsible for breaking down nutrients and making them available for plants. Studying the microbial community offers an opportunity to look at short-term and long-term agricultural impact. This study examines the use of cover crops on soils that are not tilled. This research helps address if cover crops continue to provide soil quality benefits in no-till fields.

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THE MYCOBIOTA ASSOCIATED WITH *AEDES ALBOPICTUS* AND *CULEX RESTUANS* LARVAE

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BACKGROUND AND PURPOSE: Mosquito microbiota studies revealed the impact of gut colonizing bacteria on several mosquito traits, including vector competence to several mosquito-borne disease pathogens. In mosquitoes, fungi constitute as a larval food source or pathogens for the control of larvae and adults. In the aquatic habitat, mosquito larvae interact with diverse fungal communities during filter-feeding and grazing on plant detritus. It is unclear how far mosquito-fungal interactions contribute to mosquito larval mycobiota and physiology. Our pilot study aimed to characterize the mycobiota associated with field-collected *Aedes albopictus* and *Culex restuans* mosquito larvae to ultimately determine the drivers of mycobiota composition and its impact on mosquito physiology. **METHOD:** Mosquito larvae and the corresponding aquatic habitats were sampled during Fall 2017 from three sites in Manhattan, KS. Mycobiome compositions were assessed through barcoded amplicon sequencing of the Internal Transcribed Spacer Region 2 (ITS2) using the Illumina MiSeq platform. Fungal operational taxonomic units (OTU) were assigned using mothur (v.1.38.1) bioinformatics pipeline. **RESULTS:** Preliminary results suggest that the mycobiota differed among habitats, as well as between habitat and mosquito larvae with regards to the dominant OTUs and OTU richness. In addition, fungal communities within mosquito guts were more similar to the aquatic habitat compared to the carcasses from the same mosquito larvae. **CONCLUSION:** This study provides a first glimpse at the diversity of the mycobiota associated with field-collected mosquito larvae whose composition is driven by several factors, including the environmental conditions, fungal as well as mosquito physiology.

Relevance of Research to State-Related Topic(s)

Mosquitoes pose a threat to us by transmitting numerous disease-causing agents. In Kansas, the population of *Aedes albopictus* mosquitoes, the secondary transmitter of Dengue and the Zika virus, is booming. My research aims at (1) identifying mosquito larval-fungal interactions in the field and determining its contribution to the mosquito population dynamic; and (2) identifying potential local strains of entomopathogens that can be used for survival bioassays on different mosquito species adults and larvae in the aim of identifying successful biological control agents for mosquitoes.

GROUP 3

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EFFECTS OF PROSTATE CANCER AND EXERCISE TRAINING ON LEFT VENTRICULAR FUNCTION AND CARDIAC AND SKELETAL MUSCLE MASS

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BACKGROUND: Prostate cancer is the most common type of non-skin cancer found in men. Recent evidence suggests prostate cancer independent of treatment has atrophic effects on whole heart and left ventricular (LV) mass associated with a reduced endurance exercise capacity. We tested the hypothesis that exercise training will mitigate prostate cancer-induced cardiac and skeletal muscle atrophy and improve LV function versus sedentary tumor-bearing counterparts. **METHODS:** Copenhagen rats (n=39; ~5 mo. old), randomized into four groups; exercise-trained tumor-bearing (EXTB) or control (EXCON) and sedentary tumor-bearing (SEDTB) or control (SEDCON). Dunning R-3327 prostate cancer cells were injected orthotopically in 19 of the 39 animals. Treadmill exercise training was performed for 60 min/day for ~30 days. Animals underwent echocardiography to examine ventricle dimensions pre-cancer injection or exercise (PRE) and 15 (Post 1) and 32-35 (Post 2) days post-cancer cell injection with tissues collected after Post 2. LV cytokine concentrations were measured post-mortem. **RESULTS:** Cardiac and LV mass of SEDTB animals were lower than all groups ($p<0.05$). Tumor mass was negatively correlated with LV mass in EXTB (-0.75, $p<0.02$) and SEDTB animals (-0.72, $p<0.02$). EXCON group had higher stroke volume Post 2 assessment compared to both sedentary groups ($p<0.05$), but not EXTB animals. No difference between cytokines were found between cancer groups. **CONCLUSION:** This study demonstrates the atrophic effects of prostate cancer on cardiac and skeletal muscle mass independent of anti-cancer treatment(s) that can be mitigated with moderate intensity exercise. These findings have notable implications for potentially improving therapeutic outcomes and quality of life for prostate cancer patients.

Relevance of Research to State-Related Topic(s)

Recently cancer overtook heart disease as the leading cause of death in the US, and with an incidence rate in the top 20 of all states, this is an area of major concern for Kansans. Prostate cancer is the most common type of non-skin cancer found in men making it a target of research today. Cancer is deadly, but aside from itself, the most common cause of non-cancer related deaths in cancer patients is heart disease. Heart disease is often attributed to cancer therapy regimes called cardiotoxicity. However, preliminary evidence suggests prostate cancer independent of treatment has atrophic effects on whole heart and left ventricular (LV) mass which are associated with reduced endurance exercise capacity in rats, highlighting an additional malignancy possibly contributing to cardiotoxicity or heart disease seen in cancer patients and survivors today.

WITHDREW

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DROSOPHILA TRIM32 COOPERATES WITH GLYCOLYTIC ENZYMES TO PROMOTE CELL GROWTH

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BACKGROUND AND PURPOSE: Control of tissue and organismal size requires the continual reprogramming of metabolic pathways to integrate biosynthetic and degradative signals. During cell growth and/or proliferation, one such mechanism that promotes the accumulation of cellular material is a switch from oxidative to glycolytic metabolism, whereby glycolytic intermediates are diverted towards anabolic pathways. How this switch is regulated in different tissues is not clear. Herein we identify a novel role for the tripartite motif (TRIM) family member, TRIM32, in the maintenance of glycolytic flux. **METHOD:** Using a proteomics approach, we uncovered the glycolytic enzymes Aldolase (Ald) and Phosphoglycerate mutase (Pglym) as TRIM32 interacting proteins. **RESULTS/FINDINGS:** Loss of Drosophila TRIM32, encoded by the thin (tn) gene, showed a reduction in glycolytic activity and amino acid abundance in whole larvae. This altered metabolic profile caused a striking reduction in the overall size of two inherently glycolytic larval tissues – somatic muscles and the developing brain. **CONCLUSION:** Consistent with a role for glycolytic intermediates in glycolysis-driven biomass production, nutritional supplementation of amino acids in tn mutants restored muscle mass. Many tumors favor glycolytic metabolism to maximize substrate production for uncontrolled cell growth and proliferation. Remarkably, wing disc-associated tumor growth is abolished upon loss of TRIM32. Our results reveal a novel connection between TRIM32 in maintaining glycolytic enzyme levels and upregulated pathway activity for the sustained growth of normal and cancerous tissue growth.

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.

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DEVELOPMENT OF A SUBCUTANEOUS EAR IMPLANT TO DELIVER AN ANAPLASMOSIS VACCINE TO DAIRY STEERS

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BACKGROUND AND PURPOSE: Bovine anaplasmosis is the most prevalent tick-transmitted disease of cattle worldwide and a major obstacle to profitable beef production. Use of medicated feed to control anaplasmosis infections throughout tick season has raised concerns about the emergence of antimicrobial resistance in bacteria that pose a health risk. The objective of this study was to develop a single-dose vaccine to produce long-lasting immunity against anaplasmosis infections. **METHODS:** Twelve steers were administered 3-component, single-dose vaccines against *Anaplasma marginale (Am)* major surface protein 1a. The inoculation consisted of a soluble injection administered for immune priming, a polyanhydride depot for intermediate release of vaccine to boost immune response, and an implant for extended antigen release deposited subcutaneously in the ear. Six calves were randomly given vaccines with components containing a combination of two different adjuvants (Group A). The remaining calves were randomly given vaccines with components containing the same adjuvant (Group B). Calves were later challenged with *Am* and monitored for fever, decreased hematocrit and bacteremia. **RESULTS:** Calves in Group A had higher hematocrits than calves in Group B ($P = 0.006$) at day 35 post-infection. Similarly, calves in Group A were less likely to require antibiotic intervention compared with calves in Group B ($P = 0.014$). **CONCLUSIONS:** These results indicate that calves exhibited diminished clinical signs of anaplasmosis when vaccine antigen was delivered with a combination of adjuvants as opposed to a single adjuvant. Results demonstrate the feasibility of providing long lasting protection against clinical bovine anaplasmosis infections using an implant.

Relevance of Research to State-Related Topic(s)

Vaccine development is of particular importance to animal health as antibiotic overuse and efficacy are increasing concerns of agriculturalists and the general public, alike. Today, producers have fewer options when it comes to treating bacterial infections with over-the-counter antibiotics, and prescription treatments are often expensive and require veterinary oversight. Vaccines can help preserve herd health without the need to intervene with costly and potentially ineffective antibiotics after disease onset. This is an especially effective strategy for cattle operations that are managed extensively over vast expanses of land. Cattle raised in this way, as is common in Kansas, are often impractical to treat (and retreat) with antimicrobials during disease outbreak. Effective vaccination protocols can limit the need to work cattle with such frequency and maintain herd health in environments where animals are not routinely or easily caught. Work presented here is congruent with efforts by legislators to safeguard agriculture in Kansas.

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DO EFFECTIVE ANTIBIOTICS REQUIRE STEREOCENTERS? THEY DO NOT.

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BACKGROUND AND PURPOSE: Antibiotic resistance is a growing issue around the world. The number of deaths caused by resistant bacterial infections is on the rise and is expected to surpass cancer as the leading cause of death worldwide by 2050. It is vital that new antibiotics are put on the market that are readily produced, cost-efficient, and effective. **METHOD:** A new family of copper-activated drugs can be used to treat bacterial infections, including Methicillin-Resistant Staphylococcus aureus and Mycobacterium tuberculosis. These novel drugs are easily synthesized and manipulated to achieve maximum effectiveness. Structure activity relationship studies are currently underway to discover what is most important about the chemical structure to maintain potent killing of the bacterial infection. **RESULTS/FINDINGS:** It has been shown that small changes to the structure make a large impact, sometimes as much as yielding a nearly ten-fold increase in activity. Many of the NNSN molecules that have been synthesized are more effective at killing the bacteria than Vancomycin, which is the current form of treatment. **CONCLUSION:** Nearly 100 novel NNSN drugs have been synthesized and the number is continuously growing. These compounds can be used to treat bacterial infections by reacting with copper (I) found naturally within the body. This allows for a targeted approach as copper (I) can only be found at the disease site because it is toxic to normal cells. Theoretically, the patient can be dosed with a large amount of this drug without worry of side effects because of this specificity.

Relevance of Research to State-Related Topic(s)

Antibiotic resistant infections affect the health of Kansas and the threat is becoming ever more dangerous. Additionally, the treatment of these infections and the increasing number of cases expected will lead to a large escalation of health care cost. Novel NNSN drugs are more effective than the established treatment and they can be made more cost-effectively because they are much more quickly and easily synthesized than drugs like Vancomycin because they do not contain any stereocenters. The specific nature of these drugs also means that side effects are less likely, which can also save the state money by preventing the need for further drugs or procedures to alleviate any negative side effects.

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INVESTINGATING THE OCCURANCE OF TRANSPLACETNAL ANAPLASMA MARGINALE TRANSMISSION IN ENDEMIC BEEF CATTLE HERDS

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BACKGROUND AND PURPOSE: Bovine anaplasmosis is a bacterial disease of cattle caused by the bacterial pathogen *Anaplasma marginale*. Anaplasmosis is endemic in Kansas beef cattle herds with approximately 47% of Kansas beef herds actively infected with *A. marginale*. Transmission of *A. marginale* to naïve animals can occur via ticks (the most efficient and only biological vector) or blood-contaminated surgical instruments and biting fly mouthparts. Anaplasmosis literature states that transplacental transmission between dam and calf may also occur, however, robust data on the frequency of transplacental transmission is lacking. This study was designed to investigate the frequency of transplacental *A. marginale* transmission in highly endemic cow-calf herds. Knowing how and when cattle become infected with *A. marginale* is important when developing anaplasmosis management strategies. **METHOD:** Two fall-calving cow-calf herds with high incidence of anaplasmosis were identified. Blood samples were collected from dams and calves and were tested for *A. marginale* infection using a molecular test to detect *A. marginale* DNA. **RESULTS AND CONCLUSION:** The *A. marginale* infection incidence of the dams was 65.8% and 85.7 % for each cow-calf herd, respectively. The *A. marginale* infection rates of the calves will be examined within one month of birth and again between 5-7 months of age. Knowing how and when cattle become infected with *A. marginale* is important when making herd anaplasmosis management strategies, including retention of *A. marginale*-infected dams, use of antibiotics for the purpose of anaplasmosis control, and integration plans for new animals entering an endemic herd.

Relevance of Research to State-Related Topic(s)

Bovine anaplasmosis is the most prevalent tick-transmitted disease of cattle worldwide and a major obstacle to profitable beef production in the U.S. As the third largest beef-producing state, effective anaplasmosis management strategies are essential to support profitable beef production in Kansas. As approximately 47% of Kansas beef cattle herds are actively with *Anaplasma marginale*, the causative agent of anaplasmosis, contemporary data-driven recommendations on effective anaplasmosis management are increasingly needed. Knowing how and when cattle are becoming infected with *A. marginale* is important in developing anaplasmosis management recommendations. This study examines the contribution of transplacental transmission as a source of initial *A. marginale* infection and maintenance of anaplasmosis endemic herds.

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FLUORESCENCE ASSAYS FOR DETECTION, DISCRIMINATION AND QUANTIFICATION OF SIDEROPHORES

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BACKGROUND: Iron is vital for bacteria, as it plays a central role in energy production, intermediate metabolism, DNA synthesis etc. Bacteria secrete siderophores that specifically chelate iron and actively transport this ferric siderophore complex. Siderophore production and ferric siderophore acquisition are frequently associated with microbial infections. To survive in hosts, pathogenic bacteria obtain iron with TonB dependent ferric siderophore transport systems. For example, the outer membrane protein FepA actively transports the iron complex ferric enterobactin (FeEnt), and the inner membrane protein TonB provides the energy for this uptake reaction. I created fluorescent sensors that monitor high affinity binding reactions, and used them to detect, discriminate and quantify ferric siderophores, as either isolated iron complexes or in complex mixture of metabolites and other biochemicals. **METHOD:** By introducing site-directed Cys residues in bacterial iron transporters and modifying them with maleimide fluorophores, we generated living cells that bind but do not transport target compound. By cloning, genetically engineering and fluoresceinating ferric siderophore transporters, we created specific sensors for the native, degraded and glucosylated forms of the catecholate ferric enterobactin, for the hydroximates ferric aerobactin, ferrichrome and ferrioxamine B, for the porphyrins hemin and vitamin B_{12}. **RESULT AND DISCUSSION:** When employed in spectroscopic analysis, these constructs sensitively detected ferric siderophores, and measured their concentrations in solutions. Sensitive Assays of Biochemical specificity, affinity, and capacity are valuable for both basic research and drug discovery. The sensors, which we created monitored production of siderophores by the pathogens, each of which manifested a particular profile of iron chelator production.

Relevance of Research to State-related topics:

ESKAPE pathogens (Enterobacter, Staphylococcus, Klebsiella, Acinetobacter, Pseudomonas and Escherichia) are the leading cause for the nosocomial infections around the globe. According the reports, 2/3rd of the nosocomial infections are caused by ESKAPE pathogens. As stated before, siderophore production and ferric siderophore acquisition are associated with microbial infections; we used the sensors to study siderophore secretion by ESKAPE bacteria. This would be vital step forward to sense pathogens siderophore secretion profile in a quick manner and then respond either with appropriate antibiotics to block this ferric siderophore acquisition or to conventional antibiotics targets.

WITHDREW

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RELIABILITY OF ULTRASOUND IMAGING OF THE MEDIAL GASTROCNEMIUS IN A LOADED AND UNLOADED POSITION

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BACKGROUND AND PURPOSE: Diagnostic ultrasound (US) is commonly used to assess structural characteristics of muscle (pennation angle,PA; muscle thickness,MT; fascicle length,FL; echo intensity,EILong). These characteristics can serve to inform clinicians of the quality and potential strength of a muscle. Typically, US assessments are performed in a non-weight bearing position, lying or sitting, depending on the muscle as to avoid structural alterations that may occur due to axial compressive forces. However, non-weight bearing positions may not appropriately capture muscle structure during functional movements (standing, walking, etc.). **METHODS:** Twelve healthy females (mean±SD:age=19.42±1.16yrs) volunteered for this investigation on 2 non-consecutive days at the same time of day. Each visit, participants were placed in the unloaded (ULD) position (laying prone on table with the low leg extended) and a loaded (LD) position (standing with weight shifted to right leg). Two longitudinal US images were obtained of the medial gastrocnemius (MG) from both ULD and LD positions on each visit. Reliability was determined using intra-class correlation coefficient (ICC, model2,1) and standard error of measurement (SEM) also reported as a percentage (SEM%). Systematic variability was examined using separate one-way repeated measures analyses of variance (ANOVAs). **RESULTS:** The ANOVAs indicated no systematic variability in any of the dependent variables (P>0.05). The ICCs and SEM values expressed as a percentage of the mean for UL PA, MT, FL, EILong, ranged from 0.980-0.996 and 4.132-10.264%. **CONCLUSION:** Overall, these finding suggest that US imaging of the MG in an ULD and LD position may be a reliable and a beneficial technique for practical examinations of muscle architecture.

Relevance of Research to State-Related Topic(s)

Non-invasive assessments of muscle structure are advantageous for programs and initiatives while at the same time informing clinicians and physicians diagnosing, treating, and rehabilitating Kansans. By demonstrating ultrasound's reliability in the traditional unloaded position as well as in the more functional standing, loaded position this study could provide a better understanding of performance deficits which ultimately promote strategies that optimize performance and reduce the risk of injury in the active population here in Kansas.

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ISOLATION AND CHARACTERIZATION OF TWO *ANAPLASMA MARGINALE* ISOLATES

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BACKGROUND AND PURPOSE: Bovine anaplasmosis is a tick-borne bacterial disease caused by Anaplasma marginale, a pathogen that can be found worldwide and is endemic throughout the United States. Anaplasmosis is conservatively estimated to cost the U.S. cattle industry >$300 million per year. To be most informative in studies evaluating different anaplasmosis control strategies, use of actively circulating strains for challenge studies is important. The objective of this study was to locate and multiply two isolates of A. marginale actively circulating in Kansas cattle and characterize the progression of infection and severity of clinical disease in adult beef cattle. **METHOD:** Adult beef cows containing A. marginale strains not previously isolated or studied were identified from the Kansas State University Cow-Calf herd, a herd naturally-endemic for anaplasmosis. Blood samples containing these unique strains (KS1 and KS2), were collected and sub-inoculated into splenectomized calves for isolate multiplication. Once a high parasitemia was reach in the splenectomized calves, infected blood was harvested and preserved. To determine virulence of these isolates, adult beef cows were intravenously inoculated, and progression of infection and clinical disease were monitored. **RESULTS/FINDINGS:** KS1-challenged animals reached clinical anaplasmosis ~3 days earlier than KS2-challenged animals. KS1-challenged animals reached a peak bacteremia of 1x106.5 bacteria per milliliter of blood while KS2-challenged animals reached levels of 1x108.9 per milliliter of blood. **CONCLUSION:** Both KS1 and KS2 isolates produced clinical anaplasmosis in challenged animals that required treatment intervention. Infection kinetics differed significantly between KS1- and KS2-challenged animals with KS2-challenged animals developing significantly greater bacteremia levels.

Relevance of Research to State-Related Topic(s)

Most approved and current control strategies for bovine anaplasmosis rely heavily on the use of antibiotics in feed. Some strains of A. marginale have shown susceptibility differences to the approved in-feed antibiotic, chlortetracycline. Increasing concerns over the efficacy of the current FDA-approved chlortetracycline dosage to control active anaplasmosis, based on efficacy studies performed decades ago, suggest that efficacy should be re-evaluated using actively circulating A. marginale strains. As the third largest beef-producing state in the U.S., efficacy evaluation of antibiotic-based anaplasmosis management is important to promote profitable beef production in Kansas. The aim of this study was to characterize the virulence of actively circulating A. marginale strains in Kansas and compare the progression of bacteremia between strains to generate data to be utilized in future studies on treatment and prevention of anaplasmosis in adult beef cattle.

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NOVEL THERAPEUTIC TREATMENT REDUCES MELANOMA GROWTH

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BACKGROUND AND PURPOSE: Melanoma is the deadliest form of skin cancer and is becoming one of the most common forms of cancer in young men and women. The growth of tumors is dependent on the formation of new blood vessels to provide oxygen and nutrients. Beta2 glycoprotein 1 (β2-GPI) is a protein in the blood that can either increase or limit blood vessel formation. We hypothesize that the therapeutic treatments developed from β2-GPI may block melanoma tumor growth and blood vessel formation. **METHOD:** We tested novel treatments on mouse melanoma growth and development of new blood vessels. Melanoma grew for ten days in mice with or without the treatment. Tumors were removed for further studies. **RESULTS/FINDINGS:** After ten days, the tumors in treated mice were less than half the size of tumors from untreated mice. The treated tumors also were less developed, due in part to changes in blood vessels. Blood vessel cells in culture moved slower after the therapeutic treatment compared to control treated cells. **CONCLUSION:** These results show that our novel treatments significantly reduce melanoma growth. This suggests a future treatment for melanoma and possibly other forms of cancer.

Relevance of Research to State-Related Topic(s)

The American Cancer Society lists melanoma as the fifth most common cancer in Kansas and predicts nearly 900 new cases within the state in 2019 alone. The Center for Disease Control (CDC) predicts that the average age of melanoma diagnoses will decrease in the next decade while the rate of diagnoses will steadily increase. With the threat of melanoma becoming more common every year, it is imperative to focus research on melanoma treatment and prevention. Our research offers a treatment that may become a promising melanoma treatment. Our therapeutics could be used a treatment on their own as well as in combination with other techniques. The significant decrease in melanoma size with our treatment may provide more time for surgical intervention and longer patient survival. While melanoma may always be a serious concern, novel treatments like ours can be a life-saving difference.

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EFFECTS OF NEUROMUSCULAR FATIGUE ON MAXIMAL AND RAPID STRENGTH CHARACTERISTICS OF THE SHOULDER INTERNAL ROTATORS

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BACKGROUND AND PURPOSE: Investigate the effects of submaximal contractions on maximal and rapid strength recovery of the glenohumeral internal rotators in college-aged males. **METHODS:** Fourteen (mean ± SD: age = 24.3 ± 3.3 yrs) males performed a familiarization and a submaximal fatigue session, separated by 7(±1) days. Experimental session began with maximal voluntary contractions (MVCs) followed by a fatigue-inducing protocol consisting of intermittent isometric contractions of the glenohumeral internal rotators using 50% of MVC until volitional fatigue. For each MVC, peak torque (PT), peak rate of torque development (RTDpeak), early (0-50 milliseconds, RTD50), and late (0-200 milliseconds, RTD 200) RTD were examined. MVCs were again performed at 0, 7, 15, and 30 min post-fatigue. A one-way repeated measures ANOVA was used to analyze all torque data. **RESULTS:** Significant main effects for time were observed for all maximal (PT) and rapid (RTDpeak, RTD50, and 200) strength variables. PT was greater at Pre compared to Post 0 ($P = 0.001$), and Post 7 ($P = 0.034$), however no differences were observed at all other recovery time points ($P > 0.05$). Early rapid strength was significantly lower at all post-fatigue time points compared to Pre for RTDpeak ($P = 0.001$-0.009), and RTD50 ($P = 0.001$-0.030). However, late rapid strength (RTD200) was significantly lower only at Post 0 ($P = 0.001$), and Post 7 ($P = 0.034$) compared to Pre. **CONCLUSION:** These findings suggest fatigue-induced deficits in maximal and rapid strength exhibit differential recovery patterns that may potentially lead to an increased risk of musculoskeletal injury.

Relevance of Research to State-Related Topic(s)

Changes in shoulder kinematics due to increased fatigue of the internal rotators may accompany greater risk of musculoskeletal injury. Youth sports with high velocity throwing activities such as baseball may have a greater incidence of shoulder injury due to accumulating fatigue within the shoulder internal rotator musculature. The proposed increase of injury risk in youth throwing athletes may lead to greater incidence on surgical interventions and rehabilitation cost to the state of Kansas. Pitch Smart guidelines set forth by the USA Baseball Medial and Safety Advisory Board should be implemented to help reduce incidence of injury for youth throwing athletes. Proper coaching techniques such as limiting pitch count and implementing appropriate rest and recovery between pitch outings should be compatible with guidelines in an attempt to reduce incidence of shoulder injury and the associated medical costs.

GROUP 4

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SCREENING AND DISCOVERY OF SYMBIOTIC AND ANTAGONISTIC MICROBIAL NETWORKS USING EXTRACTABLE MICROWELL ARRAYS

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BACKGROUND AND PURPOSE: Understanding the dynamic interactions among microbes in complex, multi-species communities is a grand challenge in microbiology. However, uncovering important interactions is critical for understanding community structure and function, response to environmental perturbations, and for design of constructed communities. Here, we present a high-throughput microwell array platform designed to screen a vast array of interactions within a microbiome and uncover those with highest levels of symbiosis or antagonism on a microbial focal species. **METHOD:** The platform generates ~10^5 unique, multi-membered microbial networks by combining a GFP-producing test species *Pantoea* sp.YR343, a plant growth promoting isolate from *Populus deltoides* rhizosphere, with the *P. deltodies* root microbiome, each in 10-µm diameter microwells. *Populus deltoides* is a Kansas native plant species with enormous potential as biofuel feedstock. Wells with highest/lowest levels of *Pantoea* growth after co-culture were identified and isolate mixtures were sequentially extracted from wells using a patterned illumination system for 16S sequencing and follow-up validation in 96-well plate format. **RESULTS/FINDINGS:** Using this approach, we screened, isolated and validated an antagonistic *Stenotrophomonas maltophilia* strain, as well as a 5-membered *Psuedomonas-Enterobacter* symbiotic network. Follow-up, off-chip analysis on the latter revealed that symbiosis occurred only when all five members were present, demonstrating the unique capability of the platform to identify emergent phenotypes elicited exclusively by multi-membered consortia. **CONCLUSION:** This knowledge will inform the development of beneficial consortia that promote the production of *Populus* biofuel feedstock, while the platform can be adapted to screen interactions across any microbiome of interest.

Relevance of Research to State-Related Topic(s)

Achieving a fundamental understanding of higher-order microbial interactions that occur in environmental microbiomes is critical for predicting the function of communities and for rational design of constructed communities. However, very few experimental tools have been developed to explore the vast number of unknown interaction that exist within an environmental microbiome. In my research, we described a new approach to high-throughput screening and discovery of multi-species networks that antagonize or promote the growth of *Populus deltoides* to enhance biofuel and biofertilizer production. The approach has the unique capability to uncover multi-membered networks that lead to emergent phenotypes, knowledge informative for the formulation of consortia for biofertilizer, biocontrol, human microbial therapies, and production of biosynthetic compounds. I would like to refer my research to Kansas House Standing Committee on Energy and Environment and Kansas House Standing Committee on Agriculture and Natural Resources.

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MAGNETIC SKYRMIONS IN ATOMIC THIN CRI_3 MONOLAYER

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BACKGROUND AND PURPOSE: Magnetic skyrmion, a quasiparticle with topologically protected spin textures hosted in magnetic systems, are of great interest because of their future applications in logic and memory devices. After the experimental demonstration of atomic thin van der Waals 2D magnets, there has been great interest in the possible observation of 2D skyrmions in them. CrI_3, a 2D van der Waals material shows a ferromagnetic (FM) ordering at a monolayer limit at temperatures below 45K. Both Dzyaloshinskii-Moriya type interaction (DMI) induced skyrmions and 2D Moire induced skyrmions have been recently proposed in CrI_3. But, understanding of their large scale (sample scale) evolution and dynamics is missing which is further needed for the physical study of skyrmionic devices in CrI_3 systems. **METHOD:** In this work, using Landau-Lifshitz Gilbert (LLG) model and first-principle calculations we theoretically compute the occurrence of skyrmions in monolayer CrI_3. **RESULTS AND CONCLUSIONS:** Our calculations revealed that the isolated skyrmionic spin textures evolved in a wide range of applied magnetic field. We found the chiral domain walls or helical states in the 2D monolayer CrI_3 along with the presence of skyrmions at low magnetic field strengths. However, with increasing strength of the magnetic field, the density of occurrence of chiral domains reduces converging and forming separate skyrmions.

Relevance of Research to State-Related Topic(s)

With Moore's law of device scaling seeking transformative changes for future of electronics, A number of alternative ideas have been proposed, among which spin-based electronics (spintronics) poses huge promise. Magnetic skyrmions although with less propagation velocity than conventional domain walls, require less current density for propagation. Hence skyrmionic systems (skyrmionic racetrack memory) have been proposed as potential candidates for future data storage technologies.

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NANOSCALE MANIPULATION OF CARBON NANOTUBE STRUCTURE WITH ULTRAFAST LIGHT-MATTER INTERACTION

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BACKGROUND AND PURPOSE: Carbon Nanotubes have been extensively studied in more than two decades for their physical and chemical properties, and more recently in their industrial applications, including wafer scale nano-electronic devices and nanocomposite structures. The interest in carbon nanomaterials has been greatly enhanced by the rise of graphene, the two-dimensional analog of the one-dimensional tubes. Due to their extreme scaled-down geometry, particularly the diameter, a small perturbation in their structure could induce large changes in their electronic properties. However, such controlling their structure is difficult to achieve due to processing complexity in a growth reactor. **METHOD:** In this work, we use a fast, scalable and room temperature process to alter the nanotube structure by exploiting the light-matter interactions from a femto-second laser radiation. Multi-wall carbon nanotubes are irradiated with pulsed laser beam to modify the tube structures. And we use scanning electron microscopy, atomic force microscopy and Raman spectroscopy to study the structural properties of these carbon nanomaterials. **RESULTS AND CONCLUSIONS:** In conclusion, we developed a fast, flexible, and scalable method to generate graphene nanoribbons (GNRs) and carbon crystals from multiwall carbon nanotubes (MWCNTs) simultaneously. This method provides an ability to arrange nanocrystal formation pattern (form along the tube-like structure) in a linear chain geometry. Furthermore, this method could be used to down-scale the size of nanodiamonds by choosing nanotubes of smaller diameters. These unique topological structures such as nanoribbons and nano-crystals embedded nanoribbons could be used as nano-probes and nano-sensors for a wide variety of applications, ranging from biomedical imaging to optoelectronic devices.

Relevance of Research to State-Related Topic(s)

Carbon nanomaterials have great physical (electrical, optical, mechanical, and thermal), chemical, and bio-chemical properties due to their unique electronic structures. Carbon nanoribbons are the nanometer wide strips of graphene with ‘topological electronic states’ that makes them unique from graphene and nanotubes. In Sub-20nm regime the properties get enhanced due to ‘quantum signatures’ that could make these materials special. Laser unzipping method turned out to be a green method because it can avoid contamination from chemical catalysts and other induced nanoparticles in other existing methods. Our method could bring a manufacturing route of these materials with potentially a number of applications such as nanoelectronics, nanophotonics, spintronics and biomedical imaging.

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GRAPHENE: IMPACTING THE FUTURE OF KANSAS

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BACKGROUND AND PURPOSE: Throughout the last decade, graphene has become one of the latest sensation materials of research, due to the uniqueness of its physical properties, which include excellent electrical and thermal conductivity, optical transparency and mechanical strength. For this reason, researchers are exploring possibilities to use graphene in areas, such as nanoelectronics, sensors, batteries, supercapacitors, and hydrogen storage. However, taking complete advantage of graphene has been difficult since large-scale production methods are not simple and economical. The largest issue remains in maintaining sheet separation of graphene to prevent irreversible agglomeration and restacking of sheets forming multilayer graphite. Therefore, the purpose of this project is to develop a novel, simple, and economical method for the preparation of graphene/graphene oxide particles from explosion-synthesized graphene to overcome the issue of agglomeration and restacking of graphene sheets. **METHOD**: For this study, the Fenton Oxidation method was implemented, in which iron (II) reacts with hydrogen peroxide in aqueous solution, ultimately leading to the oxidation of graphene in a much safer environment. **RESULTS/FINDINGS**: Graphene/graphene oxide particles were synthesized which have excellent dispersibility in water, and possess the mechanical and electrical properties of graphene, after reduction or removal of the graphene oxide shell. **CONCLUSION:** This study developed a simple and economical method, using Fenton oxidation, for producing processable graphene which can be easily up-scaled while maintaining the unique properties of graphene.

Relevance of Research to State-Related Topic(s)

Thanks to the significant success achieved, this project managed to get the attention of major national and international investors (USA, Canada, Poland), who are interested in building a graphene production facility in Manhattan, Kansas in the years to come. This achievement will not only lead to an economic development in Kansas, but it will also attract other investors and researchers interested in exploiting the properties of graphene. Ultimately, graphene besides causing a major economic impact, can be used to create major impacts in other areas such as 1) health, by developing sensors for early detection of different diseases, 2) environment and energy, by developing environmentally-friendly materials for energy storage systems and concrete production. In reality, this project will not only impact people around Manhattan area, it will have an impact on Kansas, the entire nation, and the entire world.

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BENEFICIAL RECOVERY OF AMMONIA FROM SWINE WASTEWATER FOR REUSE AS TARGETED SLOW RELEASE FERTILIZER

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BACKGROUND AND PURPOSE: Swine wastes contain high concentrations of nutrients and organic matter. Anaerobic membrane bioreactor treatment (AnMBR) of swine wastewater offers the benefit of simultaneous resource recovery as energy and water for indirect potable reuse, along with the potential for controlled capture of Nitrogen (as Ammonium) and Phosphorus (as Ortho-Phosphate). This study uses clinoptilolite clay, an abundant natural zeolite that is capable of selectively removing ammonium ions from the AnMBR treated permeate using the ion-exchange mechanism. Subsequently, the ammonia saturated clinoptilolite can be used as a slow release fertilizer for conventional or organic agriculture. **METHOD:** Bench-scale experiments for ammonia removal from AnMBR treated synthetic swine effluent were undertaken. Further, soil incubation experiments aimed at using ammonia saturated clinoptilolite as a fertilizer is being carried out to understand the mechanisms of ammonia transformation and release in the soil. **RESULTS/FINDINGS:** The maximum ammonia removal of 18.2 mg NH_4-N/g clinoptilolite was observed at initial concentration of 600 mg NH_4-N/L. The column study revealed that the breakthrough concentration of 20 mg NH_4-N/L (5% initial concentration) was reached after 16.7 Bed Volumes (BV) and 23.9 BV for the treated swine permeate and ammonium chloride solutions, respectively. Both external film and intra-particle diffusion were identified as the fundamental mechanisms for ammonia adsorption using clinoptilolite with intra-particle diffusion being the rate limiting step. **CONCLUSION:** Overall, implementing this study will enhance soil quality, prevent nutrient (N and P) contamination in surface water and groundwater aquifers while enabling sustainable recovery of ammonia from animal wastes for use as fertilizer.

Relevance of Research to State-Related Topic(s)

The major outcomes of this project will be to produce a potential ammonia-based slow release fertilizer from the anaerobically treated agriculture/livestock wastes from an AnMBR platform. Benefit to community: This project will spawn new innovations within public water, wastewater, and energy utilities in Kansas to consider AnMBRs as a means to achieve energy positive operation, while still meeting stringent nutrient discharge goals. Finally, AnMBRs will create a greener workforce in the rural Kansas communities, pivoted around nutrient product marketing, water and renewable energy (biogas) management, as well as reused water reallocation budgeting, without compromising cropland and food safety. Protection of environment: Implementing the project would enhance soil quality, prevent NO^{3-} and P contamination in surface water and groundwater aquifers, and eliminate greenhouse gas emmisions due to land application of agriculture waste biosolids.

GROUP 5

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VOLATILITY OF KANSAS FARM INCOME

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BACKGROUND AND PURPOSE: Farm income in the United States varies greatly from year to year, due to factors such as commodity prices, business cycles, and changes in yield. Large, unplanned fluctuations in farm income can put farmers at risk to repay or obtain loans, expand their business, and provide for their families. How farmers manage the risk of income volatility shapes their production and financial decisions and impacts both farm and household welfare. **METHOD:** This poster discusses farm income volatility of Kansas Farm Management Association farms and how it has varied across the state of Kansas, by type of farm, and over time. Farms may manage finances differently, so income volatility is calculated on both a cash and accrual basis. **RESULTS/FINDINGS:** Results show that small farms whose primary occupation was not farming were associated with greater farm income volatility but less volatile off-farm income than small farms whose primary occupation was farming. Specializing into livestock production was associated with more volatile income at both the farm and household levels. **CONCLUSION:** This study sheds light on how farm household income volatility differs by farm size and income source. United States agricultural policy historically sought to address farm income volatility through programs such as price supports, disaster assistance programs, and insurance programs. Results suggest that policymakers seeking to expand the farm safety net perhaps should consider differences by farm type and specialization. Although previous literature suggests farm household income volatility has declined over time, farm households still face significant volatility at the farm, off-farm, and household levels.

Relevance of Research to State-Related Topic(s)

According to the Kansas Department of Agriculture, the agriculture industry in Kansas supports 125,411 jobs and has a total direct output of approximately $46.4 billion per year—or over 40% of the state's gross regional product. United States farm policy has sought to minimize farm income fluctuations through programs such as price supports, disaster assistance programs, and crop insurance programs. However, several key sources of volatility, such as fluctuations in international trade and macroeconomic conditions remain. Farm families depend on farm income for their livelihood. Many may also seek off-farm employment in their community or change their production decisions if faced with large swings in income from year to year. The health of farm families depends on the economic health of local rural communities, and vice versa. All of Kansas benefits when both rural and farm families thrive.

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BAND OF BROTHERS (AND SISTERS): GENDER FRAMING IN U.S. ARMY COMMERCIAL ADVERTISING

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BACKGROUND AND PURPOSE: The U.S. Army spends over 7 billion dollars in recruitment advertising, with its largest percentages going toward television marketing. However, little research has been dedicated to military advertising besides strategic recommendations. This project offers a critical investigation on the depiction of gender in military advertising in relation to framing theory. **METHOD:** A content analysis on a sample of 54 U.S. Army commercials produced between 2008 and 2018 offers an exploratory discussion on how gender is visually and verbally framed within the Army's advertising. **RESULTS/FINDINGS:** Results indicated that the visual framing of gender surrounded by independent variables such as frequency, depiction, clothing, location, and overall visual focus were significant. Results indicated that the verbal framing of gender through variables such as narration and frequency of verbal focus within a clip were significant. This study found that males were more likely to be depicted in combat roles (97.8%), than females (2.2%). Although formally 'allowed' in combat roles, the commercials studied within this project still feature females more prominently in traditional gender roles such as civilian spouses (88.9%) and as medical aid (68.8%). Narration was always masculine. **CONCLUSION:** This study found significant correlations between gender and a range of variables in U.S. Army advertising. It also opened a new realm for possible exploration, looking at gender across Armed Forces advertising. Within this study, it appears females are featured less prominently than males in U.S. Army Commercials and in traditional gendered roles. However, future research is needed to study the implications of this study's findings.

Relevance of Research to State-Related Topic(s)

With Fort Riley down the street from KSU and Fort Leavenworth just a few hours away, my topic is very pertinent to Kansas specifically. Many of KSU's and KU's students come from military background and/or families and would be interested in my findings. In addition, Kansas' Army recruiting agencies can benefit from the results of this study in how to best market to a diversity of candidates in relation to gender and ethnicity. Kansas taxpayers also contribute to the billions spent in recruitment advertising. My study aids in many of the specific legislative focuses including community development, education, and workforce development. In addition, the standing committees most interested by this research would include Education, General Government Budget, Security, Federal and State Affairs, etc.

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EXPLORING GLOBAL SNACK FOOD MARKETS AND CONSUMERS TERMINOLOGIES TO GENERATE NEW TEXTURE CONCEPTS FOR PRODUCT DEVELOPMENT

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BACKGROUND AND PURPOSE: The food companies need to continue innovate products to uphold market leadership. The current markets are overloaded with products pools, the challenge is to innovate new products, and update the existing products to gain new consumers. Japan and South Korea snack food markets were chosen for new product idea generation. The collected products were profiled for appearance, texture, and flavor attributes, with major emphasis on textural attributes. The objectives are to apply white space analysis from mapping exercise and sensory descriptive profiling to find new opportunities for product innovation. The developed products are formulated by raw material and other ingredients produced locally in Kansas. This gives an advantage to boost the use of locally produced agricultural commodities. **METHOD:** Sensory professionals performed projective mapping, followed by sensory descriptive profiling by trained panelists to find white spaces, and consumer focus groups for testing concepts and prototypes. **RESULTS:** Developed a methodological procedure model to conduct product category assessment in an unfamiliar country (Japan). Published lexicon to profile snacks and snack like foods. Identified consumer terminologies from four different cultures (languages) used to describe perceived texture experience. Delivering four new snack food prototypes each year to industry partner. **CONCLUSION:** The study of products found in foreign countries can be beneficial to domestic companies or research institutions for product development or other research purposes. The developed methodology can be used by food manufactures to generate new product ideas. Differences in laws, language, customs, and culture can make international research a daunting task.

Relevance of Research to State-Related Topic(s)

The state of Kansas is a top producer of several raw materials and agricultural commodities that naturally gives an advantage to be a leader in finished foods and ingredients. The texture concepts generated in this research work can be turned into prototypes using raw materials produced by the state of Kansas. The utilization of raw material for example sorghum will not only deliver nutritional benefits to consumers but will also aid to cultivate a niche category market. The developed methods will help to identify the feasibility of products, identify target consumer, market testing, consumer testing, low development cost, and will advance in delivering consumer benefits. The state of art facilities at Center for sensory analysis and consumer behavior at KSU can function as hub for idea generation, idea screening, and concept testing. Overall, the above-mentioned actions will help to advance Kansas State agriculture economy.

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CONSERVING KANSAS COMMUNITIES THROUGH VOLUNTARY GROUP EFFORTS TO MANAGE OGALLALA GROUNDWATER

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BACKGROUND AND PURPOSE: Rural farm communities in western Kansas rely on groundwater from the declining Ogallala aquifer. We present findings from a four-year, USDA-funded research project on the values and motivations for groundwater conservation among Kansas producers (farmers). **METHODS:** We conducted a survey of 1226 producers across the Ogallala aquifer region (279 in Kansas), 41 interviews with Kansas producers, and a case study of the Wichita County Water Conservation Area. **FINDINGS:** An overwhelming majority of Kansas producers believe that Ogallala groundwater should be conserved. Their primary motivations for groundwater conservation are securing their way of life for future generations, supporting their local communities, and preparing for droughts. While most Kansas producers believe that they are already doing all they can individually to conserve water, producers involved in voluntary group efforts like Local Enhanced Management Areas and Water Conservation Areas are finding additional ways to conserve. Voluntary group efforts have tremendous opportunity to grow. While only 4% of Kansas producers are currently involved in organizing voluntary group conservation efforts, 81% are open to the possibility that such efforts can solve problems and 79% believe they might personally have something to contribute. Successful voluntary group conservation efforts involve: diverse stakeholder representation, an early focus on team-building, hiring an outside facilitator, frequent, respectful community outreach, and partnering with state and local government. **CONCLUSION:** Voluntary group efforts are effective at conserving groundwater and merit state support to help local organizers succeed and to create a social and political environment that encourages producers to participate.

Relevance of Research to State-Related Topic(s)

A sustainable water supply, a robust agricultural economy, and community development and quality of life in rural communities in western Kansas are dependent on the Ogallala Aquifer. Our research provides Kansas farmers/producers, policymakers and local communities with a better understanding of the values, opportunities and constraints driving Kansas producers' groundwater management decisions. We focus particularly on the opportunities for state government to work with Kansas producers to scale-up voluntary, group water conservation efforts.

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INVESTIGATING THE ROLE OF EXPERIENTIAL LEARNING IN OBTAINMENT OF SUSTAINABLE KNOWLEDGE: THE INCORPORATION OF SOCIAL, ECONOMIC, AND ENVIRONMENTALLY SUSTAINABLE RESOURCES INTO APPAREL PRODUCTION COURSEWORK.

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BACKGROUND: The lifecycle of a garment, from fiber to landfill, has a significant social, economic, and environmental impact. Achievement of broad sustainability goals and changes in the industry is contingent on appropriate education of future industry professionals. **PURPOSE:** The primary goal of this study was to determine the influence of experiential learning on students' comprehension of a sustainable supply chain. To accomplish this goal, we implemented a sustainable supply chain into a project in an introductory apparel course. Students were provided with locally-produced patterns and ethically sourced fabric. They were also guided through natural dying and print design. Outcomes were showcased at a fair-trade retailer. **METHOD:** Students were asked to participate in a qualitative survey. Students reported their understanding of the project components concerning sustainability. Data from this survey were analyzed using an open coding technique. Follow-up semi-structured interviews were held approximately seven months after the project concluded. **FINDINGS:** It was found that students needed more scaffolding within the experiential learning process to connect each part of the project to the stakeholders. Responses most often focused on the hands-on aspects of the plan (materials and natural dyes) and considerably less on the stakeholders removed from the classroom setting (sourcing agent and patternmaker). All respondents recognized the positive economic impact of using fair-trade fabric. Students identified the use of natural dyeing and printing as the primary way they reduced their environmental impact during the project. **CONCLUSION:** Findings from the follow-up interviews indicate a new and robust sustainable connection with materials because of this project.

Relevance of Research to State-Related Topic(s)

This project utilized the skills and knowledge of four female entrepreneurs working in the sustainable fashion industry in Kansas. The project began with a partnership with Zoe Schumm, owner of 4 All Humanity, based in Hutchinson. Zoe arranged the weaving and importation of the fabric for this project. The style of skirt was designed by Linda Lee, of the Sewing Workshop in Topeka. Notions and guidance were provided by Livie Olsen of Fenceline Fabrics in Manhattan. Lastly, the student's work was displayed at the retail store, Connected Fair Trade, owned by Amy Kay Pavlovich of Lindsborg. The effort of these entrepreneurs made this an economically and socially sustainable project, and exposed K-State students to viable career paths in the State of Kansas.

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COMPARISON BETWEEN CHECK-ALL-THAT-APPLY (CATA) AND CHECK-APPLY/NOT APPLY (CANA)

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BACKGROUND AND PURPOSE: Inclusion of consumer perceptions in product design and development is vital in the life cycle of a product. Without understanding consumers' choices and motivations, it is impossible for Kansas companies to sell products and ingredients. Check-All-That-Apply (CATA) has been used as a simple, fast and cost-efficient technique that collects consumers' opinions based on a list of product related-terms they can check or not. A variation of this technique is the Check-Apply/Not-Apply (CANA) where consumers are required to respond to each term. The purpose of this eating motivation survey was to examine CATA and CANA techniques. **METHOD:** One format of the questionnaire with CATA questions and another format of the questionnaire with CANA questions were randomly assigned to respondents from Brazil, China, India, Spain and the USA (N~200 per country). A total of 16 eating motivations for five food categories (Starchy, Protein, Dairy, Fruit and Sweet foods) were assessed. Each of the 16 eating motivations had 3 subscales with the exception of the Choice motive that had two subscales. Chi-square analysis that allowed for comparison of the CATA and CANA data was used. **RESULTS:** Results showed that CATA and CANA were different with CANA showing many more motivations in five countries. Also, consumers in China and Spain took longer to complete the CATA questionnaire while participants in USA, Brazil and India had similar time durations for the two survey formats. **CONCLUSION:** This research highlights the need for more qualitative research on methods that provides more understanding of consumer perceptions.

Relevance of Research to State-Related Topic(s)

The CATA technique is a common tool for product developers that guides decision making in many industries including those in Kansas. It helps in providing consumers around the world with their desired products. Unfortunately, it may be that the CATA question format underestimates consumer motivations which could be detrimental in selling products or ingredients elsewhere. CANA may help provide more detail.

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FACTORS THAT INFLUENCE MARKET PARTICIPATION FOR SMALLHOLDER MAIZE FARMERS FROM NORTHERN GHANA

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BACKGROUND AND PURPOSE: Ghana represents a unique economic environment. Although Ghana, overall, was successful in moving above the poverty line for sub-Saharan African countries, there remains a clear economic disparity between the northern and southern regions. Compared to their counterparts in the south, farmers in the northern region of the country face several environmental and economic hurdles that hinder the production and marketing of their principle crop, maize. Profit generating endeavors such as successful market participation are critical to reducing poverty as well as essential for sustaining the livelihoods of farmers in the north. The purpose of this research is to recognize factors that influence market participation and identify the principle marketing channels maize farmers utilize to sell their product. **METHODS**: A survey of 7,140 farmers in northern Ghana was conducted in 2015 by the United States Agency for International Development (USAID). The study sample contained 1,370 observations from which four marketing channels were identified: direct to consumer, wholesale/retail, contract buyer, and farmer-based organizations (FBO). A farmers' participation in a channel was determined by using a multinomial logit regression model that controlled for: age, gender, USAID program participation, household size, farmers' education, and the proportion of cropland dedicated to maize production. **RESULTS AND CONCLUSION**: The results indicate that farmers who participate USAID Programs or dedicate higher quantities of cropland to maize are more likely to sell to contract buyers due to program support and higher production quantities, respectively. Additionally, educated farmers are less likely to sell to FBOs which appeal to farmers with little education or experience.

Relevance of Research to State-Related Topic(s)

Kansas State University and the Feed the Future Innovation Lab focus in partnership with United States Agency for International Development focus on education and research that help farmers in Feed the Future countries tackle constraints on integrating smallholder operations, producer cooperatives, and agribusiness enterprises. Maize is one of the primary crops in Ghana and agricultural production is one foundational industries to the growth of a nation. By understanding the factors that influence market participation in smallholder farmers, poor or developing nations can increase the market participation by advising farmers on which markets to sell in to generate income. With Ghana being a Feed the Future country, and as the first African country to achieve the Millennium Development Goals set by the United Nations, it has the potential to serve as example for other sub-Saharan African countries facing similar challenges.

GROUP 6

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"BLAH BLAH BLAH CONDOMS AND STDS": EMERGING ADULTS' SUGGESTIONS FOR IMPROVING SEX EDUCATION IN SCHOOLS

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BACKGROUND/PURPOSE: Adolescents in the U.S. are disproportionately at risk for sexually transmitted diseases and pregnancy. Despite efforts to provide adolescents with sexual health information in schools to prevent these outcomes, research shows that many U.S. students report dissatisfaction with sex education and call for change. Literature in this area is sparse with only a handful of studies seeking the opinions of U.S. adolescents and young adults. To address this gap, our study sought to answer the following research question: What suggestions do U.S. college-attending young adults have for improving sex education in schools? **METHOD:** Participants consisted of 38 first-year students (50% females) recruited from a Southern public university. They participated in focus groups divided by gender, consisting of 5-8 participants per interview, and were compensated $20. A coding team of four trained research assistants then coded the interview transcripts using thematic analysis to identify salient themes. **RESULTS/FINDINGS:** Our analyses yielded five main suggestions for improving sex education. Participants wanted to receive basic information about sexuality (e.g., contraceptives, anatomy, etc.), cover LGBTQ-specific topics, address mental, relational, and emotional aspects of sex, receive sex education earlier and more frequently, and be presented with updated and realistic information. A small number of students also wanted information on sexual assault/coercion, suggested a sex positive approach, and specified desired characteristics of sex education teachers. **CONCLUSION:** Our findings show that school-based sex education is not meeting the needs of young people. Serious changes should be made in order to maximize the benefit of sex education.

Relevance of Research to State-Related Topic(s)

Currently, there is no Kansas legislation mandating school-based sex education. For schools who include sex education programming, no laws require that this information be medically accurate, age-appropriate, delivered by trained instructors, or include discussions of consent, STD/HIV prevention, or healthy relationships. This is problematic as sex education that is not comprehensive is seen by teens as unhelpful and inadequate. With almost half of Kansas high schoolers reporting having engaged in sexual activity, it is clear that sex education that adolescents see as informative, realistic, and trustworthy is crucial to protecting them from negative health outcomes. Our findings suggest that legislation should require that sex education not only be comprehensive, but also include updated, frequent, and inclusive information on a wide variety of sexual topics. By listening to the desires and needs of this important stakeholder group, legislators can help to promote sexual health in the next generation of Kansans.

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DIFFERENCES IN EXERCISE BEHAVIORS BY DIABETES STATUS: IMPLICATIONS FOR DIABETIC KANSANS' ACTIVITIES

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BACKGROUND: In Kansas, 10% of adults have type one or type two diabetes (T1D, T2D). Although Federal physical activity (PA) guidelines, including aerobic and strength training exercises are recommended for T2D; guidelines lack for T1Ds. A better understanding of differences in exercise behaviors between populations is needed. **PURPOSE:** This study compared exercise behaviors of T1D, T2D, and non-diabetics (ND). **METHODS:** Male (n=68) and female (n=267) participants ages 18-64 were recruited via social media (e.g. Facebook, Instagram) and newsletters and indicated consent prior to participation in the online survey. Data was collected for demographics, anthropometrics, diabetes status, and exercise (PA) behaviors. One-way ANOVAs, with Games-Howell post hoc tests were used to determine differences in aerobic activity and strength training between T1D, T2D, and ND participants. **RESULTS:** Participants included 48 T1Ds, 24 T2Ds, and 240 NDs. Statistically significant differences existed for moderate aerobic PA between groups, $f(2,304)=3.9$, $p=0.021$, where T2D reported fewer weekly minutes (109.2±88.8) than ND (215.7±186.5; $p=0.021$). T1D (179.0±171.7) were not significantly different. No significant vigorous PA differences were found ($p=0.242$; T1D=66.3±80; T2D=41.7±60.5; ND=73.8±94.8 min/week). Strength training days/week differed between groups, $f(2,314)=3.6$, $p=0.028$ with T1D (1.8±2.0) reporting significantly more than T2D (0.7±1.0; $p = 0.024$); no significant differences for ND (1.5±1.7). **CONCLUSION:** Although statistically similar to T2D/ND, T1D's mean moderate activity was over the recommended 150 min/week. T1D did report significantly more strength training days/week than T2D approaching recommended 2 days/week. Participants' most popular PAs were walking (51%), and strength training (18%), thus Kansans should consider walking and strength training exercises.

Relevance of Research to State-Related Topic(s)

Diabetes diagnosis is increasing in Kansas. According to the Kansas Department of Health and Environment (KDHE), 1/10 adults in the state has either type 1 or type 2 diabetes. Diabetes is the seventh leading cause of death in the U.S. and Kansas. Almost 2,000 Kansan deaths occurred in 2014, listing diabetes as a contributing cause. Treating diabetes costs the state approximately $2.6 billion. The KDHE recommends diabetics maintain hospital follow-ups, regularly check blood sugar, and take medication. I would like the House Standing Committee of Health and Human Services and the Senate Standing Committee of Kansas to look at a different approach to diabetes prevention. My approach is to analyze the differences in exercise behaviors amongst diabetics and diabetic counterparts. Exploring this allows us to have greater insight on the physical activity levels of this population and identify which modes of exercise may be best in future recommendations.

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LET'S MAKE KANSAS HAPPY: IMPROVING EMPLOYEE WELL-BEING THROUGH WORK BREAKS USING VIRTUAL REALITY

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BACKGROUND AND PURPOSE: Deteriorating mental health such as depression and burnout causing low psychological well-being has been becoming a social problem. Since people spend a third of their day time at work, it is effective to enhance individuals' well-being by improving the work environment. In this study, work breaks, a short period of time during the work day, are explored as a means to recover employees' mental health. Previous studies have found that taking a break benefits employee, yet there are many unanswered questions. With the sample of Gen Y who consist of most of the workforce, we identify how taking an appropriate workday break in favorable physical environmental conditions of employee break room enhance employees' psychological well-being. **METHOD:** For study 1, online survey through Amazon Mechanical Turk was conducted. Participants are required to be Millennials working in hospitality industry. For study 2, we adopted a with-in subjects experiment using Virtual Reality. The participants were instructed to experience the existing condition and rate the questionnaire. Consequently, they were asked to experience the manipulated treatment and answer the same questionnaire. **RESULTS AND CONCLUSION:** Physical environment of employee break room, preferred break activities, and control of break were positively related to psychological well-being with the mediation effects of feeling of energy. Also, layout arrangement with enhanced privacy can boost workplace friendship opportunity, job satisfaction and reduce emotional exhaustion. Thus, managers should allow employees to have control over their workday breaks and provide a well-conditioned employee break room with a proper configuration to enhance the restorative process and well-being.

Relevance of Research to State-Related Topic(s)

According to a Gallup survey conducted in 2017, Kansas shows a low well-being score, ranked in 4th Quintile in the United States. From the perspective of economic analysis, the economic burden of serious mental illness in Kansas is estimated to be at least $300 million. Meanwhile, Kansas hospitality industry including food preparation and serving related occupations is growing promisingly with the highest number of jobs, exceeding two hundred thousand. Given the seriousness of the degenerating psychological state and the significance of hospitality industry in Kansas, our attention to increase hospitality workers' well-being is highly needed. The current research explores how to promote employees' psychological well-being in hospitality in Kansas. We found out that a proper micro-break at the workplace can help employees replenish their energy and consequently improve employees' psychological well-being. Our study can offer detailed implications to employers, state and community leaders in Kansas.

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SURVEY OF VETERINARY STUDENT ATTITUDES TOWARD ANIMAL WELFARE AND PAIN

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BACKGROUND AND PURPOSE: Discrepancies in the background and training of veterinarians regarding the painfulness of procedures across species may impact their decision to use analgesia. The objective of this study was to investigate veterinary student attitudes toward animal welfare and pain. **METHOD:** An electronic survey instrument was developed to assess demographic information, perceptions of animal welfare, concern with specific animal welfare issues, and estimation of pain scores on a scale of 1-10 for certain procedures and conditions. **RESULTS:** Six hundred thirty-eight responses from veterinary students were analyzed from 8 colleges of veterinary medicine in the U.S. and Canada. Results suggest that respondent preparedness to discuss certain animal welfare topics differed by pre-veterinary school background, year in veterinary school, and which veterinary school they attended (P <0.04). Females consistently assigned higher pain scores to painful conditions and procedures than males (P <0.001). When asked if veterinary programs were doing a sufficient job preparing students to be welfare advocates, responses differed by whether or not an animal welfare and ethics course was offered as part of their veterinary curriculum (P =0.003). Sixty-four percent of respondents who were enrolled in veterinary programs that offered an animal welfare and an ethics course felt prepared to be welfare advocates, compared to only 11% of respondents who felt prepared that were not offered an animal welfare or ethics course. **CONCLUSION:** These data show that gender, background and the year of veterinary school should be considered when developing and standardizing the delivery of animal welfare topics across the veterinary curriculum.

Relevance of Research to State-Related Topic(s)

Veterinary program curriculum shapes how veterinary students will make hard decisions in their future practices. Ensuring that we give them the experience and resources to be confident in making hard decisions related to animal welfare and animal pain will greatly impact animal health and welfare in Kansas. Many veterinarians struggle to maintain their mental health due to working long hours and compassion fatigue. One way that we can help veterinarians feel better about the tough decisions they make every day is by giving them the tools and resources they need to be animal welfare advocates in the communities where they practice. By continuing to better prepare veterinary students for meaningful careers we can positively impact animal health, rural communities, and create a sustainable environment for veterinarians to make a difference.

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SELF-COMPASSION IN THE AFTERMATH OF SEXUAL VIOLENCE

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BACKGROUND AND PURPOSE: Sexual violence (completed or attempted rape, sexual coercion, and unwanted sexual contact) is common with higher rates for women, some racial and ethnic minorities, and gender and sexual minorities. The medical model of trauma has been used to understand the aftermath of traumatic events in general, however, feminist critiques of this model have argued that the experience of sexual trauma is different due to many contextual factors such as insidious trauma from marginalization and the lack of accountability for sexually violent offenders. Self-compassion is a two-factor construct that describes either the kindness we offer ourselves (self-warmth) or the self-judgment we experience (self-coldness) during difficult times. This may be an important construct for treatment after sexual violence, but research is limited. **METHOD:** The sample consisted of 368 women (88.6% white, 94.6% straight) recruited from a large undergraduate class over two semesters who completed an online survey at three time points through the semester. A path analysis was conducted to explore the possible mediating role of self-warmth and self-coldness in the relationship between sexual violence and mental health outcomes. **RESULTS:** Sexual violence was significantly associated with more self-coldness, anxiety, depression, and PTSD symptoms. Self-coldness mediated the relationship between sexual violence and mental health outcomes. **CONCLUSION:** While there was evidence that self-coldness contributes to worse mental health outcomes, there was limited evidence that self-warmth contributes to better mental health outcomes. Future research should look into how survivors of sexual violence are conceptualizing the core concepts of self-compassion in order to improve both measurement and treatment.

Relevance of Research to State-Related Topic(s)

Improving mental health outcomes for survivors of violence increases their productivity at work and reduces utilization of public resources. In the long-term, unresolved trauma from sexual violence is also associated with physical illness, relationship difficulties, and substance use. This study provides evidence that self-coldness improves mental health outcomes. Individuals and agencies who interact with survivors of sexual assault should be trained on avoiding policies and practices that blame survivors or increase shame. Kansas took a huge step forward with the Sexual Assault Kit Initiative (SAKI) which audited untested sexual assault kits and started testing them. Legislators should support plans to keep kit testing up to date as the process of completing a kit can be traumatic, especially if the survivor knows it may not be tested. In addition to improving the experience of survivors who report sexual assault, keeping testing up to date can help Kansas identify serial offenders.

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TOOLS FOR ASSESSING CARDIOVASCULAR DISEASE RISK FACTORS IN UNDERSERVED YOUNG ADULT POPULATIONS: A SYSTEMATIC REVIEW

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BACKGROUND AND PURPOSE: Cardiovascular disease (CVD, i.e., disease of the heart and its blood vessels) is a major cause of death globally. Despite the importance of CVD risk assessment for effective CVD prevention intervention, current assessment tools use either clinical or non-clinical factors alone or in combination to assess disease risk(s). The aim of this review is to critically appraise and summarize existing CVD risk assessment tools to enable the development of a non-clinical based survey instrument for risk factor identification in underserved young adult (18-34 year-old) populations. **METHOD:** Two online electronic databases - PubMed and Scopus - were searched to identify existing risk assessment tools, using a combination of CVD-related keywords. Search strategy was limited to articles available in English only and published between 2008 and 2019. **RESULTS AND CONCLUSION:** Initial search yielded 10,427 articles – 9,094 for tools available for CVD risk assessment in the general young adult populations and 1,333 for underserved young adult populations. Only four studies were included for CVD risk assessment tools in underserved young adult populations. These comprised two longitudinal studies, a cross-sectional study and a qualitative (descriptive) study. Even though an included study used a risk assessment tool, it had already been previously developed for another study. This review provides some evidence for the limited research on CVD risk assessments in young adulthood. Thus CVD risk assessment among young adult, particularly from underserved populations, is warranted.

Relevance of Research to State-Related Topic(s)

To the best of our knowledge, this is the first study to design an instrument specifically to be used in a non-clinical or -medical setting. This is useful because the proposed instrument will improve CVD screening rates, help recognize symptoms, and understand the different CVD risk profiles in underserved populations. This may further improve chronic disease detection among racial minority and low-income populations and potentially, reduce existing health disparities, which aligns with one of the priority areas of the Kansas Heart Disease and Stroke Prevention program of the Kansas Department of Health and Environment.

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LONG ACTING INJECTABLE METHADONE FOR POST-OPERATIVE ANALGESIA

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[1]Department of Anatomy and Physiology, College of Veterinary Medicine; [2]Department of Clinical Sciences, College of Veterinary Medicine

BACKGROUND AND PURPOSE: Cardiovascular disease (CVD, i.e., disease of the heart and its blood vessels) is a major cause of death globally. Despite the importance of CVD risk assessment for effective CVD prevention intervention, current assessment tools use either clinical or non-clinical factors alone or in combination to assess disease risk(s). The aim of this review is to critically appraise and summarize existing CVD risk assessment tools to enable the development of a non-clinical based survey instrument for risk factor identification in underserved young adult (18-34 year-old) populations. **METHOD:** Two online electronic databases - PubMed and Scopus - were searched to identify existing risk assessment tools, using a combination of CVD-related keywords. Search strategy was limited to articles available in English only and published between 2008 and 2019. **RESULTS AND CONCLUSION:** Initial search yielded 10,427 articles – 9,094 for tools available for CVD risk assessment in the general young adult populations and 1,333 for underserved young adult populations. Only four studies were included for CVD risk assessment tools in underserved young adult populations. These comprised two longitudinal studies, a cross-sectional study and a qualitative (descriptive) study. Even though an included study used a risk assessment tool, it had already been previously developed for another study. This review provides some evidence for the limited research on CVD risk assessments in young adulthood. Thus CVD risk assessment among young adult, particularly from underserved populations, is warranted.

Relevance of Research to State-Related Topic(s)

According to the CDC, opioids were involved in 67.8% of drug related deaths in 2017 in the United States. Opioid abuse remains a prominent public health concern. Our research aims to reduce the amount of opioids and their need for access in veterinary medicine. Our results show that with the addition of fluconazole we were able to halve the amount of opioids used for post-operative pain management in dogs. This treatment method lasts for roughly 24 hours, decreasing the need for opioids to be sent home with clients. There are also notable benefits for the patient. Methadone maintains a more stable effective concentration when administered with fluconazole, reducing the chance the patient will experience breakthrough pain before they get their next dose. Therefore, our results can be used to decrease opioid access, the risk of opioid abuse, and better the standard of care for post-operative canine patients.

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