K-State Graduate Research, Arts, and Discovery (GRAD) Forum

Program Booklet

March 8 and 9, 2023
K-State Student Union

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Social Sciences, Humanities, and Education
Room 227
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Ernestina Wiafe

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Poster Presentation Abstracts

Agricultural Sciences

EFFECT OF ACIDIC TEMPERING AND HEAT TREATMENT ON *SALMONELLA* LOAD OF WHEAT DURING TEMPERING AND ITS IMPACT ON WHEAT FLOUR QUALITY

Shivaprasad DP, Jared Rivera, and Kaliramesh Siliveru
Department of Grain Science and Industry

BACKGROUND AND PURPOSE: The number of foodborne illness outbreaks and recalls associated with wheat flour and wheat-based products contaminated with enteric pathogens such as Salmonella has increased in the past decade. This shows the need for effective antimicrobial interventions to be incorporated in the milling industry. **METHOD:** This research sought to determine survival of four different Salmonella enterica serovars on wheat during tempering (hydration). Hard red spring (HRS) wheat kernels were inoculated with Salmonella (cocktail) and were dried for 24h at ambient temperature. Following which, wheat kernels were tempered to 17% moisture with sodium bi sulfite (SBS), lactic acid (LA) and/or citric acid (CA) solution (10 and 15% w/v concentration) and were held at 25oC and/or 55oC. Wheat kernels tempered with sterile water was taken as a control. **RESULTS/FINDINGS:** The study's findings demonstrated that, after 24h of treatment, wheat tempered with acidic water (15% w/v) reduced the Salmonella load by at least 3 log CFU/g for all the tested acids. Heat treatment (55oC) alone significantly reduced the Salmonella load while acidic water tempering coupled with heat treatment (55oC) resulted in greater reduction with complete inhibition achieved at 12h for LA and 18h for both SBS and CA. Furthermore, Tempering HRS wheat at 15% concentration did not significantly alter the baking (volume, texture, and crumb structure) or physicochemical properties (rheology, composition) of the treated wheat flour compared to the control. **CONCLUSION:** Acidic water tempering, as opposed to the traditional water tempering method, may result in milled products with improved microbiological quality.

COMPARATIVE ANALYSIS OF THE PHYSICOCHEMICAL CHARACTERISTICS OF KAFIRIN PROTEINS EXTRACTED FROM VARIOUS GRAIN SORGHUMS AND THEIR DISTILLERS' GRAINS

Ruoshi Xiao[1], Shan Hong[1], Sang Li[1], Yi Zheng[1], Donghai Wang[2], and Yonghui Li[1]
[1]Department of Grain Science and Industry; [2]Department of Biological and Agricultural Engineering

BACKGROUND AND PURPOSE: Sorghum storage protein, kafirin, can be an innovative plant protein source. This study aims to conduct a comparative analysis of the physicochemical and functional properties of kafirin extracted from different types of sorghums, and their dried distillers' grains (DDG), in order to understand the effect of sorghum type and fermentation process on protein properties. **METHOD:** Seven different types of sorghum, including white, red, black, and waxy varieties were sourced. A portion of each type of sorghum was used to produce distilled spirits (baijiu), and the resulting DDG were collected. Both the original grains and DDG were ground into fine flours, and kafirin protein was extracted using the glacial acetic acid method. The protein content, SDS-PAGE profiles, secondary structure composition, surface hydrophobicity, *in vitro* protein digestibility, and functionality of the extracted proteins were characterized. **RESULTS:** The protein content of extracted kafirins ranged between 75-85%. SDS-PAGE results showed that kafirins from different types of sorghums had similar band profiles, but new bands in the range of 10-15 kDa were observed for the kafirins from DDG. The surface hydrophobicity of the kafirins from different types varied between 50-60 µg SDS/mg protein, and the fermentation process further altered the surface hydrophobicity to some extent. The kafirin from black sorghum DDG had slightly lower *in vitro* protein digestibility (around 74%) compared to that of other sorghum DDG (75-79%). **CONCLUSION:** This study provides fundamental knowledge of the protein properties associated with different sorghum genotypes and their DDG, which will aid in the future production and wider applications of sorghum proteins.

DEVELOPING AND CHERACTRIZING ANTIOXIDANTS FROM CORN DISTILLERS' GRAINS

Ruijia Hu and Yonghui Li
Department of Grain Science and Industry

BACKGROUND AND PURPOSE: Corn distillers' grain with solubles (DDGS) is a by-product from corn ethanol production with about 30% proteins and 1.5% polyphenols. The objectives of this study were to extract both antioxidative phenolic and protein hydrolysates from corn DDGS and characterize their antioxidant performances using both chemical assays and o/w emulsions. **METHOD:** Water, acetone, ethanol, methanol, 1-proponal and 2-proponal were selected to extract phenolic compounds from corn DDGS at optimum concentration, and the residue was used for protein hydrolysates production using Alcalase at 0.1 Au/g of protein. Extracted phenolic compounds were quantified and qualified using UPLC-QTOF-MS/MS. Prepared protein peptides were characterized using degree of hydrolysis, peptide content and SDS-PAGE for MW distribution. Antioxidant activities was determined using DPPH scavenging activity and ferrous ion chelating capacity. Antioxidant performance of selected antioxidants in o/w emulsions was evaluated by POV and TBARS value.
RESULTS/FINDINGS: Overall, phenolic antioxidants indicated better DPPH scavenging activity than peptide antioxidants, while peptide antioxidants showed relatively higher ferrous ion chelating capacity. A 50% acetone resulted in extracts with the highest total phenolic content, followed by 50% ethanol. Both phenolic and peptide antioxidants could efficiently prevent oil oxidation in o/w emulsions. **CONCLUSION:** Our study provides useful information for extracting natural antioxidants from corn byproducts. Both phenolic and peptide antioxidants prepared indicated penitential to used as naturally derived antioxidants with high efficiency.

FOOD DUST DOES NOT DECREASE THE EFFICACY OF THE INSECTICIDE NETTING AGAINST STORED PRODUCT INSECTS

Sabita Ranabhat[1], Katie Mongeau,[2] Tanja McKay[3], Laura Starkus[3], Kun Yan Zhu[1], and William R. Morrison III[4]
[1]Department of Entomology; [2]Department of Animal Science; [3]Department of Entomology, Arkansas State University; [4]USDA, Agricultural Research Service, Center for Grain, and Animal Health Research

BACKGROUND AND PURPOSE: As agriculture commodities move from farm to fork, insects can readily infest commodities. Therefore, it is critical to develop effective pest management strategies to reduce loss of commodities due to insect infestations. Insecticide-treated netting is one of the new tactics that has successfully been used to impair insect mobility and prevent insect infestation after commodities are harvested. However, there are various factors that could influence effectiveness of insecticide netting. Two issues that could influence the efficacy are accumulation of food dust on the netting and the cleaning process for the netting. In this study, we assessed whether food dust and air cleaning can affect the efficacy of insecticide netting. **METHOD:** We exposed each of two cosmopolitan stored product pests, lesser grain borer and red flour beetle, for 10 min to the control netting (without insecticide), Vestergaard netting (with 0.4% deltamethrin), or BASF Carifend netting (0.34% cypermethrin-incorporated) after dipped or undipped in food dust in the laboratory or after exposed under field conditions at rice processing plants. We then examined the efficacy of netting against each insect species immediately after exposure, or 24 h or 72 h of post-exposure holding duration. We repeated five times for each treatment combination and 20 insects were used in each replication**. RESULTS/FINDINGS:** We found that either food dust or cleaning procedure did not affect the efficacy of the netting against both insect species. **CONCLUSION:** Our study demonstrates that insecticide netting could be effectively used against stored product pests at food facilities where food dust often accumulates over time.

CHARACTERIZATION OF PHENOXY HERBICIDE RESISTANCE IN PALMER AMARANTH (*Amaranthus palmeri* S. Watson)

Rishabh Singh and Mithila Jugulam
Department of Agronomy

BACKGROUND: Weed management is becoming a challenge owing to continued increase in incidence of herbicide resistance. Phenoxy herbicides (2,4-D and MCPA) are widely used to manage broadleaf weeds including Palmer amaranth (*Amaranthus palmeri*), one of the most troublesome weeds in the US. We documented resistance to 2,4-D and MCPA in a Palmer amaranth (KCTR) population from Kansas. Our recent research suggested rapid metabolism of 2,4-D bestows resistance in KCTR Palmer amaranth; nonetheless, the mechanism of MCPA resistance is unknown. We hypothesize that KCTR plants metabolize MCPA, as that of 2,4-D, thereby bestow resistance. **OBJECTIVES:** To a) evaluate the level; and b) determine the physiological basis of MCPA resistance in KCTR Palmer amaranth. **MATERIAL AND METHODS:** Greenhouse MCPA dose-response experiments were conducted to access the level of resistance in KCTR relative to MCPA-susceptible, KSS and MSS plants. Using [^{14}C] labelled MCPA, the absorption, translocation and metabolism was assessed in KCTR and MSS plants. **RESULTS:** Regression analyses indicate that KCTR exhibits a 2.8-to-3.3-fold resistance to MCPA. No difference in absorption of ^{14}C MCPA between MSS or KCTR plants was found. However, the KCTR plants translocated less ^{14}C MCPA at 48 hours after treatment (HAT) and metabolized more MCPA faster than MSS plants at 12 and 24 HAT. **CONCLUSION:** Reduced translocation coupled with enhanced metabolism, possibly mediated by cytochrome P450 enzymes impart resistance to MCPA in KCTR Palmer amaranth. Understanding the mechanism(s) of herbicide resistance will help to develop prudent weed management practices thereby, enhance the crop yield. Future research will identify genes involved in MCPA metabolism using RNA-sequencing.

EFFECT OF ROOT ASSOCIATED BACTERIA ON CORN NITROGEN USE EFFICIENCY

Wagner Squizani de Arruda, Irosha Wanithunga, and Charles W. Rice
Department of Agronomy

BACKGROUND AND PURPOSE: Nitrogen (N) is one of the highest input costs for corn production. As a source of plant growth, it plays a key role in the agricultural sector, enabling farmers to achieve greater yield and helping feed the human population. Agriculture relies on synthetic N fertilizers, and half is lost to the environment, resulting in negative impacts. Therefore, find a optimal nitrogen management is critical for efficient production. A bio-inoculant Pivot Bio Proven®, colonizes corn roots by nitrogen-fixing bacteria, forming plant-microbe relationships that could improve nitrogen use efficiency, increasing sustainability and productivity. The objective of this study was to determine grain yield, dry biomass, and N uptake with and without Proven®. **METHOD:** This study was initiated in 2021 at the Agronomy North Farm, Manhattan, KS. The experiment had 4 N rates (0, 56, 112, 168) kg N ha^{-1} with and without Proven® with six replicates. Plant biomass was sampled at three growth stages (V7, VT, and Harvest). **RESULTS:** In 2022, plant biomass, plant N uptake, and yield were significantly affected by N rate. In 2022, yield increased from 6.9 Mg/ha (110.3 bushels/acre) with no N fertilizer to 11.25 Mg/ha (174.9 bushels/acre) with 168 kg N/ha of applied Nitrogen. Proven® did not statistically affect plant biomass, N uptake, or yield. **CONCLUSION:** In the second year of a 3 yr study, the optimum N fertilizer with Proven® was 122 kg N ha^{-1}. Proven did not provide a substantial source of N to corn.

HAPLOTYPE-INFORMED PREDICTION OF FUSARIUM HEAD BLIGHT RESISTANCE IN USA WHEAT BREEDING PROGRAMS.

Lawrence Tidakbi[1], Guihua Bai[2], Jessica L. Rupp[1], and Katherine W. Jordan[3]

[1]Department of Plant Pathology; [2]Department of Agronomy; [3]United States Department of Agriculture-Agriculture Research Services Hard Winter Wheat Genetics Research Unit

BACKGROUND AND PURPOSE: Fusarium Head Blight (FHB), a major pathogenic fungal disease in wheat and barley caused by *Fusarium graminearum* (*Gibberella zeae*) has a major economic impact on wheat and barley production due to the production of mycotoxins. Breeding for resistance in adapted wheat varieties is not trivial due to several minor effect alleles identified in QTL studies. **METHOD:** To successfully develop resistance, diagnostic markers for quantitative traits loci (QTLs) across the wheat genome need to be identified to help pyramid promising resistance genes into adapted wheat varieties in breeding programs. We are developing a Practical Haplotype Graph (PHG) database coupling phenotypic and genotypic data from a panel of 270 wheat cultivars from across the US. The objective of identifying novel QTLs and building a genomic selection (GS) model is underway with one year of field data evaluated. **RESULTS/FINDINGS:** Preliminary results show significant variability in phenotypic scab severity, the normalized area under disease progressive curve (AUDPC), and the severity of fusarium damaged kernels (FDK) (p-value <0.05) across breeding lines, including some more resistant than the moderately resistant control. Additionally, ~15x sequencing data from these lines produced nearly 600,000 variants across the genome for association analyses and model building. **CONCLUSION:** Preliminary results indicate phenotypic and genetic diversity/variability in the panel. We were able to map resistance and susceptibility alleles using this panel of wheat lines spanning most of the US growing regions, using mixed linear models genome wide association studies (GWAS).

Engineering

OFF-GRID CONSTRUCTION VIA SUSTAINABLE COMPRESSION CURING OF VEGETABLE OIL-IMPREGNATED SEDIMENTS

Ibrahim Al Qabani[1], Scott Thompson[1], Genevieve Baudoin[2], and Karin Goldberg[3], Drew Snelling[4], Rafael Quirino[4], Julio Silva[4]

[1]Department of Mechanical and Nuclear Engineering; [2]Department of Architecture; [3]Department of Geology; [4]Georgia Southern University

BACKGROUND AND PURPOSE: It is becoming apparent that we can no longer depend solely on traditional manufacturing processes, and that new methods of manufacturing are needed to fulfill todays modern need for efficiently and sustainably. The research project presented here aims to innovate a new additive manufacturing (AM) binder jetting system for use by use in the construction sector. The AM system uses binder jet printing (BJP) and will primarily operate on renewable energy sources and be portable. The uniqueness of this new AM technology is the ability to 3D print solid objects of complex geometry made primarily from earth-based materials and binding them using bio-based polymers to limit the use of raw fossil materials. The main goal is to ensure that the system is portable, 100% eco-friendly, and can manufacture products with sufficient mechanical properties. **METHODS:** Teaming up with Georgia Southern University, the investigated AM system will be validated through the manufacture of building "blocks" consisting of a wide range of sand particle sizes and a vegetable-oil-based (VOB) binder formulated from tung oil. **CONCLUSION:** Preliminary results demonstrate that adjusting the resin and sand rheological properties, a drop-on-demand/roller AM method can be used to fabricate structural building blocks using coarse, variably shaped sand. Samples of Kansas-sand/VOB composite have shown significant mechanical strength, two steel saws were ruined when trying to cut the composites. Furthermore, sand composites only started degrading at temperatures close to 350 ºC. Wood starts showing chemical changes with temperatures as low as ~120˚ C, making the new composite "bricks" superior to wood used in construction today.

OPTIMAL MULTI-ROBOT COVERAGE PATH PLANNING FOR AGRICUTURAL FIELDS USING MOTION DYNAMICS

Jahid Chowdhury Choton and Pavithra Prabhakar

Department of Computer Science

BACKGROUND AND PURPOSE: Multi-robot Coverage path planning (CPP) is the task of computing an optimal path to completely scan or survey an area of interest by using mobile robots. The optimal coverage path ensures minimization of operational costs and mission time. Each type of robots has different motion dynamics that lead to different trajectories for the coverage path. Most of the recent works on multi-robot CPP do not consider the motion dynamics while generating the optimal path. **METHOD:** We proposed a novel approach to find the multi-robot optimal coverage path of an agricultural field using motion dynamics while minimizing the mission time. Our approach consists of three steps: (i) divide the agricultural field into polygonal areas to optimally distribute them among the robots, (ii) generate an optimal coverage path to ensure minimum coverage time for each of the areas, and (iii) generate the trajectory for each coverage path using Dubins path motion dynamics and compute the total mission time. **RESULTS:** We performed several experiments and simulations to assess the performance and validation of our approach in three different agricultural fields. All our experiments showed expected behaviors, the total mission time decreased when we either increased the velocity, number of robots, or coverage parameter and vice versa. **CONCLUSION:** We developed a new approach to solve the multi-robot CPP problem using simple motion dynamics where the robots move at a certain height from the ground. In future, we would like to extend our work for robots with complex non-linear motion dynamics while ensuring the optimal coverage path.

RED CEDAR BIOCHAR IN CONSTRUCTED WETLANDS DESIGN FOR ANTIBIOTIC REMOVAL

Jessica Demarco[1], Stacy Hutchinson[1], Prathap Parameswaran[2], Ganga Hettiarachchi[3], and Trisha Moore[1]
[1]Carl and Melinda Helwig Department of Biological and Agricultural Engineering; [2]Department of Civil Engineering; [3]Department of Agronomy

BACKGROUND AND PURPOSE: Constructed wetlands (CWs) represent a natural wastewater treatment system, offering economic and environmental advantages. These systems can remove several compounds, including antibiotics, that may cause negative impacts on the environment. Antibiotics are widely used in the swine industry to treat diseases and improve animal growth. Tetracyclines (class) are among the most effective antibiotics and have been used extensively to treat bacterial infections. Nevertheless, these compounds are poorly absorbed by pigs and have been classified as micropollutants due to their occurrence in surface water, wastewater, and soil. Amending CWs media with red cedar biochar can be effective to remove antibiotics from swine wastewater. Previous studies showed that biochar generated at temperatures above 700 ºC effectively removed antibiotics. Thus, the goal of this study was to investigate the capacity of red cedar biochar pyrolyzed at 450 ºC to remove antibiotics commonly used in swine wastewater. **METHOD:** The CWs were designed to operate with a 10 cm drainage layer (gravel size ¾" to 1"), a 20 cm main gravel layer (gravel size ½" to ¾"), a 3 cm separation layer (gravel ¼" to 3/8"), a 20 cm soil layer (silt loam:sand, 2:1 ratio) mixed with red cedar biochar (70% soil:30% biochar), and 7 cm top layer (gravel size ½" to ¾"). **RESULTS:** The results indicate that red cedar biochar effectively removed up to 99.93% of tetracycline, 96.23% of oxytetracycline, and 98.28% of chlortetracycline. **CONCLUSION:** Overall, the results highlighted the potential utilization of eastern red cedar biochar in CWs to remove antibiotics from swine wastewater.

IDENTIFICATION OF PALMER AMARANTH (AMARANTHUS PALMERI) USING MACHINE LEARNING

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BACKGROUND AND PURPOSE: Rapid evolution of herbicide-resistant (HR) Palmer amaranth (major weed in Great Plains) populations and increasing costs of their control build a strong rationale for developing site-specific Palmer amaranth management strategies. Site-specific Palmer amaranth control warrants its rapid and accurate detection in various cropping situations. **OBJECTIVES**: (1) to identify and detect Palmer amaranth plants using two open-source object detection algorithms (Detectron2 and YOLOv7x), and (2) compare the performance of both object detection algorithms for speed and accuracy in Palmer amaranth detection. **METHOD:** A soybean field site with natural infestation of Palmer amaranth population was established in the 2022 growing season at Kansas State University Agricultural Research Center near Hays, KS. Images (total 372) of Palmer amaranth plants at various vegetative growth stages were manually collected using a GoPro Hero 4 camera at ground level. These images were labelled and produced 650 total annotations. The annotated images were used to train 2 machine learning algorithms: Meta's Detectron2 with Fast R-CNN configuration and YOLO v7x algorithms. We used different metrics to evaluate the accuracy and speed of both object detection algorithms. **RESULTS/FINDINGS:** Results indicated that both Detectron2 and YOLO v7x algorithms performed well in detecting Palmer amaranth. The YOLOv7x algorithm achieved the mAP score of 78.4% @0.5 and 51.9 % @ 0.75 and an inference speed of 30.8 milliseconds. However, the Detectron2 algorithm with Fast R-CNN configuration had an mAP of 80.76% @0.5 and 45.58% @0.75 and an inference time of 0.2 seconds. **CONCLUSION:** These results suggest that YOLOv7x algorithm can detect Palmer amaranth plants accurately and about 6.5 times faster than Detectron2 in agricultural fields.

EXPLORING THE ROLE OF PHYSICAL ACTIVITY IN MANAGING DEPRESSION AMONG HISPANIC ADULTS

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BACKGROUND AND PURPOSE: Cases of depression are increasing among Hispanic adults in the United States, which may cause adverse health effects. Increasing physical activity (PA) may help counteract depressive symptoms, however more research is needed to determine any possible associations. The purpose of this study was to assess the association between PA and depression among Hispanic adults. **METHODS:** U.S. adults currently in therapy for a mental health condition were recruited via Prolific to complete an online survey. For this study, we used data from a subsample of Hispanic adults (n=73, M_{age} = 29.6±8.31 years, 41.1% male/50.7% female) reporting frequency of weekly moderate PA, depression (PHQ-9), PA barriers, and beliefs about the role of PA in managing mental health. **RESULTS:** A majority of the Hispanic adults in this sample (84.9%) reported having depression. There was a negative relationship between PA and depression (r=-.253, p=0.03). The most significant barriers for PA were lack of energy (M= 6.46/10), lack of motivation (M=6.23/10), and mental health (M=5.76/10). Participants strongly agreed that PA is beneficial for managing mood (M=4.48/5), stress (M=4.41/5), and anxiety (M=4.23/5). Participants were moderately receptive to discussing PA during therapy (M=3.48/5) and walking outside to manage mental health (M=3.86/5). **CONCLUSION:** The data demonstrate participants are open to discussing PA with their therapist, which may be beneficial in addressing barriers to being physically active. The results of this study demonstrate that building PA recommendations into therapy sessions could assist in managing depression among Hispanic adults and lead to decreased physical and mental health risks.

HOW ARE WE DOING? MOTHER'S OVERALL LIFE SATISFACTION AND CHILDREN'S FELT CLOSENESS

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BACKGROUND: Women make up almost 50% of the workforce, responsible for 70% household duties, and 40% of the financial duties for their family (Geiger et al., 2020). It is a difficult task for mothers to manage all of her responsibilities and also create a space to connect with her child. It is critical for children to develop healthy relationship with caring for them. The Social Support Theory discusses how different supports can reduce the effects that different stressful life events happen has have on others (Kort-Butler, 2017). Hypothesis one: mothers who have higher familial/social support, flexible employment, and financial support will have a higher overall life satisfaction. Hypothesis 2: children whose mothers have higher financial support will have a higher perceived level of closeness with their mother. **METHODS:** Data from the Fragile Families and Child Wellbeing Study (FFCWS) was used with 927 mothers and children from wave 9. The outcome variables are: How satisfied you are with your life overall(mothers)? How close you feel to your mom (children)? with nine predictor variables. **RESULTS:** The Regression results revealed a positive correlation between mother's life satisfaction and children's felt closeness to their mothers were positively associated with family/social support and flexible work hours. With the strongest correlation being Family/Social support. **CONCLUSION:** Future research should study difference between single, married, and coparenting mothers, difference in mother's age and race, and number of children. A change in policy and resources to assist ease the workload of the working mother to help foster healthy relationships with their children.

THE LONGITUDINAL ASSOCIATION OF STRUCTURE PARENTING FROM EARLY ADOLESCENT TO EMERGING ADULTHOOD EMPATHY AND VALUE-REGULATION

Lindsay Howard
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BACKGROUND AND PURPOSE: Emerging adulthood is a time of exploration and discovery, and many emerging adults struggle to adapt. This study seeks to understand the role of parent structuring for adolescents on later development of empathy and value-regulation. Parent structuring includes parental involvement, positive monitoring, and connection. **METHOD:** Data from 284 parent-child dyads from the Flourishing Families Project were used in this study. Structural equation modeling was used to analyze data from multiple validated measures and multiple informants. **RESULTS:** Increased mother structure in parenting while children were in adolescence predicted higher levels of empathy, internalized value regulation, and externalized value regulation in emerging adulthood. **CONCLUSION:** Empathy and value regulation are important in social development and success in young adulthood. Findings from this study could empower parents to better understand what they can do to make a meaningful impact on their adolescents that will increase their children's success through the transition into adulthood.

A CONFRIMATORY FACTOR ANALYSIS OF A TRAUMA BONDING MEASURE

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BACKGROUND AND PURPOSE: Trauma bonding has frequently been correlated to the experience of Stockholm Syndrome. Research of the phenomenon has tapered off for many years and needs to be revisited to attune to the current cultural and phenomenological circumstances. The purpose of this study is to differentiate traumatic bonding from the experience of Stockholm Syndrome and provide a more fluid and holistic perspective to how this phenomenon is experienced. The Trauma Bonding Scale is comprised of multiple subscales with the aim to describe Trauma Bonding as a spectrum of experiences. **METHOD:** An exploratory factor analysis (EFA) was conducted to determine the initial factor structure using data from a United States nationally representative sample (N = 732) collected via a Prolific panel. **RESULTS/FINDINGS:** The EFA identified the factor structure of the scale and ensured reliability and validity of the scale as a whole as well as subscales. The CFA identified adequate model fit for participants who self identfied being in a relationship in the sample collected. **CONCLUSION:** In conclusion, findings suggest this scale can be used with individuals who self-identified being in abusive relationships and currently being within a relationship. Further exploration is necessary to identify the reliablity and validty of this scale with other samples.

EXAMINING CLIENTS' RECEPTIVENESS TO DISCUSS PA WITH A MENTAL HEALTH PROVIDER: ANALYZING DIFFERENCES BY SEXUAL ORIENTATION

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BACKGOURD/PURPOSE: Disproportionate numbers of LGBTQ+ people visit mental health providers (MHP). Physical activity (PA) effectively improves mental health. It is not known if receptiveness to discuss PA with MHPs is impacted by sexual orientation. This study examines differences in predicting factors of receptiveness to discuss PA (RDPA) with MHPs between heterosexual and LGBTQ+. **METHODS:** A nationwide survey was administered to MHP clients (N=478). Measures included demographics, sexual orientation, Godin-Shephard Weekly Leisure Physical Activity Questionnaire (GSLTPAQ), height/weight, mental health inventories, and RDPA. Separate linear models were created for LGBTQ+ and heterosexual clients using gender identity, body mass index (BMI), reported PA minutes (GSLTPAQ), and mental health metrics as independent variables to examine their association with RDPA. **RESULTS/FINDINGS:** Significant difference existed in average receptiveness between heterosexual (n=269 - 55%) and LGBTQ+ (n=217 – 45%) clients (3.805 vs 3.660 out of 5; p = 0.033). For heterosexual clients, BMI (ß -0.062, p = 0.098) and loneliness (ß -0.138, p= 0.014) scores negatively associated with RDPA. For LGBTQ+ clients, GSLTPAQ (ß 0.003, p = 0.021) positively associated with RDPA. Cisgender-males (compared to cisgender-females) positively associated with RDPA for both LGBTQ+ (ß 1.366, p = 0.069) and heterosexual (ß 1.390, p = 0.005) clients. **CONCLUSION:** Results give MHPs insight for discussing/prescribing PA with clients. Additional rapport/support may be needed when discussing the benefits/prescription of PA for LGBTQ+ clients and/or those with traits of negative RDPA correlations. MH clients' positive perceptions of RDPA. Negative correlations should not disvalue discussion of PA. Negative correlations provide an opportunity to improve PA perceptions.

EXTREME HEAT, SOCIAL VULNERABILITY, AND ITS IMPACT ON RESPIRATORY HEALTH

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BACKGROUND AND PURPOSE: Extreme heat is a considerable threat to human health as it both directly and indirectly impacts physical, social, and environmental health. The reduction of extreme heat impacts is a crucial One Health effort. More specifically, research has shown associations between rising global temperatures and increased rates of respiratory illness. Drastic changes in heat without ample time for human acclimation results in certain populations being more highly vulnerable to its effects. This study was conducted with the goal of geographically identifying populations most vulnerable to extreme heat in Kansas. The main purpose of this identification was to propose specified public health resource distribution and suggest best practices for mitigating the negative respiratory health impacts of the warming climate. **METHOD:** Readily available Kansas social vulnerability, respiratory illness, and extreme heat data were analyzed and interpreted using geographic information system mapping. Census tract-level data were visually explored to identify areas showing potentially associated extreme heat rates and COPD or asthma crude prevalance. Furthermore, using social vulnerability data, populations that are more likely to need related resources were identified. **RESULTS/FINDINGS:** Results indicated visual associations between crude respiratory illness prevalance and high levels of social vulnerability. Kansas census tracts with historically high numbers of extreme heat days tend to be associated with a higher crude prevalance of respiratory illness. **CONCLUSION:** Preliminary conclusions indicate potential associations between extreme heat and respiratory illness. Results of this mapping indicate a need for future work in the targeted distribution of physical and educational health resources to areas that are considered highly socially vulnerable.

EFFECT OF PULMONARY HYPERTENSION ON RESPIRATORY MUSCLE FUNCTION

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BACKGROUND: Pulmonary hypertension (PH) is a disease characterized by high blood pressure in the blood vessels within the lungs, resulting in poor gas exchange, labored breathing, dysfunction of the heart, and eventually, death. This increased work of breathing taxes the primary respiratory muscle (the diaphragm), which displays impaired function, further exacerbating the pathogenesis of PH. Because muscles require oxygen for proper function, we hypothesized that PH impairs blood flow, and therefore oxygen delivery, to the diaphragm, providing a mechanistic basis for impaired respiratory muscle function. **METHODS:** Progressive PH was induced in adult female rats via a one-time injection of monocrotaline. Rats were monitored via echocardiography. Once PH was confirmed, fluorescent microspheres were injected for determination of diaphragm blood flow. **RESULTS:** 3 weeks following injection, PH rats displayed pulmonary and cardiac characteristics consistent with moderate PH. Blood flow in the quiescent diaphragm was not significantly different between PH (n=7) compared to healthy rats (n=7). However, when diaphragm contractions were electrically induced, the percent increase in blood flow to the working muscle was less in the PH rats compared to healthy counterparts (44 ± 4 vs. 55 ± 3%; $P<0.05$).**CONCLUSION:** These data suggest that PH impairs the blood flow response to increased diaphragmatic work. This may be due to dysfunction of the inner lining of the diaphragm vasculature, therefore reducing oxygen delivery and providing a mechanistic basis for PH-induced diaphragm weakness and failure. Our findings and future studies will help determine therapeutic targets to improve quality of life in PH.

EXAMINING THE STATE OF COMMUNITY WELL-BEING AT THE INTERSECTION OF RURALITY AND AGRICULTURAL ENGAGEMENT IN THE CONTIGUOUS UNITED STATES

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BACKGROUND AND PURPOSE: As the 21st century progresses, rural residents across U.S. have often found themselves in disadvantaged positions by many socio-economic measures compared to their urban counterparts. In addition, agriculture – once the emblem of rurality – shared a disputed relationship with the well-being of rural communities in the social science literature. However, the literature specifically related to how community well-being (CWB) varies across the intersection of rurality and agricultural engagement is limited. This study addresses this gap in the body of knowledge. **METHOD:** Using county-level data on socioeconomic conditions from the past decade, we examine how agricultural engagement is associated with community well-being in rural areas. We construct a CWB index and examine variations in the index scores based on rural status of counties and level of engagement in agriculture. **FINDINGS:** We show that CWB varies widely regardless of rural status and engagement in agriculture across the 3107 counties included in the study. However, the most disadvantaged communities are primarily located in rural places. Study findings also show that agricultural engagement is not consistently associated with improved or worsened CWB in rural areas. These findings indicate that the primary factor driving differences in CWB is the level of urbanicity/rurality and that CWB in rural communities is consistently similar regardless of local economies' reliance on agriculture. **CONCLUSION:** Study results suggest revisiting carefully rural development interventions that have generated the current living conditions of rural communities to address their needs as CWB affects the quality of life of individual residents.

PHYSICAL MANIFESTATIONS OF UNGRAMMATICALITY

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BACKGROUND AND PURPOSE: Previous research in linguistics on grammaticality judgements has focused on the cognitive aspects, ignoring the physical sensations of discomfort that native and near-native speakers feel when confronted with ungrammatical language. The goal of this research is to examine involuntary physical responses to ungrammatical language production and see if non-native speakers are more likely to pick up on ungrammatical language when speaking out loud versus reading silently. **METHOD:** The study contains two timed readings, one silent and one out loud. The participants are asked to determine if the sentences are grammatically correct. The timed readings are followed by an interview. The goal of the interview is three-pronged: Determine (i) whether participants experience physical discomfort when reading and/or producing ungrammatical forms in their second language; (ii) how this discomfort is manifested; and (iii) whether this discomfort is stronger when reading aloud as compared to silent reading. **RESULTS/FINDINGS:** Preliminary results suggests that German learners pick up on more grammatical mistakes when reading out loud versus when reading silently. Furthermore, they suggest the physical discomfort manifests itself differently in different people. This phenomenon has not been studied before. **CONCLUSION:** Findings form this study could help develop new language teaching techniques that promote learner autonomy as well as reduce the need for rote memorization. The data on the physical manifestations would also add a new dimension to the existing discourse on the topic of grammaticality judgements in a foreign language.

A RHETORICAL CRITICISM OF THE 2018 PAID FAMILY LEAVE DEBATE

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BACKGROUND AND PURPOSE: Despite a century of demands for paid family leave, the United States remains one of a handful of countries in the world that has yet to enact paid federal family and medical leave. Millions of Americans are offered no income by their employer when they take time off to care for a newborn child or sick elderly family member. In this study, I examine the construction of arguments used by Congressional representatives and experts as they testified before the Senate during a 2018 hearing on the importance of paid family leave to analyze attempts at persuasion. **METHOD:** While initially reading the testimonies, I made note of recurring themes that arose among advocates for and against the paid family leave bill. I then researched similar arguments made by previous legislators related to the themes of family, economics, and poverty as they considered social welfare legislation. **RESULTS:** The results of my analysis show that all speakers linked economic prosperity with family relations. Unlike previous arguments in favor of changing social welfare legislation, modern arguments tend to focus on worker productivity and individual health. When analyzing individual testimonies, it became clear that "working families" meant something different to each of the speakers. **CONCLUSION:** This study gives insights into the similarities and differences between those arguing for and against paid family leave. By paying closer attention to the language used in testimonies we can become more informed citizens and better make sense of what is proposed when both sides claim to be advocates for working families.

EXPLORNING AND IDENTIFYING YOUTH ADULT PARTNERSHIPS, AND THE LIVED EXPERIENCES AND PRACTICES OF YOUTH AND ADULT LEADERS WITHIN THE AMERICAN HEREFORD ASSOCIATION.

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BACKGROUND: Positive youth development (PYD) is a vision for developing young people by addressing their strengths. Youth adult partnerships are an important part of a youth's environment and can influence their development. Previous researchers have studied youth adult partnerships within Extension programs and have revealed that both youth and adults had positive thoughts about their interactions with one another. Research on youth adult partnerships within a trade industry organization is very limited. **METHODS:** The goal of this research was to understand youth adult perceptions of their interactions and experiences of working with each other and determine knowledge of PYD of youth and adult leaders in a trade industry organization. Modifying the Involvement and Interaction Rating Scale, researchers measured perceptions through a web-based survey. Participants were also invited through email to participate in a Zoom interview. **RESULTS:** The results revealed that youth and adults were both positive in their interactions with each other while working together but adults perceived themselves as being more positive than youth in their perceptions of the consideration of youth opinions. **CONCLUSION:** Adults were more positive in their perceptions of working together than youth. Youth and adults were unsure of what PYD meant and it is recommended that training be offered to allow individuals to understand what PYD is. Training would provide the ability to interact positively and clarify misunderstandings. Future research is needed to define youth voice as both youth and adults appeared to have different meanings of what was meant by youth voice and being heard.

COLLEGE STUDENT PERCEPTIONS OF IMPORTANT OF FARM BUREAU ADVOCACY AREAS

Allison Chambers, Gaea Hock, and Nellie Hill
Department of Communications and Agriculture Education

BACKGROUND AND PURPOSE: As Gen Z increasingly realizes their purchasing potential and voting power, the need to engage this young generation with agriculture increases as well. **METHOD:** This research sought to identify the perceived importance and opinion toward American Farm Bureau's (AFB) 15 agricultural advocacy topics according to KSU College of Agriculture students. Results *(N*= 86*)* were analyzed by examining the mean score to determine the final ranking. The lower the mean, the more important the topic. **RESULTS/FINDINGS:** Students ranked the top five issues as: food security (*M*= 3.24; *SD*= 4.34) food supply chain (*M*= 4.34; *SD*= 3.07), farm workforce (*M*= 4.97; *SD*= 3.29), farm policy (*M*= 6.85; *SD*= 3.26), and energy (*M*= 6.95; *SD*= 3.94). The least important topics were gene-editing (*M*= 9.93; *SD*= 3.37), rural broadband (*M*= 9.98; *SD*= 3.95), federal land use (*M*= 10.13; *SD*= 2.93), trade (*M*= 10.37; *SD*= 4.50), and tax reform (*M*= 10.83; *SD*= 4.17). AFB has existing programs on the national level to address several of the top topics including trade issues, farm policy, and energy. AFB also includes other topics like food safety and security but aren't highlighted as top issues. In comparison to what the students recorded, AFB resources do not align to the ranking of advocacy areas. **CONCLUSION:** Future research recommendations include replication with a larger college student population and inquiring about the perceived efficacy of AFB's current educational programs.

EXPLORING DISABILITY INCLUSION IN YOUTH LIVESTOCK EXPOSITIONS

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Department of Agricultural Education and Communication

BACKGROUND AND PURPOSE: In recent years there has been an increase in the number of children with disabilities participating in livestock exhibitions as livestock shows provide youth with different layers of development and skills that can be learned in the barn and the show ring. Integrating youth with disabilities in agricultural programs can improve social acceptance, self-esteem, and social skills for all youth involved as they can benefit from the opportunity to become more aware of differences and more tolerant and accepting of others. The purpose of this study was to understand and describe the lived experiences of participants in a disability inclusive livestock show and the perceived best practices of livestock expositions that are constructed with diversity inclusion towards youth with disabilities. **METHODS:** LaVergne's Diversity Inclusion Program Model was used to construct interview questions. Fifteen semi-structured interviews were conducted as a collective case study with twenty participants involved in a disability inclusive livestock exposition to understand their perceptions and experiences with the program. **RESULTS:** Results from this study illuminated how disability inclusion in the livestock industry can create disability awareness and acceptance amongst participants to expose them to diverse individuals. This study offers insight on the lived experiences of individuals with and without disabilities and the benefits gained, along with parent/guardian and adult volunteer perspective on the perceived best practices for disability inclusive livestock expositions. It was concluded participants obtained a positive experience from participating in the show and developed life skills while also gaining an understanding of equity in the show ring.

WHAT PERSONALITY TRAITS ARE CUSTOMIZED ACROSS THE VARIOUS JOB FUNCTIONS IN HOTEL INDUSTRY?

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Department of Hospitality Management

BACKGROUND AND PURPOSE: Understanding suitable employee personality is the first task for companies to develop human resources practices in facilitating job satisfaction and curtailing turnover intention. This task is significantly vital for hospitality companies due to the high labor intensity and turnover rates in the hotel industry. Moreover, a wide range of hotel job functions requires further action to deeply understand suitable personal traits for each job function. Depending on the job duties and responsibilities, different personalities should be preferable and thus have distinct effects on job satisfaction and turnover behavior. Thus, this research is designed to investigate different effects of personality traits on job satisfaction and turnover behavior across hotel job functions. **METHOD**: From LinkedIn.com, a professional social media, employee career information in the hotel industry will be collected for individual employee personalities and turnover behavior. In particular, drawing upon the Big Five personality framework, five personalities (i.e., extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience) will be measured by analyzing textual data from employee postings. Job satisfaction will be measured by counting star-ratings from Glassdoor.com, a professional online platform, for each hotel company. **RESULTS**: Our expected findings show that five personalities have different effects on job satisfaction and turnover behavior across various hotel job functions. **CONCLUSION**: This research would provide hotel employers with practical ways of enhancing employee job satisfaction and reducing turnover rates. In specific, companies could hire the right person and design effective training programs based on employee personalities.

Oral Presentation Abstracts

Biological Sciences

PREGNANCY SUCCESS AMONG EASTERN KANSAS BEEF COWS INFECTED WITH *ANAPLASMA MARGINALE* AND/OR BOVINE LEUKEMIA VIRUS

Naemi Bickmeier[1], Tippawan Anantatat[1], Mallory Beltz[1], Autumn Eggers[1], Bryan Weaver[2], Juan Almaraz[2], Shaun M. Huser[2], Ching Kang, Xiaoxu Song[3], and Kathryn E. Reif[1]
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BACKGROUND AND PURPOSE: Anaplasma marginale and bovine leukemia virus (BLV) are economically-significant, production-limiting cattle pathogens. In the U.S., both A. marginale and BLV are widely endemic in most states. Both A. marginale and BLV establish chronic infections often leading to cattle becoming life-long carriers and reservoirs. Maintenance of asymptomatic chronic infections could predispose cattle to secondary infections further exacerbating their disease state or causing poor production performance (e.g. calving success). We hypothesize that maintenance of chronic infections will reduce pregnancy success. Objectives were to evaluate A. marginale, BLV, and co-infection prevalence and investigate associations between infection and pregnancy success. **METHOD:** Eastern Kansas cows (n=2,857) were sampled during routine pregnancy screening. Information captured for each cow included: age, breed, county of residence, pregnancy status and hematological parameters. Blood samples were screened for A. marginale and BLV using a combination of quantitative PCR and ELISA assays. Infection status, pregnancy status, and host variables were statistically analyzed using logistic regression and linear regression analyses. **RESULTS/FINDINGS:** The prevalence of A. marginale and BLV were 28% and 55%, with co-infection significantly associated with cow age. The A. marginale prevalence was highest in older, pure bred, and lower body condition cows. Cow open rate (8.5%) was highest in A. marginale infected cows. **CONCLUSION:** Investigating how chronic infections impact pregnancy success is important to optimize production

PREDICTING THE SPATIAL DISTRIBUTION OF THE INVASIVE JAPANESE BEETLE, *POPILLIA JAPONICA NEWMAN* IN THE AMERICAN MIDWEST.

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Department of Entomology

BACKGROUND AND PURPOSE: Japanese Beetles, *Popillia japonica*, are invasive agricultural pests in the United States affecting turfgrass, ornamentals, fruit crops, and row crops, causing over $450 million of damage in the United States each year. Even with current controls and quarantines, Japanese beetle expansion continues westward in the United States. Using citizen science data gathered in iNaturalist, we examined temporal changes in Japanese beetle populations across different regions. The beetles reached the highest proportions in the Midwest region. In the Great Plains region, proportions appeared to grow exponentially after their first observation. We aim to (1) identify the main landscape factors related to Japanese beetle occurrence in the central United States, and (2) utilize current regional species distribution data to predict where Japanese Beetles are most likely to pose a threat. **METHOD:** We combined occurrence data with land-use classification data to model species niche and distribution. We then fit generalized linear models to assess landscape effects on Japanese beetle presence/absence in Missouri counties. **RESULTS/FINDINGS:** The additive model, including both the developed land variable and the corn and soybean variable was significantly better than the no information rate ($p=0.001$), and developed land had a clear positive relationship with Japanese beetle presence ($\beta=1.615 \pm SE=0.737$). We are currently working on our second aim, to predict the occurrence of JB in new areas using landscape and climate variables. **CONCLUSION:** This information will be important for targeting pest management efforts to growers and understanding how climate change might interact with land use change on invasive species distribution.

LOOK ELSEWHERE FOR BITING MIDGE CONTROL: THE GREENER INSECTICIDE BTI WORKS POORLY IN CULICOIDES SONORENSIS

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BACKGROUND AND PURPOSE: Efforts to control pest insects can come up against a desire to protect natural ecosystems from large-scale chemical insecticide applications. *Bacillus thuringiensis* subsp. *israelensis* (BTI) is a bio-rational insecticide and is touted as a safer alternative for the environment. While effective against mosquitoes, reports suggest that BTI is inefficient at killing midge larvae. *Culicoides sonorensis* is an economically important vector of animal viruses in the United States and effective control of the immature stages is should reduce adult populations which will protect vulnerable livestock. Here, we examine the toxicity of BTI in a commercial formulation (VectoBac® WDG) and separately its active ingredient against larvae of the biting midge *C. sonorensis*. **METHOD:** Larval *C. sonorensis* were exposed to each insecticide in a dilution series to calculate lethal concentration values (LC). Separately, midge larvae were soaked in a pH indicating dye after toxin exposure to monitor their gut pH. **RESULTS/FINDINGS:** The determined LC_{90} of VectoBac® WDG was 386 mg/L (95% CI: 319-503 mg/L), which is over 2,000 times more material than is required to kill most mosquito species. This discrepancy has previously been attributed to a larval gut environment impermissible for BTI toxin activity, and indeed, we show that the midge gut becomes unfavorably acidic when exposed to toxin. **CONCLUSION:** We conclude that BTI is not practical for killing *C. sonorensis* larvae at the same rate as mosquitos, and show gut pH as a mechanism to explain this. We are now investigating new larval control methods that seek to balance efficacy, specificity, and environmental safety.

ARE BIG BLUESTEM PLANTS LOCALLY MATCHED TO THEIR SOIL MICROBES ACROSS THE MIDWEST PRECIPITATION GRADIENT?

Eli Hartung[1], Soumyadev Sarkar[1,2], Kian Fogarty[1], Anna Kazarina[1], Jack Sytsma[1], Kierra Holloman[1], Nassima Amiar[1], Kori Howe[1], Ari Jumpponen[1], Sonny T M Lee[1], and Loretta Johnson[1],
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BACKGROUND AND PURPOSE: Big bluestem (*Andropogon gerardii)* is a dominant forage grass of prairies and is distributed across a steep rainfall gradient in the Midwest. This gradient has given rise to locally adapted wet and dry ecotypes. A gap in our understanding of plant ecotypes is the extent to which local soil microbes interact with ecotypes. We investigated how soil microbes affect big bluestem growth and whether plant ecotypes are locally matched to their microbes. We predicted that ecotypes would grow better when grown with native microbes than with microbes adapted to other big bluestem ecotypes. **METHOD:** We collected seeds and soils from six native big bluestem populations from western KS (580mm) and Illinois (1,167mm). We isolated microbes from field soils and reciprocally injected wet and dry microbes into common garden soils planted with either dry or wet big bluestem ecotypes. Plants were grown in greenhouse with 6 replicates per treatment and were measured and injected weekly. After 12 weeks, plants were harvested and weighed. **RESULTS:** We found that ecotypes differed in leaf width, height, and total biomass. Wet ecotypes were larger, taller, and produced more biomass than dry ecotypes. Physiological traits, such as chlorophyll absorbance, a proxy for photosynthesis, were enhanced in ecotypes growing with their local microbes. Additionally, dry ecotypes produced ~30% more biomass when matched with their local microbes. **CONCLUSION:** These results provide insight into how plants interact with native microbes, and how researchers might harness microbial communities to increase plant productivity and enhance prairie sustainability.

LOCAL ADAPTATION OF THE DOMINANT PRAIRIE GRASS IN RECIPROCAL GARDENS ACROSS THE RAINFALL GRADIENT OF THE US CENTRAL GRASSLANDS: DECADAL PATTERNS

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BACKGROUND AND PURPOSE: Big bluestem (*Andropogon gerardii*) is a dominant, native, grass that is for critical cattle forage, conservation, and restoration. This grass has a wide distribution across the Great Plains rainfall gradient (500-1200 mm rain/yr) giving rise to dry, mesic, and wet ecotypes. The objective was to observe growth of big bluestem cross-transplanted across the precipitation gradient. We predicted that each ecotype performs best in their home site, experimental drought most negatively impacts plant performance of the wet ecotype, and locally adapted ecotypes are dominant over the surrounding plant community. **METHODS**: In 2010, each ecotype was cross-transplanted into four reciprocal garden sites (Colby, Hays and Manhattan, KS to Carbondale IL). Canopy cover and aboveground biomass was monitored over time until 2022 to estimate growth. To examine the effects of drought, rainfall was reduced by 50% using rainout shelters in three sites. **RESULTS/FINDINGS**: By 2022, wet and dry ecotypes demonstrated local adaptation, based on cover and biomass, confirming that wet and dry ecotypes perform best in their home environments. Experimental rainfall reduction resulted in increased cover and biomass in the dry ecotype in the wet site, demonstrating its adaptation to low rainfall. Finally, the locally adapted population reduced cover and biomass of the surrounding plant community. **CONCLUSION:** These results indicate the prominent role of ecotypes across the natural and experimental rainfall conditions. Big bluestem is vital for forage and widely used in restoration, so knowing its response to rainfall is critical. Thus, grassland restoration should consider the use of climate-adapted ecotypes in anticipation of future droughts.

DISENTANGLING THE EFFECTS OF PLASTICITY AND GENETICS IN PHENOTYPIC TRAIT EXPRESSION OF SULFIDE SPRING FISH

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BACKGROUND AND PURPOSE: A key endeavor in biology is understanding how traits vary between populations in different environments. These differences and their origins—whether from genetic or environmental influences—offer insight into how adaptation works and how evolution has unfolded. **METHOD:** The extremophile fish *Poecilia mexicana* offers an ideal system for studying trait variation and its origins. In the wild, *P. mexicana* is found in both normal streams and springs rich in toxic hydrogen sulfide (H_2S). We compared traits between populations in the wild and in the lab to test which traits differ and if those differences were genetic or environmentally induced. We analyzed the relative size of six different organs, metabolic rate, and body shape. **RESULTS/FINDINGS:** We found significant trait differences between populations from different environments, both in the wild and in the lab. We found several traits with strong genetic drivers, and traits shaped by both genetic and environmental influences. **CONCLUSION:** Traits showed both genetically and environmentally induced differences between populations. This indicates that both genes and the environment affect the trait expression of *P. mexicana* in H_2S springs. Our findings raise new questions about what altered trait expression first, genetic or environmental influences, and how these different origins impact the ongoing evolution of these two populations. These findings also illustrate just how readily environmental variation interacts with genetic variation, and the risk of proclaiming traits as purely adaptive—and therefore genetic—without examining their true origins.

DETERMINING THE PHOSPHORUS RELEASE CURVE FOR SMIZYME TS G5 2,500 PHYTASE FROM 500 TO 2,500 FTU/KG IN NURSERY PIG DIETS

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BACKGROUND AND PURPOSE: Phytase is an exogenous enzyme included in swine diets to release phosphorus from its major storage form, phytate. Smizyme TS G5 2,500 has shown to improve growth performance and fibula mineralization of nursery pigs up to 1,500 FTU/kg. However, implementation at higher inclusion levels or with additional bone criteria has not been investigated. The objective was to evaluate the effects on growth performance and bone characteristics of nursery pigs and to develop an aP release curve for Smizyme TS G5 2,500 from 500 to 2,500 FTU/kg. **METHOD:** A total of 320 pigs were used in a 21-d growth study**.** Pigs were blocked by average pen body weight and randomly allotted to 1 of 8 dietary treatments on d 18 post-weaning. Treatments included 3 diets containing increasing (0.11, 0.19, and 0.27%) inorganic P from monocalcium P, or 5 diets with increasing phytase (500, 1,000, 1,500, 2,000, or 2,500 FTU/kg) added to the diet containing 0.11% aP. At the conclusion of the study, 1 pig per pen was euthanized and the right fibula, rib, and metacarpal were collected to determine bone characteristics. **RESULTS/FINDINGS:** Pigs fed increasing phytase had increased (P<0.05) ADG, ADFI, and G:F. Additionally, pigs fed increasing phytase had increased (P<0.05) bone ash weight, percentage bone ash, bone density, and bone P. **CONCLUSION:** The available P release curve generated for percentage bone ash using data from all three bones is: aP = (0.219 × FTU/kg) ÷ (993.238 + FTU/kg). This release curve can be used by nutritionists to aid in diet formulation.

NOVEL PHARMACEUTICALS TO IMPROVE EXERCISE CAPACITY IN HEART FAILURE

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BACKGROUND: Heart failure inflicted by a heart attack (myocardial infarction) results in impaired changes in blood flow control. For instance, decreased muscle blood flow significantly hampers heart failure patients exercise capacity and quality of life. Soluble guanylyl cyclase (sGC), a signaling protein that aids in distributing blood flow, becomes damaged in HF. Utilizing novel pharmaceuticals (sGC stimulators) to "restore" sGC activity improves blood flow in lung and heart disease. However, it is unknown whether these improvements may alter exercise capacity. It was hypothesized that utilizing a sGC stimulator would improve exercise capacity in a heart failure model. **METHODS:** Heart failure was induced in male rats via surgically-induced myocardial infarction. Following ~5 weeks of progression, rats were acclimated to treadmill exercise for 5 min/day for 5 days at 25 m/min up a 10% grade, then treadmill time-to-exhaustion (TTE) tests determined endurance capacity. After initial TTE measurements, rats were randomized to receive 1.0 mg/kg sGC stimulator (sGC; n=9) or placebo (HF; n=7) via oral gavage for 5 days. Post-TTE tests were performed following the dosing protocol. **RESULTS:** All rats displayed moderate heart failure. Rats receiving the sGC stimulator increased post-TTE (1363 ± 96 vs. 758 ± 99 sec) and total work capacity (300 ± 25 vs. 215 ± 36 m*kg) compared to rats receiving the placebo (P<0.05). **CONCLUSION:** Utilizing pharmaceuticals to stimulate sGC activity increases the endurance capacity in heart failure rats suggesting a strong therapeutic potential for sGC modulating drugs in improving muscle blood flow and exercise capacity in humans with cardiovascular diseases.

EVOLUTIONARY AND ENVIRONMENTAL FACTORS SHAPING THE MICROBIOMES OF FISHES ADAPTED TO EXTREME ENVIRONMENTS

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BACKGROUND AND PURPOSE: Animals have microbial communities—collectively referred to as "the microbiome"—that are closely associated with their tissues. It is well-established that animal-associated microbiomes influence host functions, and they are also shaped by the host's environment and evolutionary history. In some cases, the host's microbiome can mediate tolerance to environmental stress and facilitate adaptation of the host. However, the role of the microbiome in host adaptation remains unstudied in vertebrates. To understand how host-microbe interactions influence adaptation, a crucial first step is to understand the factors shaping host microbiomes. We are utilizing a system of livebearing fishes that repeatedly colonized toxic sulfide springs in southern Mexico to explore how host microbiomes change upon colonization of extreme environments and to test how the environment and the host's evolutionary history shape host-associated microbiomes. **METHOD:** We analyzed the gut microbiomes of 23 populations of livebearing fishes in sulfidic and nonsulfidic streams throughout the Río Grijalva basin, as well as water and sediment microbiomes from each site, in order to better understand what evolutionary and environmental factors shape host microbiomes. **RESULTS/FINDINGS:** We found that host-associated microbiomes are shaped by both the host's evolutionary history and the environment, and we identified microbial communities that are shared among all of the sulfidic populations. These shared microbes are candidates for potentially adaptive symbionts of sulfide spring fishes. **CONCLUSION:** Our findings provide insight into the dynamics shaping host-microbe interactions. Analyzing microbiomes within an evolutionary framework provides a foundation for understanding how host-microbe associations arise and what role they play in adaptation.

SEASONALITY PREDICTS VARIATION IN LIFE HISTORY PHENOTYPES IN THE LIVEBEARING FISH *PRIAPICHTHYS ANNECTENS*

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BACKGROUND AND PURPOSE: Perhaps no other group of vertebrates has been as important as the livebearing fishes (Poeciliidae) to test models of life history theory. Previous work in this family has shown that traits such as age and size at maturity, reproductive allocation, fecundity and size of offspring can be shaped by natural selection as well as the environment. Interestingly, some life history traits vary more within species than others, although it is not clear why. One hypothesis is that some life history traits show a greater response to environmental changes than others. **METHOD:** Here, we evaluate this hypothesis by quantifying life history traits in the livebearing fish *Priapichthys annectans*, and comparing trait values within populations collected during the dry season versus the wet season. **RESULTS/FINDINGS:** We found that life history traits related to reproductive investment differed between seasons, whereas traits tied to the timing of reproductive events were not explained by season. Interestingly, during the wet season, female body condition increased, but females invested less in reproduction, marked by fewer and larger offspring. We also found that regardless of season, as females grow larger, they give birth to larger offspring. Finally, we found that this species provisions each egg with nutrients prior to fertilization (lecithotrophy), and that females carry one developing brood at a time (non-superfetation). **CONCLUSION:** This is the first study documenting the life history of *Priapichthys annectans* and adds to a growing body of work suggesting that seasonal environmental differences can induce changes in the expression of some, but not all life history traits.

DIVERSITY OF THE BACTERIAL AND VIRAL COMMUNITIES IN THE TROPICAL HORSE TICK, *Dermacentor nitens*, IN COLOMBIA

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BACKGROUND AND PURPOSE: Ticks are obligatory hematophagous ectoparasites that transmit pathogens to vertebrates, including humans. Composition of tick symbiotic microorganisms, including viruses, is highly diverse and may play a role in the transmission of tick pathogens. The tropical horse tick, *Dermacentor nitens*, is distributed throughout the Americas and it is the natural vector of *Babesia caballi* and *Theileria equi*, the causal agents of equine piroplasmosis. We characterized the viral and bacterial communities associated with partially-fed *D. nitens* females collected from horses in three distinct geographical areas in Colombia; Bolivar, Antioquia, and Cordoba. **METHOD:** Metatranscriptomics of collected ticks was performed through RNAseq for viral and bacterial sequence identification. Sequencing of the V3 and V4 hypervariable regions of the 16S rRNA gene was conducted using Illumina-Miseq for bacterial identification and assignment of Operational Taxonomic Units (OTU). **RESULTS/FINDINGS**: The metatranscriptomics approach revealed 9 contigs corresponding to 6 different viruses in 3 viral families and 13 bacterial associated contigs containing *Francisella*-Like Endosymbiont (FLE) genes. The 16SrRNA gene sequencing yielded a total of 356 OTUs, where the endosymbiotic species complex; Francisellaceae/*Francisella*, was predominant. Differences in the relative abundance of the microbial composition among the geographical regions were found to be independent of the presence of FLE. **CONCLUSION:** Our data revealed differences in microbial abundance among ticks by region. These findings can potentially be used to identify regional distinctions among the ticks and their microbiota. Deeper understanding of tick microbial and viral communities may allow us to develop new measures to mitigate pathogen transmission by ticks.

Engineering

TOWARDS ADAPTING RAINFED CORN PRODUCTION UNDER FUTURE CLIMATE CHANGE IN EASTERN KANSAS RIVER BASIN

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BACKGROUND AND PURPOSE: Eastern Kansas River Basin, an important rainfed producing region in the US Great Plains, lacks information on baseline yield conditions, and future climate change impacts on rainfed corn production. In this study, we assessed the baseline yield conditions (1985-2014), impacts of climate change and deep root proliferation adaptation strategy on yield, rainfall and nitrogen uptake productivities. **METHOD:** A well-calibrated and evaluated dynamic crop growth model was used to simulate changes in yield, rainfall and nitrogen uptake productivities. **RESULTS/FINDINGS:** Baseline yield varied from 6,522 kg/ha to 12,849 kg/ha, with regional average yield of 9,270 kg/ha. Corn yield is projected to decline by 36% to 50% relative to baseline conditions, with regional average decline of 45%; while rainfall and nitrogen uptake productivities are projected to decline by 25% to 42% (35%, regional average), and by 28% to 42% (37%, regional average), respectively. With deep root proliferation adaptation strategy under future climate change, regional yield gain is projected to increase by 37%. Similarly, rainfall and nitrogen uptake productivities were projected to increase by 39% and 12% in the region, respectively. It was observed that deep root proliferation adaptation strategy explored in this study targeted more on yield and rainfall productivity than nitrogen uptake productivity. **CONCLUSION:** The results of this study will be useful to corn producers and breeders in making relevant decisions to adapting rainfed production to future climate change in the region.

MODELING THE POTENTIAL INFLUENCE OF SUBSURFACE TILE DRAINAGE SYSTEMS ON DOWNSTREAM FLOODING IN A MIDWESTERN WATERSHED

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BACKGROUND AND PURPOSE: Subsurface drainage systems are common in agricultural regions of the midwestern United States. These systems remove excess water from the surface and soil profile of agricultural fields, allowing crop production in previously unsuitable locations. Drainage systems, however, impact watershed hydrology and could influence downstream flooding. Therefore, this study determines whether subsurface tile drainage systems influence downstream flooding from a midwestern, agricultural watershed: Skunk Creek watershed. **METHODS:** The Soil and Water Assessment Tool (SWAT) model is used to simulate the hydrologic processes of Skunk Creek Watershed for a period of 18 years (2004-2021). The model is calibrated and validated using observed daily streamflow data with the SWAT Calibration and Uncertainty Program (SWAT-CUP) software. Statistical parameters are used to evaluate how well-simulated streamflow matches observed streamflow. Five tile drainage scenarios—ranging from 15% to 75% tile-drained agricultural land—are individually incorporated into the model. **RESULTS:** As the drained area increases, the volume of tile flow contributing to daily streamflow increases. However, a comparison of tile drainage scenarios shows that increasing the amount of tile-drained agricultural land reduces downstream flooding events from 24 to 11 days. **CONCLUSION:** The findings of this study can be used to provide beneficial information to support and maintain stream systems, environments, and ecosystems at the outlet of drained, midwestern, agricultural watersheds.

ESTIMATING CHANGES IN FUTURE CROP WATER DEMANDS UNDER EXTREME CLIMATE CONDITIONS

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BACKGROUND AND PURPOSE: Groundwater supplies are crucial for agricultural productivity in places like the High Plains region. However, due to insufficient precipitation, groundwater withdrawals have outpaced recharging, endangering the long-term viability of agriculture. By providing the precise amount of water needed by crops per time, crop evapotranspiration (ET) data helps to minimize water waste. However, the occurrence of extreme climate events during growing seasons, significantly affect evapotranspiration rates, leading to water stress which negatively impact crop yields at the end of the season; especially if they happen during sensitive growth stages of crops. Therefore, it is essential to quantify the future change in seasonal evapotranspiration and to examine the nature of interaction between these extremes and crop ET. **METHOD:** Historical climate data was analyzed to determine which among eleven extreme climatic indices, selected from those recommended by the Expert Team on Climate Change Detection and Indices, most influences evapotranspiration. Based on FAO-Penman-Monteith equation, reference evapotranspiration was estimated from weather data and then multiplied with crop coefficient data from remotely-sensed Normalized Difference Vegetation Indices, to estimate crop evapotranspiration. **RESULTS:** Consecutive dry days most influences crop evapotranspiration. Crop evapotranspiration increased by 1.60%, 5.80%, and 7.94% under low emissions scenario, and by 2.65%, 9.0% and 15.87% under high emissions scenario in the Near-Term, Mid-Century and End of Century respectively. **CONCLUSION:** Temperature-derived indices influence crop evapotranspiration more than precipitation indices. Predicted changes in seasonal evapotranspiration can help agricultural producers to make well-informed decisions to optimize their use of groundwater resources.

NUMERICAL SIMULATION OF PYRETHRIN AEROSOL DEPOSITION

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BACKGROUND AND PURPOSE: Aerosol insecticides, such as pyrethrin, are widely used to control stored product insects by spraying inside food facilities. Optimization of aerosol application is important for control of insects. A previous series of laboratory experiments reported 100% knockdown of insects (adult confused flour beetles, *Tribolium confusum*), held in Petri dishes, with large (16 µm) aerosol droplets and 10% or less knockdown with small (2 µm) droplets in a test chamber with falling aerosol droplets impinging on the insects. **METHOD:** To evaluate aerosol droplets impacting the insects and dishes, the flow of air and aerosol droplets inside the chamber were simulated using a standard computer modeling technique, computational fluid dynamics (CFD), which predicted the motion of individual aerosol droplets. The simulations were done with the aid of the computer program ANSYS FLUENT 2021 R1. **RESULTS/FINDINGS:** Predicted deposition of pyrethrin increased with increasing droplet size. Larger droplets tended to settle quickly while smaller droplets tended to continually flow with the air without settling out. Large droplets above the dish settled in the dish 92% of the time, while 12% of the small droplets settled in the dish. These results, with many more of the larger droplets impacting the insects and dishes, help explain the previous experimental results with greater insect knockdown with large versus small droplets. **CONCLUSION:** The model can be extended to develop improved aerosol application methods for stored product insect control

PRINTED AND WIDE-TEMPERATURE TOLERANT GRAPHENE AEROSOL GEL-BASED MICRO-SUPERCAPACITORS FOR BENDABLE AND TWISTABLE ELECTRONICS

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BACKGROUND AND PURPOSE: To power up the next-generation technology paradigm, portable and flexible microelectronics have stimulated ever-growing demands for miniaturized energy storage devices, which are conformal to biological shapes and can operate in harsh environments. Supercapacitors demonstrated greater potential to meet the demand for high-power energy storage devices but still awaiting innovations for conformity and sustainability. In this research work, we designed inkjet-printed graphene aerosol gel based flexible all-solid-state microsupercapacitors which can operate from -15 °C to + 70 °C with highly stable and reliable energy storage performance. **METHOD:** Graphene aerosol gel was prepared from a detonation based scalable one-step synthesis method that was used to formulate a super-stable printable graphene ink. Inkjet printing technique was adopted to print the formulated graphene ink into interdigitated electrodes and PVA/H_3PO_4 solid-state electrolyte was printed on top to fabricate the flexible all-solid-state microsupercapacitors. **RESULTS/FINDINGS:** The graphene aerosol gel based solid-state microsupercapacitor obtained a high volumetric specific capacitance of 376.63 mF cm^{-3} at an applied current of 0.25 µA with 99.6 % of capacitance retention over 10,000 cycles. To elucidate the mechanical flexibility of as-fabricated microsupercapacitor, the electrochemical performances were scrutinized under different bending and twisting states and resulted in outstanding mechanical flexibility. Furthermore, to study the performance stability of the microsupercapacitor in harsh environments, a wide temperature dependent supercapacitive study was performed as stated above. **CONCLUSION:** The electrochemical performance of as-fabricated graphene aerosol gel based all-solid-state microsupercapacitor demonstrates a promising way to develop highly scalable and reliable futuristic miniaturized energy storage devices for applications such as wearable electronics.

STUDYING THE IMPACT OF CLIMATE ON RAINFED CORN YIELD USING A STATISTICAL-BASED REGRESSION AND PROCESS-BASED DSSAT CROP MODEL IN KANSAS

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BACKGROUND AND PURPOSE: Changing climate and the projected increase in variability and frequency of extreme events make an accurate prediction of crop yield critically important for addressing emerging challenges in food security. Several factors including environment, management, and genetics and their complex interactions make the prediction of crop yield challenging. Precise and timely prediction of crop yield can provide valuable information to agronomists, producers, and decision-makers. This study aimed to predict the rainfed corn yield in Kansas using a developed regression model and the DSSAT process-based model and assess the impact of synthetic climate change scenarios of 1 and 2 °C temperature rise in the future. **METHOD:** For this study, historic weather, soils, and crop management data were collected and converted to model-compatible formats to simulate and compared corn yield using both models. **RESULTS/FINDINGS:** We found that DSSAT has a large Root Mean Square Error (RMSE) compared to the regression model whereas the correlation coefficient is 0.94 and 0.7 for regression and DSSAT respectively. These results indicated that statistical model yields have a stronger association with the actual yields than does the DSSAT. Climate change impact showed that the reduction in rainfed corn yield by DSSAT was 8.6% and 18.3% for scenarios of 1 and 2 °C temperature rise respectively. Reduction in rainfed corn yield by regression was almost 5% in both scenarios. **CONCLUSION:** Due to the extreme heat effect, predicted impacts under uniform climate change scenarios are considerably more severe for the DSSAT than for the statistical-based model.

SPRAY COVERAGE AND DROPLET SIZE UNIFORMITY OF PULSE WIDTH MODULATION (PWM) SYSTEMS AT DIFFERENT DUTY CYCLES AND FREQUENCIES

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BACKGROUND AND PURPOSE: Agriculture is heavily dependent on the application of agriculture chemicals to increase crop production. Correct operability and accurate spray coverage are essential to minimize off-target application and mitigate potential environmental and human health concerns in chemical applications. PWM control system provides uniform application pressure during operation to maintain the target application rate and droplet size. However, little knowledge exists on the impact of PWM system's duty cycle and frequency on spray coverage and droplet size uniformity. This study aims to develop a methodology to quantify spray coverage and droplet size uniformity from a self-propelled agricultural sprayer utilizing PWM system at different duty cycles and frequencies. **METHOD:** Two PWM systems were operated at different combinations of duty cyles and frequencies. Water sensitive cards (WSCs) were used to evaluate the spray coverage and droplet size uniformity. After spraying, WSCs were scanned (@ 600 dots per inch resolution), and analyzed using a custom MATLAB program. **RESULTS/FINDINGS:** The results indicated that producers might consider implementing 30Hz frequency for the PWM1 system in order to achieve greater spray coverage area, higher spray coverage and droplet size uniformity. For PWM2 system, the producer might consider 20Hz frequency for greater spray coverage area. There was no significant difference between spray coverage uniformity, droplet size and droplet size uniformity when operating PWM2 system at 20Hz and 30Hz. **CONCLUSION:** Overall, the results exhibited that greater spray coverage and droplet size uniformity could be achieved when PWM spray systems were operated at frequency greater than 20Hz.

TOWARDS REALTIME SEEDING DISTANCE AND DOUBLES PREDICTION ON A PLANTING SYSTEM

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BACKGROUND AND PURPOSE: The traditional method of obtaining information about seed placement for quantification of planters is a time-consuming and manual process. The goal of this study was to design an automated system that could perform this task more efficiently. **METHOD:** The system used cameras and GPS technology to measure seed spacing at different planting speeds and seed populations. Image Detection alogrithms were trained to detect seeds and a special algorithm was designed to estimate the distance between seeds. **RESULTS/FINDINGS:** The results of this study showed that the automated system was able to provide more accurate and efficient measurements compared to manual methods by cutting down the time from 2 hrs to less than a minute. **CONCLUSION:** The findings from this study have the potential to significantly impact the way seed placement information is gathered in the future. The use of cameras and GPS technology in this system can make the process of obtaining seed placement information quicker and more accurate, potentially leading to improved outcomes for planter design and performance.

DEVELOPING AUTOMATED SYSTEMS FOR AIR-SEEDER ROW-CLEANER EVALUATION

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BACKGROUND AND PURPOSE: Farmers use air drills to put different crops into the ground, but they have some concerns when it comes to hair pinning, low soil temperatures and seedlings that do not come out of the ground due to heavy residue in the surface. Row cleaners are designed to move residue from the opener disc's path in order to get a clean and uniform trench for the seed. This experiment tested how different models of row cleaners work and develop a method for automatic quantitative evaluation of that work using computer vision. **METHOD:** Different models of row cleaners were installed on a John Deere air seeder to asses their work. Besides, a data acquisition system was installed to capture high definition videos to develop an AI model that should be able to evaluate cleanliness of the trench after the row cleaner has passed using Image Analysis. **RESULTS/FINDINGS:** Some row cleaners leave a high amount of residue in the trench and some of them disturb the soil and move residue into the gauge wheel's path, which can lead to an uniform seeding depth. **CONCLUSION:** Manufacturers are offering row cleaners for air drills that may not provide a clean and uniform seed trench. On the other hand, further research should be conducted on this topic in an objective manner. The AI model that is being developed aims to tackle this situation by providing an accurate and bias-free methodology for this evaluations.

UNIDL4BIOPEP: A GAME CHANGER IN BIOACTIVE PEPTIDE PREDICTION MODEL DEVELOPMENT

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BACKGROUND AND PURPOSE: The identification of potent peptides through model prediction can reduce benchwork in wet experiments. However, conventional model buildings are complex and time-consuming, involving challenges such as peptide representation, feature selection, model development etc. Recently, advanced language models (LM) have been released for protein sequence representation and successfully applied to structure/function prediction. Based on these developments, we propose and develop UniDL4BioPep, a universal deep-learning model architecture that can be self-adaptive to model various bioactivities of peptides with any length. This model can achieve cutting-edge performance by directly fitting various bioactive peptide datasets, thus meeting the demands of biochemistry researchers and facilitating the exploration of bioactive peptides. **METHOD:** Ten binary (i.e., active and in-active) benchmark datasets were retrieved from published state-of-the-art models to conduct an unbiased performance evaluation and comparison. The LM evolutionary scale modeling (ESM-2) was employed to generate numerical vectors to represent peptide sequences, which were then used for a convolutional neural network (CNN) model development. **RESULTS/FINDINGS:** By combining the LM with a convolutional neural network, UniDL4BioPep exhibited greater performances than the respective state-of-the-art models for nine of ten different bioactivity prediction tasks. The accuracy, Mathews correlation coefficient were 1.6-7% and 3.6-26.4% higher, respectively. UniDL4BioPep model architecture has great potential to be applied to other bioactivities prediction and multiclass classification tasks. A user-friendly web server for accelerating peptide screening and practical applications has been deployed and is freely available online at https://ecp2jxachm.us-east-1.awsapprunner.com/.

USE OF RAW MATERIAL PHYSICO-CHEMICAL PROPERTIES FOR DESIGN OF OPTIMAL QUALITY PLANT-BASED EXTRUDED BEEF AND FISH ANALOGUES

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BACKGROUND AND PURPOSE: Plant-based meat retail sales recently exceeded $5 billion with consumers wanting nutritious, affordable, sustainable and tasty products. This research attempts to optimize the utilization of plant protein ingredients with unique properties to design meat analogues that can target specific goals such as a plant-based beef burger or fish patty. **METHOD:** Recipes for plant-based patties were based on soy proteins but other plant proteins (pea and wheat gluten) were also used to modulate product texture. Proteins were analyzed for water absorption index, least gelation concentration and rapid visco analyzer pasting properties, based on which they were characterized as either cold or heat swelling. This means the proteins absorbed water either at room temperature, or after heating. Treatments had varying ratios of cold/heat swelling proteins to target different textures, based on the hypothesis that higher ratios lead to softer texture. Extrusion was used to produce texturized vegetable protein, which was milled, formed into patties and tested using texture analysis and a consumer sensory study. **RESULTS/FINDINGS:** Protein chemistry allowed understanding of the basis of their cold or heat swelling nature. Density and texture data confirmed that heat swelling proteins created denser, more layered, and firmer products while cold swelling proteins lead to porosity and softness. Optimal plant-based 'beef' patties with the right chewiness and springiness were soy and wheat based, while plant-based 'fish' patties were soy based. **CONCLUSION:** By understanding how protein swelling properties influence structure formation during extrusion, different protein types can be better utilized to produce quality meat analogues targeting a specific product goal.

3D PRINTING STARCH-BASED INKS: IMPACT OF PARTICLE SIZE AND DEGREE OF PRECOOKING ON PHYSICO-CHEMICAL PROPERTIES AND PERFORMANCE

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BACKGROUND AND PURPOSE: Food 3D printing is an emerging technology used to create novel food products, which works by depositing 'food ink' through a nozzle to create shapes layer-by-layer. This study focused on characterization of starch-based inks, and found that certain combinations of physico-chemical properties allow improved performance for 3D printing. **METHOD:** Food ink mixes with a degermed corn base were formulated and milled using a grinder for 0, 15 and 30s to study the impact of particle size during printing. Additionally, degermed corn was pre-cooked using twin-screw extrusion at different shear intensities (none, medium and high) and used in the same ink formulation. Water absorption index (WAI), least gelation concentration and rapid visco analyzer (RVA) pasting properties of the base materials were analyzed. 3D printed foods developed using the starch-based inks were evaluated for shape accuracy. **RESULTS/FINDINGS:** Particle size decreased with grinding, which allowed higher WAI and better heat gelation due to greater surface area, and led to better 3D printing performance. Inks formulated with extruded pre-cooked corn base had much higher WAI as compared to the no shear control, but exhibited gelation at room temperature, leading to flow challenges in the printer. RVA data supported these observations by demonstrating that pasting temperature decreased from 75^{o}C to 50^{o}C as extrusion shear increased. Based on these results, raw and extruded starch combinations were used to develop higher performance inks. **CONCLUSION:** The approach outlined in this study will help design food inks for 3D printing to create unique textures for delivering nutrition compared to current methods.

SEASONAL DYNAMICS OF SOIL HEALTH INDICATORS UNDER DIFFERENT CROPPING SYSTEMS IN THE SOUTHERN GREAT PLAINS

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BACKGROUND AND PURPOSE: Crop productivity in the Southern Great Plains is lagging compared to other regions in the U.S. mostly because of soil health deterioration caused by mono-cropped systems. This study focuses on understanding the temporal dynamics of common soil health indicators in cropping systems of varied crop diversity and intensity to evaluate the best moment to conduct soil health-related biological measurements. **METHOD:** Six different cropping systems, ranging from winter wheat monoculture to multi-species crop rotatins, were assessed in the Rainfed Agriculture Innovation Network plots in Ashland Bottoms-KS, during the winter wheat season. Soil samples were collected at 0-5 cm depth during emergence, flowering, and harvest stages. Soil health was determined through extracellular enzyme activity and soil microbial community assessments. The enzymes evaluated as soil health indicators were β-glucosidase and Arylsulfatase, and microbial community was determined by measurements of total soil fungi biomass. **RESULTS:** Enzyme activity analysis through the growing season revealed that β-glucosidase decreased 36% in activity during flowering when compared with the emergence and harvest stages, while the results revealed a decrease of 9% in total fungi biomass during crop's flowering. Enzyme activitiy and total soil fungi biomass were also affected by environmental factors, primarily by low soil moisture conditions due to drought. These indicators also showed a high correlation with soil organic matter, which is a relevant and widely used soil health indicator. **CONCLUSION:** The optimal timing for soil sampling was during the crop emergence stage. The cropping system with the highest crop diversity and intensity exhibited the highest soil health indicators rates.

QUANTIFYING N_2O EMISSION IN CORN PRODUCTION WITH A NOVEL N-FIXING BIOINOCULANT

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BACKGROUND AND PURPOSE: Nitrous Oxide (N_2O) emission is one of the inadvertent Nitrogen (N) loss pathways in agriculture, which is a potent greenhouse gas with a ~300 times greater warming potential than atmospheric carbon dioxide (CO_2). Mitigation and quantification of N_2O emissions from cropping systems are critical to limit future climate warming effects and measure the carbon footprint of cropping systems for future carbon markets. It is important to practice innovative crop production strategies to reduce N_2O emissions and increase N efficiency and profitability in agriculture. The increased cost of N fertilizers has stimulated interest in biologically fixed N. A commercially available newly developed bioinoculant (Proven) associates with corn roots and fixes N which could reduce N_2O losses. **METHOD:** The research was conducted at the Agronomy North Farm in Manhattan KS. The experiment was a Randomized Complete Block design with 4 N fertilizer rates (0, 56, 112, and 168 kg N/ha) with and without Proven. The experiment had 6 replicates. The static chamber technique was used to quantify the N_2O flux with measurements taken twice a week. **RESULTS:** Higher N_2O emissions were detected during the precipitation events early in the growing season in the year 2022. Emissions of N_2O increase with increasing N fertilizer application rates and N_2O emissions were reduced with bio-inoculant. **CONCLUSION:** The preliminary results of the 2022 season suggested lower N_2O emissions with bio-inoculants and were not significant. Further analysis is needed to compare N_2O emission with corn yield and 15N isotopes analysis.

HIGH TEMPERATURE STRESS INCREASES SENSITIVITY OF CORN (*ZEA MAYS*) TO 2,4-D AND DICAMBA

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BACKGROUND AND PURPOSE: Climate change scenarios, including rising temperatures, can influence crop yields as well as chemical weed control. Herbicides such as 2,4-D and dicamba are routinely used to control broadleaf weeds in corn, one of the major crops grown globally. The efficacy of these herbicides has been shown to be altered at high-temperature stress thereby, weed control; nonetheless, such information is not available on corn injury. Therefore, we hypothesize that the application of 2,4-D and dicamba at high temperatures may result in corn injury. **METHOD**: Corn seedlings were raised in a growth chamber maintained at 25/23 °C (day/night (d/n)). After emergence and at the three-leaf stage, seedlings were transferred to two separate growth chambers, maintained at either, optimum [OT]: 30/25°C(d/n) or high temperature [HT]: 40/35°C (d/n) to acclimatize. At 4-5 leaf stage, corn plants were treated separately with 2,4-D doses, 0X to 4X (X= 560 g ai/ha^{-1}) and 0X to 8X dicamba (X= 560 g ai/ha^{-1}) and were placed back into the respective growth chambers. Data on herbicide injury (weekly) and the above-ground biomass of corn were recorded at three weeks after treatment**. RESULTS:** Analysis of the data demonstrated that corn is more sensitive to 2,4-D and dicamba at high temperatures, with > 70% injury and up to 40% reduction in biomass compared to non-treated plants. **CONCLUSION:** High temperature stress can increase corn's sensitivity to 2,4-D and dicamba, possibly due to altered physiological processes of corn and/or herbicide performance, which are currently being investigated.

APPLICATION OF ARTIFICIAL NEURAL NETWORKS FOR PREDICTING BAKING CHARACTERISTICS OF WHEAT DOUGH

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BACKGROUND AND PURPOSE: Farinograph analysis serves as the standard (AACC 54 – 21.02) for determining the baking quality of wheat flour. It measures water absorption (WA), dough development time (DDT), and stability (DS) of wheat dough. These characteristics depend on wheat's kernel properties (grain moisture, grain protein, and hardness) and flour properties (flour protein, flour moisture, ash and falling number value). In the study, we propose an artificial neural network (ANN) model to predict the Farinograph properties of dough as a function of grain and flour properties. **METHOD:** A total of 160 wheat sample data was used for ANN model development. A feed -forward ANN architecture with a single hidden layer trained with a back propagation algorithm was adopted. **RESULTS/FINDINGS:** A series of ANN models with increasing complexity were developed for each response variable and the model success was evaluated via mean squared error (MSE) and coefficient of determination (R^2) against a test set. Subsequently, an uncertainty analysis was carried out to demonstrate the model's strength and degree of uncertainty by constructing a 95% prediction interval. **CONCLUSION:** The proposed model would assist the bakers in predicting the rheological properties of dough and baking quality.

PHAGE BIOCONTROL OF SHIGA TOXIN – PRODUCING *ESCHERICHIA COLI* O121 AND O26 IN WHEAT AND ITS EFFECTS ON FLOUR QUALITY

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BACKGROUND AND PURPOSE: Pathogen contamination of wheat flours have become a major concern for the flour milling industry. The objective of this research is to determine the effects of bacteriophage treatment on the *E. coli* O121 and O26 load of wheat and flour quality.**METHOD:** Hard red winter (HRW) wheat grains were pre-dried and inoculated with *E. coli* O121/ O26 (5 or 6 log CFU/g). Inoculated grains were rested overnight and tempered (16%; 24 h) with the bacteriophage treatments prepared (at 0, 0.1, 0.25, 0.50, 1.0, and 10% level). Reductions in *E. coli* load was determined by plating in selective and differential media. The effects of the tempering treatments on flour milling and baking quality were then evaluated.**RESULTS/FINDINGS:** The use of bacteriophage solutions had higher ($P < 0.05$) reductions (1.7 to 3.2 log CFU/g) compared to the control (1.3 to 1.7 log CFU/g) after tempering. Both time and tempering concentration had significant effects on the reductions observed. The use of 0.1 and 10% treatment concentrations resulted in flours with comparable milling and baking performance to the control. **CONCLUSION:** The results indicate that phage tempering is a viable intervention to reduce pathogen contamination in wheat grains prior to milling which can improve flour food safety.

EFFICACY OF SILICA POWDERS ON MORTALITY AND PROGENY PRODUCTION OF THE LESSER GRAIN BORER, *RHYZOPERTHA DOMINICA* (F.) (COLEOPTERA: BOSTRICHIDAE).

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BACKGROUND AND PURPOSE: *Rhyzopertha dominica* (F.) a primary insect pest of many stored food commodities is mainly managed using synthetic pesticides, which can increase risk of chemical contamination in grains and resistance development in insects. The purpose of this study was to evaluate the efficacy of two silica powders against lesser grain borer.**METHOD:** Bioassays were performed by exposing adults to silica powder treated concrete arenas at 13 concentrations (0-5 g/m^2) for 4, 8, 12, 24, 36 and 48 h. Following exposure, the adults were transferred to 150 ml plastic containers with 30g wheat to determine mortality at 7d and progeny production at 42d. Mortality and progeny production data were analyzed using ANOVA at α=0.05 and mean separations using REGWQ procedure. Individual and pooled models were fit for mortality and progeny production data using TableCurve 2D software. **FINDINGS:** Particle size diameter of silica 2 powder was significantly higher (P<0.05) compared to silica 1 at D_{10}, D_{50} and D_{90} diameter fractions. Adults of *R. dominica* were extremely susceptible to silica 2 powder leading to complete mortality of adults and inhibition of progeny production at a lower test concentration of 0.50 g/m^2 exposed for 4h. On other hand, for silica 1 powder, complete mortality and inhibition of progeny production of *R. dominica* adults was achieved at 0.5 g/m^2 concentration following 24 h exposure. **CONCLUSION:** The application of silica powders to concrete surfaces such as the bins, can be very effective in mitigating the *R.dominica* population prior to storage of new grains.

IMPACT OF INCORPORATING PULSE MEAL ON WHOLE WHEAT BREAD QUALITY

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BACKGROUND AND PURPOSE: Pulses are good sources of protein, dietary fiber, minerals, and vitamins. Therefore, the incorporation of pulse meal in whole wheat flour may enhance their nutritional profile. The amino acids of cereals and pulses complement each other. The aim of the study was to study the impact of pulse meal incorporation on the quality of whole wheat flour bread. **METHOD:** Sixteen different types of pulses with wide genetic variability were milled to obtain pulse meal. The pulse meal was incorporated in commercial whole wheat flour at 7.5% inclusion level and bread was baked utilizing a standard baking method. The bread loaf volume and specific loaf volume which are the most important bread quality indicators were measured. **RESULTS/FINDINGS:** The specific loaf volume of the different bread ranged from 2.69 cm^3/g to 4.02 cm^3/g as compared to 4.04 cm^3/g of the control bread baked using commercial whole wheat flour. The top five pulse meal incorporated bread in terms of specific loaf volume were bambara groundnut bread, mung bean bread, rice bean bread, pigeon pea bread and cowpea bread with specific loaf volume of 4.02 cm^3/g, 4 cm^3/g, 3.94 cm^3/g, 3.83 cm^3/g and 3.74 cm^3/g, respectively. **CONCLUSION:** The novelty of this research lies in the comprehensive screening of different pulse meals to identify pulses with superior baking quality for potential application in bakery products. In future studies, we will further study the effect of the five pulse meal incorporated composite flour (with superior baking quality) on dough rheology, texture and sensory characteristics of whole wheat flour bread.

LONG TERM CARE, OLDER ADULTS, AND SEXUALITY

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BACKGROUND: A vital aspect of the human experience that is often overlooked is the sexual development, expression, and identity of older adults. Many times, any mention of "sex" is considered taboo and is often not spoken of with, among, or about older adults; this is particularly true within the realms of healthcare and long-term care. **METHODS:** To rectify this omission, through a literary review, research in recent years has encouraged conversation regarding older adults and sexuality. **RESULTS:** There exists a critical need for discussions both in healthcare and in society that expose that sexuality is a basic human right that must be encouraged, respected, and understood regardless of age. The absence or limited acknowledgement of sexual well-being within long-term care facilities, particularly, has a considerable impact on an older adult's well-being such as lack of connection, not receiving proper care, and creating an environment of fear and isolation. With regulations, there are very few that touch on sexual needs and expressions and those that do are vague, left to interpretation, and are often overlooked and under-enforced. **CONCLUSION:** Using an applied policy change approach, this presentation will highlight one state's regulations along with federal, CMS, regulations and discuss the importance of addressing and having space for sexual expression in long-term care facilities

WESTERN FORMAL EDUCATION IN GOLDCOAST-GHANA: AN OVERVIEW OF COLONIAL EDUCATIONAL POLICIES AND CURRICULUM FROM 1919-1927

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BACKGROUND AND PURPOSE: The Gold Coast, now Ghana, had some kind of formal and informal education before the advent of Europeans in the 15th century, with the goal of integrating young people into the community. Due to colonization, the Gold Coast colony adopted the colonizing country's system of education. Analysis of the numerous western educational policies and curricula adopted by Ghana's colonizer, the British, is necessary to comprehend the country's current educational policies and curriculum as well as its consequences on the Ghanaian people. **METHOD:** Using historiography methodology, Critical Policy Analysis (CPA), and Postcolonial Theory (PCT) as frameworks for interpretation and analysis, primary and secondary source documents were used to pursue the research goals. **RESULTS/FINDINGS:** It is certain that the 1919-1927 educational policies and curriculum had a good influence on the construction of Accra Government School, Achimota School, road networks, and other educational facilities. But instead of succeeding in its primary goal of educating people in morality and civility so that they might lead their own countries, it turned into a tool for imposing social control on the populace. The schooling that was supposed to civilize a "primitive" population instead led to acculturation, religious proselytism, and philology/language supremacy, highlighting the glaring discrepancies between what policy claims and what policy actually does. **CONCLUSION:** The study contributes to a better understanding of historical influences on current educational policies and curricula. This enables educational stakeholders to identify past errors and anticipate future issues in order to make the required adjustments for a better educational system

A HISTORICAL ANALYSIS OF THE KANSAS STATE AGRICULTURAL COLLEGE AND ITS INFLUENCE ON THE DEVELOPMENT OF K-STATE RESEARCH AND EXTENSION

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BACKGROUND AND PURPOSE: With sporadic success and failures in agriculture endeavors in the latter half of the 19th century, Kansas farmers and producers needed guidance and scientific and technical education. The creation of an agricultural college, research station and cooperative extension service were vital in advancing Kansas agriculture and paving a way for life on the prairie. These needs were met with the founding of the Kansas State Agricultural College in 1863 and its extension efforts. The purpose of this historical research study was to document the influence the Kansas State Agricultural College had on the development of the Kansas State University Agricultural Experiment Station and Cooperative Extension Service, now known in short as K-State Research and Extension. **METHOD:** Historical research methods were used to gather information for this study through primary and secondary sources. **RESULTS/FINDINGS:** Kansas was the first to take advantage of the Morrill Act of 1862 to establish a land grant college in the Kansas State Agricultural College. The college conducted research before the Hatch Act, was one of the first land grant colleges to host Farmers' Institutes to disseminate research data to Kansans and employed extension agents before the Smith-Lever Act. The state of Kansas had a need for knowledge and the college has always been ready to answer the call. **CONCLUSION:** Today, K-State Research and Extension, which was born from the Smith-Lever Act, is found in all 105 counties of the state and serves as a liaison between the college and Kansans.

SILENCED BY HISTORY. WHO IS NO. 6 TROOP, AND WHY SHOULD WE CARE?

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BACKGROUND AND PURPOSE: When it comes to the Second World War, the books, articles, short stories, movies, and television shows are enough to fill the shelves and storage rooms of Hale Library alone. However, the No. 10 (Inter-Allied) Commando Unit, comprised of multiple nations fighting on the same side; hence the (Inter-Allied) designation, has been silenced or lost to history. The story of this unit is examined through the lens of one of the nations involved. The Polish members of No. 10 (IA) provide a window into the unit itself and allow for a discussion of how they were lost to history and why it is essential. **METHOD:** War Diaries of No. 10 (IA), Polish records of the unit members, were among the many documents collected from the National Archives of the United Kingdom in Kew, England. For the Polish records, translation of the documents was required and is still ongoing by the author. **RESULTS/FINDINGS:** The records so far indicate that from an operational or boots-on-the-ground perspective, the unit's actions were kept hidden from the public for strategic reasons. **CONCLUSION:** While still in the early stages of research, it has become clear that further reflection on the actions of the higher command during the Second World War inadvertently or explicitly kept the unit's activities hidden for operational purposes or some other reason.

EMPOWERING WOMEN THROUGH RESISTANCE TRAINING

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BACKGROUND: Women are less likely than men to meet physical activity (PA) guidelines. Exercise is a subset of PA that includes cardiorespiratory (CT) and resistance (RT) training. Exercise empowerment may increase adherence. **PURPOSE:** Explore how women rank empowerment by PA type and the relationship between empowering exercise and PA engagement. **METHOD:** Women (N = 175) aged 18-65, 90% white, completed a cross-sectional survey. Participants reported up to five PA types ranking them from most to least empowering. They were coded by exercise type. PA engagement was collected via the Godin-Shepard Leisure Time PA Questionnaire (GSLTPAQ), which assesses participants' PA frequency in metabolic equivalents to arbitrary units. Mann-Whitney U-tests were used for between-group differences. Participant responses who ranked PA and completed the GSLTPAQ were analyzed (n = 91). **RESULTS:** RT (n = 34, 37.4%), walking (n = 11, 12.1%), and running (n = 10, 11%) were the most empowering PA types. Mean units for total PA among CT-empowered women (n = 53, all CT activities) were 45.6 ± 4.0 and 53.6 ± 4.2 among RT-empowered women (n = 34). For moderate to vigorous PA (MVPA), CT-empowered women averaged 35.5 ± 3.8; RT-empowered women averaged 43.3 ± 3.7. Unit differences were statistically insignificant (PA U = 735, $p = 0.1$; MVPA U = 716.5, $p = 0.2$). **CONCLUSION:** More women ranked RT as empowering than walking and running. Though not statistically significant, RT-empowered women reported greater average PA and MVPA than CT-empowered women. Exploring exercise empowerment in a larger sample may reveal mechanisms to facilitate PA adherence.

GOOD FOR THE SOIL, BUT GOOD FOR THE FARMER? ADDICTION AND RECOVERY IN TRANSITIONS TO REGENERATIVE AGRICULTURE

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BACKGROUND AND PURPOSE: While the ecological benefits of regenerative agriculture (RA) are becoming clearer, its effects on farmers themselves are less well-understood. Our purpose was to understand how farmers experience transitions from industrial agriculture to regenerative agricultural practices. **METHOD:** Drawing on the 'good farmer' concept of identity, we provide a qualitative, narrative analysis of 51 farmers in United States' Central Great Plains region, who, at various points in time, began transitioning to RA. **RESULTS:** We found that transitioning farmers set themselves apart from those practicing industrial agriculture, including themselves in the past, who constituted an 'other' against which they contrasted their emerging identities as 'regenerative' farmers. These farmers used the discourse of addiction to describe industrial agriculture, seeing RA as a form of recovery from the chemical-intensive and subsidy-fueled treadmill of production that characterizes industrial agriculture. **CONCLUSION:** RA is experienced as a process of recovery that entails shifts in farmers' identities as 'good' farmers.