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

Program Booklet

March 19 and 20, 2024
K-State Student Union

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Oral Presentation Abstracts

Agricultural Sciences, Biological Sciences and Engineering 1

PLANT INTRASPECIFIC TRAIT VARIATION ACROSS BROAD ENVIRONMENTAL GRADIENTS: IDENTIFYING POTENTIAL SOURCES OF CLIMATE ADAPTATION

Jack Sytsma[1], Helen Winters[1], Adam Smith[2], Erica Newman[2,3], and Loretta Johnson[1]
[1]Division of Biology; [2]The Missouri Botanical Garden; [3]Department of Integrative Biology, University of Texas at Austin

BACKGROUND AND PURPOSE: Although grasslands were once expansive across the US, only 4% of their original extent remains. They are furthermore predicted to be threatened by climate change. We aim to characterize adaptations to climate of the dominant prairie grass, Andropogon gerardi (big bluestem) across its range. Our goal is to create a climate model to inform restorations. **METHODS:** We sampled 26 sites in peak season 2023, MN-TX and CO-NC, across precipitation ranging from 325-1400mm and temperature ranging from 4-21°C. We included samples at environmental margins because they already experience climate extremes. We hypothesized that plants within the range core (optimal environment) would be most abundant, with less trait variability compared to the margins. Plants at the western (drier) margin would need reduced leaf surface area to minimize evaporative water loss and greater leaf surface area at the eastern (wetter) margin to maximize light capture. We measured morphology (height, leaf thickness, cover, biomass) and physiology (photosynthetic rate, water balance). **RESULTS:** We found that plants within the core range had highest cover and least trait variability. Plants were smaller at the dry margin and larger at the wet margin. Drier sites had higher photosynthetic rates. Precipitation (not temperature) drove all trait responses and aridity drove 9 out of 13 responses. **CONCLUSION:** Overall, this project provides novel insight into plant function in different climate scenarios. Since we include margins where the study organism is already experiencing climate extremes, our results can inform selection of traits that will thrive in altered conditions.

EVALUATING DRIED BAKERY PRODUCTS AS ALTERNATIVE INGREDIENT IN DOG FOOD

Larissa Alves Koulicoff, Yunyi Zhang, Greg Aldrich, and Julia Pezzali
Department of Grain Science and Industry

BACKGROUND AND PURPOSE: Utilizing up-cycled materials such as Dried Bakery Products (DBP) in dog food creates an opportunity to promote sustainability in the pet food industry. DBP is a human food by-product from expired bread, cookies, cake, donuts and other "bakery" products, and provides a new use for food that would become waste. However, the use of DBP as an ingredient in dog food has yet to be evaluated. This study aimed to determine palatability and digestibility of DBP-containing extruded dog diets. **METHOD:** Four diets were formulated with 0% (control), 8.5%, 17% or 22.5% DBP inclusion, replacing traditional grains (rice, lentil and sorghum). Palatability and digestibility of diets were evaluated utilizing adult dogs. **RESULTS:** Palatability of the control and the diet containing 8.5% DBP was comparable ($P > 0.05$). However, dogs preferred the control over the diets with higher inclusion of DBP ($P < 0.05$). Fecal dry matter was similar for the control and 8.5% DBP diet ($P > 0.05$) but increased with higher DBP inclusion ($P < 0.05$). Additionally, diets containing DBP led to greater dry fecal outputs compared to the control ($P > 0.05$). The inclusion of DBP resulted in a quadratic decrease in apparent total tract digestibility of dry matter, organic matter, protein, and fat, but still within acceptable ranges ($P < 0.05$). **CONCLUSION:** At low inclusion, DBP can replace grains in dog diets without affecting palatability and digestibility. At high inclusion, DBP may reduce the digestibility of macronutrients, which can be beneficial for specialty diets, such as those focusing on weight loss.

CAN PLANT NITROGEN SENSORS REVOLUTIONIZE CORN YIELD AND ENVIRONMENTAL SUSTAINABILITY?

Leonardo Bosche and Ignacio Ciampitti
Department of Agronomy

BACKGROUND AND OBJECTIVE: Diagnostic tools to support nitrogen (N) management in cropping systems are increasingly needed not only to maximize profit but also to minimize environmental impact. In today's agricultural world, protection of soil, water, and air quality has become an imperative constraint, and traditional fertilization strategies, once deemed secure, are no longer viable. Therefore, it is crucial to equip farmers with diagnostic tools for assessing crop N status, enabling informed decisions regarding the rate and timing of N fertilizer applications. This study aims to assess the effectiveness of three handheld sensors - SPAD, LI-600, and Green Seeker - in diagnosing nitrogen deficiencies in corn. **METHOD:** A corn field study with five N rates (0, 90, 120, 150, and 180 kg N ha-1) was conducted in Topeka, Kansas in 2023. Sensing data was collected 4 times throughout the crop growing season on the last developed leaf for SPAD and LI-600, while Green Seeker was placed above the crop canopy. Regression analyses were performed using the R software to assess the ability of these sensors to detect N changes over time. **RESULTS:** The results of this study indicate that all sensors under consideration enabled the detection of N changes. From an early season standpoint, the V10 growth stage (tenth leaf collar is visible) could be an opportune timing for detecting N deficiencies. **CONCLUSION:** The findings present an excellent opportunity to assess N status at early corn growth stages, thereby enhancing nitrogen management practices while mitigating environmental impacts.

FATE OF 15N FERTILIZER IN RAINFED WHEAT-BASED CROPPING SYSTEMS

Jessica Bezerra de Oliveira and Charles W. Rice
Department of Agronomy

BACKGROUND AND PURPOSE: Improving crops use nitrogen (N) is essential for enhancing crop yield and quality and protecting the environment. In this research, we looked at how wheat plants in rainfed fields can absorb N more efficiently. **METHOD:** We set up a field experiment with five different methods of growing wheat and applying nitrogen: one standard approach where nitrogen is applied once in early spring, and a progressive method, which involves two nitrogen applications - one in early spring and another in late spring. We used a special nitrogen fertilizer labeled with a stable isotope, ^{15}N-urea, to track how the wheat plants used nitrogen. For the plots with dual nitrogen applications, we created two subplots within each - one received the labeled fertilizer during the first application and regular, non-labeled nitrogen during the second application. The other subplot received non-labeled nitrogen during the first application and the labeled ^{15}N-fertilizer during the second application. We collected plant samples at different growth stages: jointing, anthesis, and soft dough. We sent the samples for lab analysis to understand how the plants were using the nitrogen. **RESULTS/FINDINGS:** The progressive method resulted in the highest N uptake by the plants, especially during the anthesis and soft dough stages. In addition, this method had an impressive N recovery rate in the grain. On the other hand, the standard method at the anthesis and soft dough had lower N recovery. **CONCLUSION**: Our findings suggest that using a dual nitrogen application in wheat farming is a more effective way to improve N use efficiency.

EVALUATING AND DEVELOPING HERBICIDE OPTION FOR PEARL MILLET PARENTAL LINES

Midhat Z. Tugoo[1], Vipan Kumar[2], P.V Vara Prasad[1], and Ramasamy Perumal[1]
[1]Department of Agronomy; [2]Soil and Crop Sciences Section, Cornell University

BACKGROUND: Pearl millet is an important cereal crop but faces weed-related production challenges, significantly reducing its yield. Four herbicides (clethodim, quizalofop, imazamox, and nicosulfuron) were screened for effectiveness on advanced pearl millet lines developed at Kansas State University. **PURPOSE:** Currently, there is no herbicide available for pearl millet. This study hypothesized that natural tolerance may exist among pearl millet parental lines and the objective of the study was to identify herbicide-tolerant lines. This will provide producers with a safe and effective way to eliminate weeds from their fields, without damaging their crops. METHOD: The research was conducted on 56 pearl millet lines to identify their response to clethodim, quizalofop, imazamox, and nicosulfuron herbicides. The three most promising lines out of 56 were sprayed with imazamox and nicosulfuron at different doses to identify the safest and most effective dose. Visual crop injury and survival percent were recorded at 7, 14, and 28 days after application of the herbicides. **RESULTS:** The study found that no line survived clethodim, only 4 lines survived quizalofop, and all 56 lines survived imazamox and nicosulfuron at 28 DAA. Also, the results showed that the selected three lines can tolerate 6-8 times higher doses of imazamox and nicosulfuron compared to the field use rates. **CONCLUSION:** These preliminary results indicate that all 56 lines can tolerate imazamox and nicosulfuron herbicides, which producers can use for controlling grass weeds in pearl millet fields. **FUTURE WORKS:** Confirmatory field evaluations and investigation of the underlying mechanism of tolerance of the selected lines.

INFLUENCE OF SEED COATING AND IRRIGATION ON TURFGRASS ESTABLISHMENT

Parul Mandal and Ross C. Braun
Department of Horticulture and Natural Resources

BACKGROUND AND PURPOSE: Seed coating technology, which includes binders, additives, and other materials, has gained significant momentum in recent years in agricultural and horticultural sectors. While seed coating has shown the potential to increase the efficacy of seed germination and viability in various crops, the impact on turfgrass establishment remains inconclusive. **METHOD:** Two greenhouse experiments were conducted to evaluate the effect of irrigation amounts and frequency on the establishment of coated vs. noncoated seed. The study examined seed coating (coated vs. noncoated), irrigation amount (2.54 mm day^{-1}, 5.1 mm day^{-1}), irrigation frequency (daily, every other day), and soil type (loam, sand, and silt loam) across four cool-season turfgrass species [perennial ryegrass (*Lolium perenne*), tall fescue (*Festuca arundinacea*), Kentucky bluegrass (*Poa pratensis*), strong creeping red fescue (*Festuca rubra* ssp. *rubra*). Similar data collection across both experiments included seedling emergence, grid counts (% turf cover), digital image analysis and visual turf cover. **RESULTS:** Seed coating, irrigation amounts, irrigation frequency, and soil type had minor to no effect on seedling emergence across all four species in both experiments. Seed coating improved turf cover in tall fescue only. Irrigation amounts had greater influence on increasing turf cover during establishment, except Kentucky bluegrass. Soil type provided the most consistent impact on turf cover from 15 to 45 DAP, irrigation frequency improved turf cover, at times. There were instances where coated seed was less influenced by irrigation frequency and soil type. **CONCLUSION:** Preliminary results show inconsistent findings, indicating a need for further investigation into the potential of seed coatings in the turfgrass industry.

EFFECT OF GRAIN SOURCE ON EXTRUDED FEED CHARACTERISTICS AND GROWTH PERFORMANCE OF RAINBOW TROUT

Tucker Graff[1], Wendy Sealey[2], and Sajid Alavi[1]

[1]*Department of Grain Science and Industry;* [2]*USDA-Agricultural Research Service, Bozeman Fish Technology Center*

BACKGROUND AND PURPOSE: Sustainable feed production methods are becoming increasingly important in aquaculture. The purpose of this study was to investigate the effectiveness of waxy grain sorghum as a dietary component for rainbow trout and its impact on processing energy use and pellet qualities. **METHOD:** Four diets were formulated to have 45% protein with four grain sources: wheat (GW), red sorghum (NRS), waxy-red (WRS) and waxy-white sorghum (WWS). Energy data was collected during grinding and extrusion. Diets were extruded using a pilot-scale X-20 single-screw extruder. **RESULTS:** Particle size reduction of wheat was significantly more energy intensive than all sorghum varieties (75 to 40 kJ/kg). A similar trend was present in post-batch grinding of mixed diets, with the GW diet requiring 45 kJ/kg, significantly more than other diets. Mechanical Energy values ranged from 201 to 160 kJ/kg, with GW having the highest and waxy varieties the lowest. Consequently, waxy-based diets had the highest bulk densities and wheat the lowest (425 to 370 g/L), resulting in a denser, less expanded pellet for the waxy-based diets, leading to a reduced pellet floatability, with WRS being only 50% floating after thirty minutes. Water stability values ranged from 93% to 87% after 15 minutes, with NRS being the most water stable. **CONCLUSION:** All sorghum varieties require less energy than wheat in grinding and extrusion. Waxy-grain inclusion led to reduced SME, and less pellet expansion and floatability. A feeding trial is currently being conducted at the Bozeman Fish Technology Center.

OPTIMIZING WATER MANAGEMENT FOR SUSTAINABLE AGRICULTURE IN THE FACE OF EXTREME CLIMATE CONDITIONS IN SEMI-ARID REGIONS

Kelechi Igwe[1], Ikenna Onyekwelu[1], and Vaishali Sharda[1]

[1]*Carl and Melinda Helwig Department of Biological and Agricultural Engineering*

BACKGROUND AND PURPOSE: To ensure the long term sustainability of groundwater resources for agricultural production in semi-arid regions, we must implement more efficient irrigation management practices that can address two most prominent challenges farmers face in these regions: the prevalent impacts of extreme climate conditions on crop yield, and the excessive withdrawal of water resources. **METHOD:** Our research employed the Decision Support System for Agrotechnology Transfer-Crop Environment Resource Synthesis (DSSAT-CERES) Maize model to assess the efficacy of evapotranspiration-based (ET-based) irrigation scheduling in improving Maize crop resilience to extreme growing-season climate conditions. We conducted a 30-year simulation on twelve different irrigation treatments defined by four ET requirement thresholds (15mm, 20mm, 25mm, and 30mm), each replaced up to three levels (50%, 75%, and 100%). A baseline for comparison, referred to as the farmers' choice was provided, where irrigation was initiated automatically to always maintain the plant-extractable water in the soil profile above 50%. **RESULTS/FINDINGS:** In comparison to the farmers' choice, we found that applying a 75% deficit of the ET when the need reaches 30mm limits yield loss to 8% and saves up to 19% more water under normal weather conditions and when the maximum temperature is increased by up to 4°C above the normal. **CONCLUSION:** ET-based deficit irrigation adapts well to extreme heat and water stress, bearing important implications for irrigation management decisions in the future.

NOVEL PLANT-BASED MEAT FORMULATIONS AND EXTRUSION OPTIMIZATION

Shirin Sheikhizadeh[1], Yonghui Li[1], Davood B. Pourkargar[2], Kaliramesh Siliveru[1], Gregory Zolnerowich[3], Sanjoy Das[4], and Sajid Alavi[1]

[1]Department of Grain Science and Industry; [2]Department of Chemical Engineering; [3]Department of Entomology; [4]Department of Electrical and Computer Engineering

BACKGROUND AND PURPOSE: The growing demand for sustainable and nutritious plant-based meat alternatives necessitates continuous innovation in production. This research focuses on formulating plant-based meats and extrusion optimization of products using faba bean concentrate. **METHOD:** Three formulations were created, each featuring a base of 45% Faba bean concentrate and incorporating 44% Pea Protein Isolate (PPI), Soy Protein Isolate (SPI), and Gluten. Additionally, 11% Soy Protein Concentrate was added to all formulations. Extrusion, a crucial step in the process, was conducted under different conditions. Treatments were processed using a pilot-scale TX-52 twin-screw extruder with the in-barrel moisture content (IBM) increased for each formulation. Data was collected during extrusion for machine learning. **RESULTS/FINDINGS:** Preliminary analyses revealed an inverse correlation between bulk density and water holding capacity (WHC) in relation to formulation and extrusion conditions. The SPI formulation with low IBM resulted in the lowest bulk density (151 g/mL) and the highest WHC (484.6 g), while the PPI formulation with the highest IBM had the highest bulk density (333 g/mL) and lower WHC (134.5 g). Specific Mechanical Energy values ranged from 595.79 to 918.86 (kJ/kg), with the lowest observed for PPI with the highest IBM and the highest for SPI with the low IBM. Machine learning techniques are employed to predict the optimal combination of formulation and extrusion conditions for texture preferences aligning with consumer tastes.

INCREASING THE KNOWLEDGE ON RHIZOMATOUS TALL FESCUE SOD STRENGTH FOR KANSAS GROWERS

Emmanuel Nwachukwu and Ross Braun

Department of Horticulture and Natural Resources

BACKGROUND AND PURPOSE: There is an increasing demand for turfgrass sod; however, sod producers need more information on mixture ratios and aggressiveness levels of cool-season turfgrass species and their influence on sod tensile strength and handling to meet demands in the northern United States. Kentucky bluegrass (KBG) (*Poa pratensis* L.) is preferred over tall fescue (TF) (*Festuca arundinacea* Shred.), because of its rhizomatous growth. Tall fescue has grown in popularity because of its superior heat and drought tolerance compared to KBG. However, the bunch-type growth habit of TF is a limiting factor. **METHOD:** Field experiments at Kansas State University were conducted to evaluate the influence of mixture ratios of TF:KBG and rhizomatous-advertised TF on sod strength [maximum tensile strength (newtons) and required work to tear (N-m)] and sod handling (1-5 scale) at three harvests; 9, 10, and 12 months after planting (MAP). **RESULTS:** We found that some rhizomatous TF cultivars produced short rhizomes, and results on sod strength were similar to mixture ratios of TF:KBG. As expected, 100% KGB sod produced the highest sod strength and handling at 9 and 10 MAP, while 100% bunch-type TF resulted in the lowest sod strength. At times, some rhizomatous TF cultivars produced higher sod strength and handling than 100% bunch-type TF but still lower sod strength than KBG sod. **CONCLUSION:** Preliminary results demonstrate the differences in sod strength and handling across rhizomatous TF cultivars to help Kansas sod producers. Experiment run 2 is in progress to confirm results and quantify rhizome length differences.

SOYBEAN BIOLOGICAL NITROGEN FIXATION ROLE IN THE AGROECOSYSTEM

Luiz Felipe A. Almeida and Ignacio A. Ciampitti
Department of Agronomy

BACKGROUND AND PURPOSE: Biological nitrogen (N) fixation (BNF) is the primary source of N for soybean [*Glycine max* (L.) Merr.] and plays a crucial role in intensified systems. Insufficient BNF in soybeans compromises the broader concept of sustainability, presenting long-term challenges to future generations of farmers. In grain legumes, the N contribution is typically estimated by calculating the N balance, which is the difference between fixed N and N removed by grains. If soybeans fix more N than what is removed in the harvested grains, it is likely to leave N in the agroecosystem, making the overall soil N balance positive. This study aims to bridge the existing knowledge gap by analyzing data from multiple locations across the United States (US), highlighting the critical role of BNF in soybean production. **METHOD:** A total of 36 field trials were carried out and analyzed using Bayesian modeling across the 2021 and 2022 growing seasons. At all site-years, soybean BNF was estimated at the full-seed phenological stage using the ^{15}N natural abundance method. Seed yield was measured at maturity. Seed N was determined, and the N balance was calculated. **RESULTS:** The majority of sites resulted in a negative N balance, with the BNF contribution averaging 43%. Seed yield varied between 1.8 Mg ha^{-1} and 5.9 Mg ha^{-1}. **CONCLUSION:** Overall, soybeans were found to remove more N from the agroecosystem than they could fix through BNF. Assessing BNF is essential for the long-term sustainability of the US corn-soybean system.

PRODUCTION OF POLYHYDROXYBUTYRATE (PHB) FROM BATCH FERMENTATION THROUGH *P.SACCHARI* AND IT'S CO-FERMENTATION WITH *C. NECATOR*

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BACKGROUND AND PURPOSE: Production of bioplastic from renewable resources such as agricultural wastes via microorganisms is a robust alternative for today's world crisis of petroleum-based products and their effects. Hemp hurd, having great potential as a lignocellulosic biomass because of high glucan and xylan content, is a promising feedstock for production of bioplastic such as polyhydroxybutyrates (PHB). *Paraburkholderia sacchari* and *Cupriavidus necator* are two of the bacteria that can produce PHB as a storage product of their secondary metabolism. **METHOD:** In this study we attempted to optimize the different parameters involved in producing PHB and observed alterations while combining both bacteria during fermentation to attain high PHB yield. *P sacchari* was subjected to increased nitrogen and phosphorus content in the batch fermentation which enhanced the proliferation of bacteria along with increase in sugar consumption rate. The pH was tried to be maintained using 50 mM phosphate buffer which reduced the decline rate of pH throughout the experiment. **RESULTS/FINDINGS:** While *P. sacchari* alone produced maximum PHB yield of .182 g/g consuming glucose as main substrate, combined fermentation of *P. sacchari* and *C. necator* showed synergistic effects in increased consumption of xylose subsequently increasing PHB yield too. Introducing high cell density as an inoculum helped overcoming substrate inhibition, however, it was counterproductive after the first 24 hours due to sharp decline in pH forming unfavorable acidic environment for bacteria. **CONCLUSION:** Our study demonstrates valorization of hemp wastes through potential synergistic approach of bacteria.

EFFECT OF ORGANIC AND INORGANIC PHOSPHORUS AMENDMENTS ON THE BIOACCESSIBLE SOIL LEAD (Pb) CONCENTRATION IN CONTAMINATED URBAN AREAS

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Lead (Pb) contamination in urban soils has become an alarming worldwide human health problem. Lead occurs naturally in soils (average ~15 mg kg^{-1}.). In contaminated urban areas, however, soil-Pb concentration can frequently be above the current Risk-Based Target Level for residential use, which is 260 mg kg^{-1} based on Missouri Department of Natural Resources. **BACKGROUND AND PURPOSE**: The application of phosphorous (P) sources could be effective in transforming Pb into Pb-phosphates minerals, reducing Pb bioaccessibility. This research investigated the effectiveness of different P amendments on the Pb bioaccessibility, the chemistry and fractionation of soil Pb, and the relationship between bioaccessible soil Pb concentration with major soil properties. **METHOD:** The research was carried out using soils from three urban sites, each in Kansas City, MO. Class A biosolids at 5% (low) and 10% (high) and commercially available fertilizers at low (1:2) and high (1:4) rate based on molar ratio Pb:P were applied. There was also a control treatment with no P application. Bioaccessible soil Pb was determined by using a modified physiologically based extraction test (PBET) at pH 2.5. Total soil Pb concentration was measured by EPA 6200 method. Additionally, soil Pb was fractionated into five operational pools. **RESULTS/FINDINGS:** The bioaccessible soil Pb concentration was strongly associated with soil chemical characteristics, especially pH. Soil P and soil pH showed a significant and negative correlation with bioaccessible soil Pb concentration. **CONCLUSION:** The application of phosphorous treatments facilitates redistribution of Pb in stable soil fractions, suggesting a reduction on bioaccessible soil Pb concentration.

WHAT'S BUGGING YOU, FROM A LANDSCAPE POINT OF VIEW

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BACKGROUND AND PURPOSE: The surrounding landscape composition can affect in-field pests in many ways, i.e. providing alternative host plants or habitat for natural enemies, overwintering grounds, etc. Here, we evaluate the abundance of a variety of pest insects in three regions of eastern Kansas to see how landscape composition affects pest presence. **METHOD:** Sweeps were performed along 50m transects at the interiors of 30 soy fields, 10 per region, throughout the 2023 growing season. Land use percentages for grassland, natural, agricultural, and developed areas were calculated within a 2km radius of each field using USDA's Cropscape. Models were used to assess relationships between surrounding landscape composition and the entire pest complex and individual species. Since many pests move through agricultural fields, we expected to see less pests overall as the percentage of natural area increased along the gradient. We also hypothesized that landscape composition effects would vary based on individual pest's biology. For example, Japanese beetles, *Popillia japonica* prefer grass as an oviposition site, so we expected to see more Japanese beetles in fields with higher amounts of surrounding grassland and pasture. **RESULTS/FINDINGS:** We found significant relationships between the overall pest community and both Natural and Agricultural landcover with regional interactions. Contrary to our expectations for the Japanese beetles, our results show a significant negative relationship with overall surrounding grassland/pasture and significant interactions with region. **CONCLUSION:** On the individual pest level, response to landcover varied, indicating that environmental relationships are more complex and varied than we may have previously believed.

THE EFFECT OF CROP INTENSIFICATIONS AND DIVERSIFICATION ON BIOLOGICAL SOIL HEALTH INDICATORS

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BACKGROUND AND PURPOSE: Crop productivity lags in the U.S. mostly because of soil health deterioration caused by mono-cropped systems. This study focused on understanding the effect of crop intensification and diversification on commonly used soil health indicators. **METHOD:** Six different rainfed cropping systems, ranging from winter wheat monoculture to multi-species crop rotations, were assessed in the Rainfed Agriculture Innovation Network plots in Ashland Bottoms-KS. Soil samples were collected at 0-5 cm depth during the fall of 2019 and the spring of 2023. Soil health indicators measured were total microbial, bacterial, and fungal biomass as indicators of microbial biomass, and extracellular enzyme activity as indicators of soil microbial activity. Enzymes evaluated were β-glucosidase, N-acetyl-β-D-glucosaminidase (NAG), Acid-Phosphatase, and Arylsulfatase. Additionally, cumulative above- and below-ground biomass was determined during the study period as a carbon input metric. **RESULTS/FINDINGS:** Results revealed an increase in soil microbial biomass after 3 years. Enzyme activity decreased on most of the treatments after 3 years, except for treatments with higher biomass accumulation. Soil health indicators were also affected by environmental factors, primarily by low precipitation during the study period, which may have affected crop biomass production. Furthermore, positive relations between enzyme activities and biomass production over the period were observed. **CONCLUSION:** The preliminary results of this study revealed a close relationship between soil health indicators and cumulative biomass production, highlighting the importance of crop residue management on rainfed intensified and diversified cropping systems. Future research suggests soil health measurements in the long term to assess the viability of the different systems.

USE OF A HURDLE APPROACH IN REDUCING THE *E. COLI* O121/O26 LOAD OF SOFT WHEAT GRAINS DURING TEMPERING

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BACKGROUND AND PURPOSE: Milled wheat products such as wheat flours have become a source of foodborne illness in humans due to pathogenic *E. coli* contamination. The objective for this study is to evaluate the efficacy of a hurdle tempering approach in reducing pathogenic *E. coli* in soft wheat grains. **METHOD:** Soft red winter (SRW) and soft white (SWW) wheat grains were inoculated with *E. coli* O121/O26 and tempered (14%, 12 h) using water, 10% (v/v) lactic acid, heating (55^{o} C), and lactic acid + heat treatments. The tempered inoculated wheat grains were sampled every 2 h and their *E. coli* load was quantified by plating. **RESULTS/FINDINGS:** Higher relative log reductions in the *E. coli* load of soft wheat grains after tempering (12 h) were observed in grains tempered with lactic acid (1.5 to 1.8 logs) and heating (3.5 to 4.0 logs) compared to using water (0.3 to 0.4 log). The hurdle approach (acidic water tempering + heat) also produced higher log reductions (4.0 to 4.3 logs) than the individual tempering treatments. **CONCLUSIONS:** The results of this study show that the hurdle approach consisting of heating and acidic water tempering is a more effective anti-microbial intervention than using individual anti-microbial tempering treatments. This study can be used as a basis for improving the food safety of milled wheat products against pathogenic *E. coli* contamination.

Interdisciplinary Research

BIND AND GRIND: HEMP PROTEIN TAKES ON ADHESIVE CHALLENGES

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BACKGROUND AND PURPOSE: In 2023, the global market size for wood adhesives was approximated at USD 7.03 billion, and projections indicate a compound annual growth rate of 8.6% from 2024 to 2030. Formaldehyde-based adhesives dominate the market and account for more than 70% of the total adhesive use due to excellent adhesion performance. However, these synthetic adhesives pose various health concerns including respiratory issues and carcinogenity. Hence, the issuance of a formaldehyde emission standard for composite wood products, and the increasing interest in developing eco-friendly alternatives. In this study, hempseed protein, a relatively new source for protein-based adhesive, was used as a bio-based wood adhesive for plywood applications. **METHOD:** Hempseed flour was defatted and processed to extract hemp proteins. Adhesive slurries with 15% protein content were prepared by pH adjustment and controlled mixing. Chemical crosslinkers were incorporated to improve protein crosslinking and strengthen the resulting adhesive. **RESULTS/FINDINGS:** The dry strength of hemp protein adhesive was highest at 150°C press temperature (5.41 MPa) and slightly declined as the temperature increased from 150 to 190°C. The highest wet strength (1.91 MPa) and soaked strength (4.93 MPa) were observed at 170°C. These values are higher and comparable to existing plant-based protein adhesives such as soy, camelina, and canola proteins. **CONCLUSION:** Hemp protein has shown a great potential as a renewable and environmentally-friendly alternative source for plant protein-based adhesives. As of writing, this is the first study that demonstrated the potential of hemp proteins for bio-based adhesive application.

DEEP LEARNING METHODS USING IMAGERY FROM A SMARTPHONE FOR RECOGNIZING SORGHUM PANICLES AND COUNTING GRAINS AT AN ON-FARM SCALE

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BACKGROUND AND PURPOSE: High-throughput phenotyping is the bottleneck for advancing field trait characterizing and yield gains for major field crops. Specifically for sorghum (*Sorghum bicolor* L.) crop, rapid on-farm yield estimation is highly dependent on characterizing the number of grains within a panicle. In this context, integrating computer vision and artificial intelligence algorithms with traditional field phenotyping can be a critical solution for reducing labor costs and time. Therefore, this study aims to improve detection of sorghum panicles and estimation of grain number from imagery collected via smartphone under field settings. **METHOD:** A benchmark dataset was collected pre-harvest at field-scale (2023 season, KS, US), with 648 imagery of sorghum panicles retrieved via smartphone device, and grain number counted. Each imagery for sorghum panicles was manually labeled, and the images were augmented. **DETECTION AND SEGMENTATION:** Two models were trained using the frameworks Detectron2 and Yolov8 for detection and segmentation, with an average precision of 75% and 89% respectively. **COUNTING GRAINS:** Three models were trained for the grain number counting task: MCNN, TCNN-Seed, and Sorghum-Net (developed in this study). The Sorghum-Net model presented a precision error of 17%, surpassing the other models. Lastly, a simple equation was presented to connect the count from the model (using imagery from only one side of the panicle) relative to the field-derived observed grain numbers per sorghum panicle. The resulting framework obtained an estimation of grain number with a 17% error. **IMPLICATIONS:** The proposed framework sets the foundation for developing a more robust on-farm application to estimate on-farm sorghum yield using imagery from a smartphone.

CREATING A GROWING DEGREE DAY MODEL FOR MANAGEMENT OF THE GIANT EUCOSMA MOTH

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Background: *Silphium integrifolium*, a native perennial oilseed crop, is under development at The Land Institute as a more sustainable alternative to sunflower oil. However, hindering its development, is its specialist pest, the giant Eucosma moth. The larva of this moth is highly destructive on the plant's seed production. Currently, there are no guidelines for pest management against this moth in the fields. A growing degree day (GDD) model can provide insight for the timing of pest control measures. This model requires the lower developmental threshold (LDT) for the species, a start date for when GDD should start accumulating, and link GDDs to the moth's life stages. **METHODS:** The LDT of the giant Eucosma moth was determined using their larval stage. The larvae were subjected to temperatures ranging from 5 to 20 ˚C, their activity was monitored, and the LDT was found to be approximately 17°C. We trapped adult Eucosma moths during the growing season in 2023 and developed predictions for life events using the LDT and a start date of March 1. We validated the model with addition data collected from the field in 2019 and 2020 using the same GDD model. **RESULTS:** There was a good fit between predicted GDD and actual GDD for life events of the giant Eucosma moth. The efficacy of this model will be tested in the 2024 growing season and linked to management tactics. **CONCLUSION:** The model is expected to be used in future years to guide management of the giant Eucosma moth.

ENHANCING THE OPTICAL TRAPEZOID MODEL (OPTRAM) FOR SATELLITE REMOTE SENSING OF SOIL MOISTURE THROUGH INTEGRATION OF LANDCOVER INFORMATION

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BACKGROUND AND PURPOSE: The Optical TRApezoid Model (OPTRAM) has been extensively utilized to map high-resolution surface soil moisture (top 0-5 cm) using surface reflectance observations. OPTRAM parameters, the intercept and slope of the dry and wet edges, are typically obtained by analyzing the data cloud created from the normalized difference vegetation index (NDVI) and the shortwave-infrared transformed reflectance (STR) in the specified region of interest. In this study, we adopt a new approach to calibrate OPTRAM dry and wet edge parameters based on distinctive landcover reflectance properties. **METHOD:** In this analysis, we used Sentinel-2 reflectance and the Cropland Data Layer (CDL) landcover datasets via the Google Earth Engine (GEE) to generate 20-m resolution soil moisture maps in Central Valley, California. We evaluated the spatial and temporal accuracy of the original and landcover-specific calibrated OPTRAM against the SMAP-HydroBlocks (HB), a 30-m satellite-based soil moisture dataset, as a well-validated reference. **RESULTS:** The root mean square error (RMSE) was obtained 0.09 m^3m^{-3} for the original OPTRAM and 0.05 for the landcover-specific calibrated OPTRAM. **CONCLUSION:** Our results indicate that the landcover-specific calibrated OPTRAM significantly improved the accuracy of the soil moisture estimates.

KERNZA AND SORGHUM AS SUSTAINABLE INGREDIENTS IN EXTRUDED PRECOOKED PASTA AND QUALITY ANALYSIS

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BACKGROUND AND PURPOSE: This study focuses on utilizing kernza, wheat, and sorghum as primary ingredients in extruded precooked pasta to address environmental challenges in conventional production. Kernza, with its deep roots, offers opportunities to reduce soil erosion and enhance carbon sequestration, while sorghum provides a sustainable alternative, especially in water-scarce regions. The research aims to assess the technical feasibility of these grains in mitigating the ecological footprint of pasta manufacturing. **METHOD:** Six distinct pasta formulations were extruded using a pilot-scale twin-screw extruder, incorporating wheat flour, kernza flour, sorghum flour, and various 50/50 flour combinations. Comprehensive analyses evaluated ingredient functionality, degradation degree, gelatinization extent, and texture characteristics. Cooking loss percentages were determined for each formulation to assess their performance during the precooking process. **RESULTS/FINDINGS:** Results show that precooked pasta formulations with only wheat flour exhibited the highest cooking loss at 5.6%, contrasting with kernza flour at 3.9% and sorghum flour at 1.9%. The wheat/kernza combination formulation also had a high cooking loss of 5.6%. This suggests that the wheat product, being less processed, has a lower binding capacity. **CONCLUSION:** In conclusion, this research contributes to sustainable pasta manufacturing by demonstrating the viability of incorporating kernza, wheat, and sorghum. These innovative grain combinations yield products meeting quality standards while reducing resource inputs and environmental impact. The findings have substantial implications for the food industry, offering a promising path toward a more sustainable future for pasta production. Future investigations will extend to life cycle assessments and consumer acceptance insights, further exploring these unique grain sources in sustainable food production.

UNDERSTANDING THE DYNAMICS OF MAIZE PRODUCTIVITY AND WATER USE IN THE US GREAT PLAINS UNDER CHANGING CLIMATE: A FINE-SCALE SPATIAL ANALYSIS

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BACKGROUND AND PURPOSE: Food security and depletion of water resources have become the two main concerns for the future of agricultural economic sustainability. Quantifying climate impacts on regional food security and agricultural productivity requires a spatially explicit assessment where soils, climate variables, and management practices vary between farm units within a region to account for landscape heterogeneity. **METHOD:** In this study, we present an approach for studying the climate change impacts on the productivity and water use dynamics of maize in the Eastern Kansas River Basin of the US Great Plains, based on different future climate scenarios and irrigation water allocation strategies at a 4 km resolution grid-scale. The impact of future climate scenarios on the maize productivity was simulated using the CERES-Maize crop simulation model. Climate change scenarios for the region were created for two Representative Concentration Pathways (RCPs) (4.5 and 8.5) over three 25-year future periods and compared to historic conditions (1991–2015). **RESULTS/FINDINGS:** We found that future maize yield declined slightly by more than 30%, despite a 9 to 27% increase in irrigation water use under full irrigation. The increase in irrigation water use could be attributed to heat stress and reduced transpiration under both RCP scenarios. However, under deficit irrigation strategy, water savings of 3 to 8% were observed without further yield loss. **CONCLUSION:** The results indicate that yield improvement under future climate change requires coupling climate-smart irrigation management strategies with cultivar genetic improvements and other agronomic management in the region.

IMPACT OF WHEAT BRAN ANTIOXIDANTS ON HUMAN INDUCED PLURIPOTENT STEM CELLS' GROWTH PERFORMANCE AND TRILINEAGE DIFFERENTIATION EFFICACY

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BACKGROUND AND PURPOSE: Wheat bran, a rich source of polyphenols, mostly phenolic acids including gallic acid, ferulic acid, syringic acid, etc. exhibits remarkable antioxidant potency compared to other milled wheat fractions. This study investigated the impact of hydrolyzed arabinoxylan oligomers linked with ferulic acid from hard wheat bran on human induced pluripotent stem cells (hiPSC). **METHOD:** hiPSC was cultured in a three-dimensional (3D) matrix and exposed to varying concentrations (30, 100, and 500 µg/ml cell suspension) of antioxidant extracts. **RESULTS:** Our findings revealed that hiPSCs treated with 100 µg of antioxidants per ml of cell suspension exhibited a significantly higher fold expansion (22.31±1.45) than the control (16.38±0.82). Moreover, these antioxidant-treated hiPSCs displayed impressive viability (97.57±0.65%), maintained excellent cell morphology, and exhibited optimal spheroid size. The relative expression of pluripotency markers in hiPSC disclosed that antioxidant induction also maintained stem integrity. **CONCLUSION:** Therefore, our results demonstrated for the first time that wheat bran antioxidants elevate hiPSC's growth performance. This finding will open avenues for their utilization in regenerative medicine and tissue engineering advancements. The investigation of antioxidant-treated hiPSC's trilineage differentiation efficiency is ongoing.

PET FOOD BUYERS' PERCEPTION OF SORGHUM AS A PET FOOD INGREDIENT

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BACKGROUND AND PURPOSE: The rapidly expanding North American pet food market, estimated at USD 57 billion in 2023, is characterized by consistent annual growth exceeding 4%. Dry pet foods, notably extruded kibbles, are a dietary mainstay for dogs and cats, often featuring starch ingredients for texture and expansion. While sorghum, a versatile starch component, offers both textural advantages and nutritional benefits for pets, its adoption has been slower than "novel" ingredients such as peas and potatoes. Recent shifts in market trends and evolving consumer preferences have sparked interest in heritage grains as potential pet food ingredients, focusing on health, nutritional value, taste, and sustainability. **METHOD:** The study is based on unique primary data. US dog owners were selected as the population of inference due to the large share of dog food in the overall pet food market. A sample size of over 5,000 dog owners was determined for the survey to be appropriate for statistical inference. The survey is conducted to explore perceptions and preferences regarding sorghum in pet food, as well as the attributes influencing pet food selection. **RESULTS/FINDINGS:** The analysis of the data will reveal several insights including: i) the relative importance of various criteria that guide pet owners' decisions when choosing between two pet food products, ii) the relative importance of health attributes, ingredient attributes, supply-chain attributes, and processing attributes. These insights can be used by industry decision-makers to inform pet food product development, manufacturing, and marketing strategies.

BARRIERS TO EXPANDING AND CONDUCTING PRESCRIBED FIRES ON KANSAS PRIVATE CONSERVATION LANDS

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BACKGROUND AND PURPOSE: Prescribed burning is the intentional application of fire to the landscape and is used for meeting land management goals like grassland rejuvenation, nuissance species removal. This includes species like red cedar which has been linked to wildfire intensification in the Southern Great Plains. While beneficial, studies in Oklahoma and Texas have identified barriers to prescribed fire. Prescribed burn associations (PBAs) are groups of landowners that pool knowledge and resources, promoting safe burn practices and addressing these barriers. The purpose of this research is to examine the barriers to prescribed burning in Kansas.
METHODS: This study takes a mixed methods approach; deploying a Qualtrics survey and semi-structured interviews with Kansas PBAs. The interviews were transcribed for qualitative analysis to identify additonal barriers and collect characteristics. Across 7 PBAs, 25 usable survey responses and six interviews were collected.
RESULTS/FINDINGS: Environmental barriers, like unsuitbale weather conditons were consistently identified as constraints. Environmental barriers had the most agreement in the survey and common in interviews. Two PBAs indicated recent inactivty due to ongoing drought conditions. Additonally, each of the PBAs discussed external actors involved in their establishment. **CONCLUSION:** Environmental barriers, mainly drought and wind limit engagement with prescribed fire in Kansas. As these conditions increase due to climate change burn windows may narrow. PBAs can build capacity necessary to burn during these conditions yet need support in their establishment. Actors like university extension, conservation districts, and the Natural Resources Conservation Service need to bolster outreach efforts focusing on the benefits of prescribed burning to support its expansion.

FEASIBILITY AND EFFECTIVENESS OF A NOVEL WORKPLACE PHYSICAL ACTIVITY PROGRAM IN SEDENTARY OFFICE EMPLOYEES: A PILOT STUDY

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BACKGROUND/PURPOSE: Inactivity is a leading contributor to the primary chronic diseases that cause most premature deaths in the US (80%). In the U.S., over 80% of jobs are predominantly sedentary and a majority of Americans (75.8%) do not meet physical activity (PA) guidelines. Meanwhile, other countries frequently integrate PA into societal work culture. Japan has implemented an effective music synchronous exercise routine (Radio Taiso [RT]), but this program has not been tested in the U.S. The purpose of this study is to explore the feasibility and effectiveness of implementing RT among U.S. employees. **METHODS:** Thirty-one sedentary employees were randomized into one of two PA break conditions (Walking or RT). Employees were asked to complete weekly educational PA lessons via Canvas and attempt to take three 10-minute PA breaks each workday. Surveys were administered pre-program and post-program measuring PA, workplace PA enjoyment (PACES), pain, and workplace wellbeing (HWQ). **RESULTS/FINDINGS:** Combined, both groups reported double PA energy expenditure (METS) from participation in the study (339.3 METS to 675.6 METS, p=0.011). The walking group reported significantly greater improvements in workplace productivity (p=0.025) while the RT group reported significantly greater improvements in focus (p=0.007) (HWQ) from pre to post. There were no significant changes in reported PA enjoyment, pain, or program evaluation scores in either group. Participants gave valuable qualitative feedback throughout the study to enhance future adaptation of RT programs for U.S. workplaces. **CONCLUSION:** Results give researchers/worksite wellness coordinators insight into ways to improve future workplace PA programming.

A TWENTY-YEAR COMPARISON OF TRADITIONALLY AND ALTERNATIVELY LICENSED SCHOOL-BASED AGRICULTURAL EDUCATION TEACHER RETENTION IN KANSAS

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BACKGROUND AND PURPOSE Nguyen et al. (2022) estimated 36,500 vacant teaching positions across all grades and disciplines nationwide in 2022. Furthermore, 163,650 positions were filled by underqualified teachers (Nguyen et al., 2022). School-based agricultural education (SBAE) is no exception. The significant growth of Kansas SBAE and high teacher turnover have contributed to school staffing challenges (Smith et al., 2021). Policymakers have looked to solve teacher shortages by increasing the supply through alternative certification programs (Ingersoll & Smith, 2003). Researchers have investigated the merit of alternatively certified teachers in SBAE and found that they have a wealth of technical and content knowledge but lack pedagogical and student management skills (Bowling & Ball, 2018). **METHODS** Researchers in this study conducted a document analysis to compare the attrition and retention rates and longevity of SBAE teachers who are traditionally and alternatively certified. Utilizing Ingersoll's "Revolving Door" framework and Schlossberg's Transition Model, the study examined the attrition patterns of SBAE teachers over 20 years in Kansas. **RESULTS/FINDINGS** Researchers found that overall retention rates and longevity in the classroom of traditionally certified teachers were comparable to alternatively certified teachers. The retention of traditionally certified teachers was 46.80% compared to 43.37% for alternatively certified teachers. Traditionally certified teachers stayed in the classroom for 3.9 years while alternatively certified teachers taught for 3.3 years. **CONCLUSION** The revolving door of SBAE teachers increased the need for alternative certification, which may be critical in solving teacher shortages. The study acknowledges the need for tailored induction programs and mentorship for both certification types.

EXAMINING FARMERS' PERSPECTIVES ON COMMUNITY CONSIDERATIONS IN AGRICULTURAL DECISION-MAKING IN THE UNITED STATES

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BACKGROUND AND PURPOSE: In the past two centuries, significant transformations have occurred in agricultural practices in the United States, including increase in farm size, decline in the number of farms and farm population, gradual switch from family to hired labor, heavy reliance on chemicals, and increasing integration of technology. A large body of research has established the benefits and consequences of these structural changes on the long-term health of ecosystems and the well-being of individuals and communities. However, there is little research exploring the incorporation of community concerns in agricultural decision-making. This study addresses this gap in the body of knowledge. **METHOD:** Through a mixed-methods approach, we investigate how and to what extent farmers account for community well-being concerns in farming decisions. We conducted semi-structured interviews with 26 crop producers in 4 counties that represent diverging trends in cropping system diversity and a national survey. **FINDINGS:** The study reveals that farmers take into account various community-related factors when making management decisions on their farms. These considerations encompass aspects such as community health, supporting the local economy, fostering community engagement, and effective resource management. **CONCLUSION:** Findings from this study have implications for fostering sustainable agricultural systems that prioritize not only production and environmental objectives but also community well-being.

UNDERSTANDING LAND-GRANT UNIVERSITY EXTENSION USE: A SURVEY OF INDUSTRY PROFESSIONALS IN 19 STATES

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BACKGROUND AND PURPOSE: Little research has been conducted on the ease of use and effectiveness of existing cooperative extension resources from 1862 land-grant universities by horticultural industry practitioners. Existing resources include plant information sheets, extension publications, brochures, blog posts, and more. Research that assists in understanding extension source and use preferences can provide better insight into how current and new users may use educational resources from cooperative extension programs across the United States through updates, changes, and expansions. **METHOD:** A 50-question survey was created in Qualtrics and distributed through 13 cooperative extension-led field days and winter conferences, mostly of the “Great Plains” region and surrounding U.S. states to see how horticultural industry practitioners use their local cooperative extension education resources. The survey contained up to 7 sections designed to better understand their service offerings, industry involvement, and where they get new information. Most questions were yes/no, drop-down menus, or on a 1 to 5 Likert scale. **RESULTS/FINDINGS:** Through this survey, we expect to be able to assess what content delivery methods are the most widely used, what new methods are most desired, and what methods could be improved upon. With respondents primarily from states with similar climates, economies, and practices, we hope to identify strong points within each cooperative extension program and evaluate the large-scale implementation of those practices. **CONCLUSIONS:** From these results, we will be able to better understand how to help and support industry professionals and end users of K-State Research and Extension through easier-to-understand and more useful resources made available to them.

ENHANCING AGRICULTURAL FEEDBACK ANALYSIS THROUGH VUI AND DEEP LEARNING INTEGRATION

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BACKGROUND AND PURPOSE: A substantial amount of information relies on consumers, influencing aspects from product adoption to overall satisfaction. Similarly, the agricultural sector is entirely dependent on farmers, who dictate the success of products and highlight associated challenges. Our study aligns with this perspective, recognizing the significance of understanding farmers' needs to assist tractor manufacturing industries. This could involve gathering opinions of pre-release prototypes used in farmers' regular practices. However, communication poses challenges, especially when dealing with numerous farmers in multiple locations. Even when dealing with a few farmers in a single location, information often passes through intermediaries, leading to potential deviations from the original script and creating communication gaps. **METHOD:** In addressing these challenges, we partnered with Dexer, a VUI application-based company. Their features, including voice recognition accuracy, offline capability, and media support, streamline the feedback process. This collaboration aims to enhance communication efficiency and bridge potential gaps in the feedback collection process. In addition to our primary objectives, we undertook an extra task by exploring various analyses for our dataset. Ultimately, we chose to conduct Sentiment Analysis of farmer feedback using Transformers, specifically opting for RoBERTa due to its advantageous characteristics. **RESULTS/FINDINGS:** The analysis aimed to answer three key questions related to specific features influencing sentiment, the impact of location or setting, and the evolution of sentiment over time. **CONCLUSION:** The insights from our sentiment analysis model support proactive and targeted agricultural management, fostering sustainability and empowering farming communities worldwide.

FUNGAL FOOTPRINTS: ARBUSCULAR MYCORRHIZAL FUNGI IMPACT ON DRYLAND CORN

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BACKGROUND AND PURPOSE: Arbuscular Mycorrhizal Fungi (AMF) are essential soil microorganisms contributing to soil aggregation and carbon sequestration. The presence and diversity of AMF are reduced in agricultural soils due to tillage and phosphorus (P) fertilizer. A 4-year study investigated the impact of a commercial AMF inoculant and varying P levels on corn production and soil health. **METHODS:** The study is located in a dryland site in Manhattan - KS. The experimental design was a split plot with four replications in randomized complete blocks. Four rates of P (0, 15, 30, and 60 kg P/ha) were applied annually, with and without the addition of a commercial AMF inoculant. Plant measurements were collected at V6 (early in the season), R1 (mid-season), and R6 (harvest), including plant biomass, nutrient uptake, grain yield, and AMF root colonization. **RESULTS/FINDINGS:** AMF inoculation and phosphorus fertilization increased corn grain yield in 2023 after no effects in 2022. Phosphorus and nitrogen uptake increased with AMF inoculation and phosphorus fertilization at the R1 stage in 2023 with no effects in 2022. AMF inoculation significantly increased AMF Root Colonization (%) at V6 and R6. Phosphorus fertilization decreased AMF root colonization (%) at R1 but not at V6 and R6. **CONCLUSION:** Our results highlights the potential for enhancing crop productivity through targeted microbial interventions and nutrient management strategies. Future studies will explore the long-term implications of AMF on soil health, microbial diversity, and plant productivity.

EFFECTS OF PUREPRO SOY ON GROWTH PERFORMANCE AND FECAL CHARACTERISTICS OF NURSERY PIGS

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BACKGROUND AND PURPOSE: Diets with high levels of soybean meal fed to newly weaned pigs can reduce growth performance. PurePro Soy is a refined soy protein concentrate with a lower content of complex carbohydrates (stachyose and raffinose) and storage proteins (glycinin and beta-conglycinin) compared to soybean meal, all of which negatively impact pig performance. Data is needed to demonstrate the impact of PurePro Soy on nursery pig performance, particularly at higher inclusion rates. **METHOD:** A total of 360 barrows were used in a 37-d growth study. Pigs were blocked by initial body weight and pens of pigs were randomly allotted to 1 of 6 dietary treatments post-weaning. Treatments 1 through 5 consisted of increasing inclusion levels of PurePro Soy at 0, 4.25, 8.50, 12.75, and 17.00% replacing soybean meal in the diets. Treatment 6 served as a positive control containing 8.50% enzymatically treated SBM (HP 300) also replacing soybean meal in the diet. **RESULTS/FINDINGS:** The inclusion of HP 300 improved nursery pig performance as expected. The intermediate inclusion levels of PurePro Soy had improved (quadratic, $P < 0.05$) ADG, ADFI, and G:F compared to the lowest and highest inclusion levels. Increasing PurePro Soy in the diets, linearly increased ($P < 0.05$) fecal dry matter on d 9. **CONCLUSION:** These data suggest an optimal PurePro Soy inclusion for newly weaned pigs is 8.50% for phases 1 and 2 to improve growth performance and fecal dry matter.

REDUCING *SALMONELLA* CONTAMINATION IN PIZZA DOUGH USING COLD PLASMA-BASED STRATEGIES

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BACKGROUND AND PURPOSE: In recent years, there has been a surge in foodborne illnesses linked to *Salmonella*-contaminated wheat flour and its products, exemplified by notable outbreaks like the 2022 French incident and the 2023 pizza recall. This highlights the ongoing threat posed by these pathogens in wheat-based products. The present study sought to investigate the survival of *Salmonella* after cold plasma-based treatment **METHOD:** Organic wheat flour was contaminated with *Salmonella* and treated with atmospheric cold plasma for 15 minutes. Plasma-activated water (PAW) was used in pizza dough preparation, followed by in-package cold plasma treatment (generated in atmospheric pressure air at 30 kV) to prolong shelf life. Reduction in pathogen levels was assessed through plating on specific agar mediums. **RESULTS/FINDINGS:** The study's findings revealed that wheat flour treated with atmospheric cold plasma at 21 kV/6 min showed a notable reduction of 2.08 log CFU/g in *Salmonella* load. Additionally, incorporating plasma-activated water in pizza dough formulation led to a reduction of at least 0.87 log CFU/g. Furthermore, in-package cold plasma exposure of packaged pizza dough further contributed to a reduction of 0.94 log CFU/g in *Salmonella* load. The collective implementation of these hurdle interventions resulted in a combined reduction of 3.91 log CFU/g in *Salmonella* contamination. Additionally, cold plasma treatment did not significantly alter the physico-chemical properties of pizza base. **CONCLUSION:** The findings of this study could be leveraged to develop more effective methods aimed at enhancing the food safety of pizza dough and preventing *Salmonella* contamination.

BACTERIAL INOCULUM ENHANCES OXIDATIVE STRESS DEFENSE OF BIG BLUESTEM ECOTYPE

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BACKGROUND AND PURPOSE: Drought frequencies and severities is increasing due to climate change. It will adversely impact the growth and performance of *Andropogon gerardii* (big bluestem), a dominant member of the tall grass prairie in the US Great Plains. While the role of plant-associated microbes in enhancing host resilience to various stresses is well studied, the mechanisms facilitating plant-microbe communication and microbial recruitment remain unknown. Our reciprocal gardens field study revealed that Dry (Hays, Kansas, 580 mm rainfall/year) and Wet (Carbondale, Illinois, 1167 mm rainfall/year) ecotypes perform better at recruiting beneficial microbes when grown at "home" environments, supporting the "home-field advantage" hypothesis. In this study, we provide mechanistic insights into how the plant host recruits these microbial populations. **METHOD:** We cultured microbes from Hays and Carbondale soils, and reciprocally inoculated them into Dry and Wet ecotypes for 12 weeks in a greenhouse experiment. We evaluated the plant host physiological responses to the treatments and examined the resultant microbial composition. We also used single cell sorting and whole genome sequencing to obtain 340 microbial isolates (dry: 171; wet: 169) and evaluated their potential functions. **RESULTS/FINDINGS:** We showed that Dry ecotype had greater biomass when inoculated with dry inoculum microbes. We further observed that the dry inoculum microbes demonstrated a number of potential functions, including mitigating oxidative stress, that are involved in enhancing plant resilience and growth. **CONCLUSION:** Our study provides a better understanding of the complex mechanisms of plant host-microbe interactions, which is critical in predicting host's responses to environmental changes.

INTRODUCING PEARL MILLET IN KANSAS: A POTENTIAL ALTERNATIVE CROP TO MEET FOOD SECURITY

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BACKGROUND AND PURPOSE: The water level in the Ogallala Aquifer is rapidly depleting, which impacts the reduction of irrigated crop acres to dryland and lower land value in the U.S. Central Great Plains. Pearl millet, a climate-resilient dryland grain and forage crop, has potential for these drought-prone areas and poor soil conditions because of its high water and nutrient-use efficiency when compared to sorghum and maize. A total of 56 pearl millet parents developed at the Kansas State University, Agricultural Research Center, Hays, Kansas, needed a detailed drought screening to select potential parents and promote hybrid development in Kansas. **METHOD:** Molecular diversity of the parents were assessed to understand diversity. Field experiments for two years (2021 and 2022) on two environmental conditions (irrigated and dryland) were conducted in Hays, Kansas to study the impact of drought on pearl millet and furthermore identify potential drought-tolerant parents. Statistical analysis was performed to identify drought tolerant parents. **RESULTS/FINDINGS:** Parents showed wide molecular diversity and distinct separation between female and male parents, indicating the potential for hybrid development. Significant phenotypic differences in agronomic traits were observed between irrigated and dryland in both seasons (2021 and 2022). Statistical analysis identified seven parents from 56 parents as potential drought tolerant parents. **CONCLUSION:** These selected drought tolerant parent**s** will be promoted for pearl millet hybrid development in Kansas.

3D PRINTING PLANT-BASED MEAT ALTERNATIVES

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BACKGROUND AND PURPOSE: There is a need to improve sustainability by decreasing consumption of traditional meat, but many consumers still desire the texture and flavor of meat. To reduce meat consumption, there need to be products on the market that replicate traditional meats. 3D printing is a novel area of food research. It can be used to create texture and make intricate shapes out of a food "ink". This gives 3D printing the potential to replicate the fibrous structure of muscle products, such as steak or grilled chicken. The goal of this study is to determine the effects of ink formulation on the printability and texture of 3D printed plant-based meat alternatives. **METHOD:** Ink formulations will be mixed in a blender. Syringes are then filled with the inks. They will be printed on an extrusion-based 3D printer. Samples will then be steam cooked. **RESULTS/FINDINGS:** The printability of inks will be evaluated by amount of clogging and surging that occurs and if the ink maintains its shape after printing. The texture of the printed products will be evaluated by subjective ratings based on touch. Later tests will use a texture analyzer to evaluate this. The texture will be compared to that of steamed chicken breast. The unprinted ink formulations will also be tested using several analytical methods. This data will be compared to printability and texture data to determine what factors influence printability and texture. **CONCLUSION:** The results from this study will aid in the development of a realistic plant-based meat alternative for a steamed chicken product.

CHARACTERIZATION OF THE PRIMARY ENDOSYMBIONTS IN THE SALIVARY SECRETION OF THE LONE STAR TICK (*Amblyomma americanum*)

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BACKGROUND AND PURPOSE: The lone star tick (*Amblyomma americanum*) is an important vector of the pathogens, *Francisella tularensis*, *Ehrlichia chaffeensis*, *E. ewingii*, and heartland virus in addition to being the causal factor of the alpha-gal syndrome. Tick endosymbiotic bacteria are in commensalism with ticks by nutritional complementation such as vitamin B. In contrast, tick endosymbionts lowering the vectorial capacity of the tick have been reported in some cases. We hypothesized that the primary endosymbionts of the lone star tick, *Coxiella*-like endosymbiont (CLE), and *Rickettsia amblyommatis* (*Ra*) are secreted at the time of tick feeding, which likely affects the host immune responses. **METHOD:** We tested this hypothesis by examining the salivary secretion (SS) and salivary gland (SG) from partially-fed female ticks. Two independent methods, microscopic observation and species-specific quantitative PCR (qPCR), were used to test the hypothesis. **RESULTS/FINDINGS:** We found that CLE is predominant in SG 97.1% (33/34) and SS 58.8% (20/34), while lower frequency and abundance were observed for *Ra* with a prevalence of 41.2% (14/34) in SG and 17.6% (6/34) in SS. Microscopic observation also supported the presence of bacteria contained in SS with two different morphotypes of bacteria in the tick SS, likely CLE cocci-form and *Ra* rod-shaped, which need to be further confirmed. **CONCLUSION:** Our data demonstrated that the tick salivary secretion contains the endosymbionts CLE and *Ra*. We will further examine the effects of tick endosymbionts on the host immune systems, during tick feeding and in pathogen transmission.

OPTIMAL EXTRUSION PROCESSING CONDITIONS FOR DOG DIETS CONTAINING WHOLE SOYBEANS (WSB)

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BACKGROUND AND PURPOSE: While there are studies based on the nutritional aspects of soy already, there is minimal research on how WSB affects extrusion processing. The purpose of this study is to examine the processing conditions during extrusion as WSB inclusion levels rise, to determine the ideal extrusion processing levels for each inclusion level, while also producing a desirable kibble. **METHOD:** This study used 4 formulations with varying levels of WSB inclusions: 0%, 10%, 20%, 30%. During extrusion processing for each diet, the feed rate, temperature coming out of the preconditioner and die, water and steam inclusion in the extruder and preconditioner, as well as die pressure, specific mechanical energy (SME), screw speed, and mass flow rate were collected. **RESULTS/FINDING:** Specific Mechanical Energy (SME) ranged from 211.762 to 312.557. The treatment with the lowest SME was SB30, and the treatment with the highest SME being the control. Specific length of the extrudates decreased as WSB inclusions increased, with the lowest average specific length being SB30, with an average specific length of 25.999 mm/g. Conversely, the treatment with the highest average specific length was the control, with an average specific length of 33.609 mm/g. Sectional Expansion Index (SEI) increased as WSB levels increased. The extrudate that experienced the highest SEI was SB20, with an average SEI of 2.049. The extrudate that experienced the lowest SEI was the control, with an SEI of 1.569. **CONCLUSION:** With soybeans rapidly gaining popularity in the pet food industry, understanding how this special ingredient affects extrusion processing is of utmost importance.

Poster Presentation Abstracts

DEVELOPMENT AND VALIDATION OF A DIAGNOSTIC KASP MARKER FOR HESSIAN FLY RESISTANCE GENE H13

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BACKGROUND AND PURPOSE: Hessian fly (HF), Mayetiola destructor (Say), is a severe insect pest of wheat (Triticum aestivum L.) globally. Growing resistant cultivars is the most effective and economical approach to manage HF. Although 37 HF resistance genes have been reported, most of them lack breeder-fridendly markers. H13, originating from Aegilops tauschii, confers a high and broad resistance but lacks such markers. This study aims to develop a diagnotic Kompetive allele specific PCR (KASP) marker for H13. **METHOD:** Anupama Joshi reproted H13 gene sequence in 2018, identifying a crucial premature stop codon responsible for HF resistance due to a single nucleiotide polymorphism. Utilizing this information, KASP markers were developed and tested in a bi-parental population derived from a Molly (resistant with H13) and Newton (susceptible) crossing. Subsequently, a polymophism marker H13-1a was used to genotype a diverse panel, including 203 winter wheat accessions from various U.S. states. **RESULTS/FINDINGS:** H13-1a was validated in the diversity panel with all wheat accessions containg H13 resistance allele exhibited resistance to HF. **CONCLUSION:** The newly developed KASP marker, *H13-1a*, serves as a validated diagnostic tool for *H13*. Its cost-effectiveness, straightforward assay, and applicability to breeding programs, whether high- or low-throughput, make it a valuable asset for selecting H13 in wheat breeding initiatives.

COMPARING AND EVALUATING THE PERFORMANCE OF TWO HIGH-SPEED PLANTING SOLUTIONS

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BACKGROUND AND PURPOSE: Farmers use planters to put different crops into the ground, but they have some concerns regarding planter productivity and toolbar flexibility due to the shape and surface of their fields. High-speed planting solutions are designed to plant as many acres as possible in the shortest amount of time possible, while achieving a high planting quality. This experiment tested how different state-of-the-art high-speed planting solutions can handle high planting speeds in varied environments. **METHOD:** Two different commercial high-speed planting solutions were compared on a field in North-Central Kansas to evaluate their planting performance. As-applied data was captured by the OEM monitor within each planting solution in order to analyze the performance using GIS tools. **RESULTS/FINDINGS:** Both planting solutions were highly efficient, but each of them performed differently across terrain changes and the field's characteristics. The frame architecturtre of each planter will provide unique abilities to adapt to field characteristics, meaning that one of them will be better than the other depending on the kind of field to be planted. **CONCLUSION:** Manufacturers are offering high technology planting solutions that consist of big high-speed planters and powerful tractor that should pull them across fields, but also provide an easy-to-use and friendly software with no integration issues between the planter and the tractor. Also, farmers must understand the kind of field to be planted in orther to pick the right planting solution for their fields.

CAN WE FORECAST SOYBEAN QUALITY USING REMOTE SENSING AND MACHINE LEARNING?

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BACKGROUND: Soybean crop is one of the crops with the largest planted area in the world. Most of the soybean production is destined for soybean meal and oil production. In this sense, digital tools can help in decision making before harvest. Therefore, the objective of this study was to develop a protein and oil estimation model, determining the best period in which to perform the estimation. **METHOD:** 804 soybean quality samples were collected in the states of Iowa and Kansas during 2019, 2020, and 2021 and the time series imageries from Sentinel-2 satellite sensor were retrieved. The time series of each site were normalized taking as reference the maximum value of the green chlorophyll index (GCVI). In addition, partial least squares regression (PLSR) analysis was performed using all satellite data, including spectral bands and various indices created, predicting oil and protein content as a variable. To determine the best-period, an iterative process was carried out, increasing the size of the window and the estimation moment, using the minimization of the RMSE as the selection criterion. **RESULTS:** The results showed that the moment of lowest RMSE was in a period of 2 to 7 days and 2 to 8 days after the peak of GCVI, for protein and oil, respectively. **CONCLUSION:** The availability of previous studies using remote sensing to develop soybean quality models is scarce. Based on this, the exploration of remote sensing and digital tools can contribute to the development of computational tools focused on quantifying crop quality.

EXPLORING THE DEPTHS: INNOVATIONS AND CHALLENGES IN WIRELESS UNDERGROUND SENSOR NETWORKS

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BACKGROUND AND PURPOSE: Effective data communication between underground sensors and surface devices is critical in precision agriculture and environmental monitoring. Unlike aboveground networks that use air as a transmission medium, Wireless Underground Sensor Networks (WUSNs) face unique challenges due to the attenuation and distortion of electromagnetic signals as they pass through soil. Understanding these underground channel characteristics is vital to enhance WUSN performance, coverage, and reliability. This research aims to assess the influence of soil properties, burial depth, and operating frequency on WUSN performace. **METHOD:** Acknowledging the limitations of existing soil path loss prediction models, our research introduces a novel multi-layer signal propagation model tailored to soil's layered structure. To validate this model, extensive field tests were conducted using various transceivers across multiple soil types. **RESULTS:** The proposed model demonstrates significantly improved predictive accuracy, with Root Mean Square Error (RMSE) and Mean Absolute Error (MAE) values of 13.63 dB and 9.48 dB respectively, outperforming existing models. Field experiments indicate that reliable underground communication is feasible up to 50 cm depth with all tested transceivers. Notably, the SX1262 transceiver with LoRa technology consistently displayed minimal path loss under different soil conditions and depths, indicating its superior performance. **CONCLUSION:** This study offers crucial insights into optimizing WUSN deployment for reliable and efficient data transmission in challenging underground settings.

ADVANCED COMPUTATIONAL APPROACHES FOR INVESTIGATING GROUND STATES AND EXCITED STATES FOR NOBLE METAL NANOCLUSTERS

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BACKGROUND: Gold and silver nanoparticles can exhibit unique physical and chemical properties such as luminescence. Those types of nanoparticles usually exist in large sizes, which leads to expensive computational costs using quantum chemistry methods. TDDFT (Time-dependent density functional theory) is a quantum chemistry calculation method which has been successfully applied to calculate the excited states properties for noble metal nanoclusters. Meanwhile, with the size of the system increasing, the computational time increase significantly for the TDDFT calculations. **METHODS DEVELOPMENT:** In the first part of the poster, we have developed machine-learning force fields for ground state molecular dynamics that achieves quantum chemistry calculation accuracy. The final force fields show good performance not only in predicting properties for the structures in the database but also can correctly predicting the properties for the structures outside the database, which demonstrates the good transferability of the force fields. The force fields can also be applied to high-temperature molecular dynamics. In the second part of the poster, we present the implementation of the TDDFT-aas method, which is an approximation method to TDDFT. **RESULTS:** The machine learning force fields can speed up the simulations and extend the molecular dynamics to the larger-size gold nanoclusters. The TDDFT-aas method makes it possible to calculate the excited states properties and study the luminescence of the systems with less computational cost. **CONCLUSION:** We have successfully developed two different approaches to efficiently calculate both the ground states and excited states properties for noble metal nanoclusters.

CAN RECLAIMED AND MANUFACTURED STRUVITE BE USED AS SLOW-RELEASING PHOSPHORUS (P) FERTILIZERS TO ENHANCE P USE EFFICIENCY?

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BACKGROUND AND PURPOSE: Phosphorus (P) is a limited, life-essential element. Reclaiming P as struvite at wastewater treatment plants provides a sustainable recovery method and aims to protect water quality. Reclaimed struvite mainly contains more or less pure struvite, whereas manufactured struvite contains struvite and other P species. The objectives of this study were to assess the solubility, mobility, and reaction products of reclaimed and manufactured struvite compared to traditional fertilizers, such as monoammonium phosphate (MAP), and to determine how they affect the potential plant availability. **METHOD:** Short-term laboratory incubation studies were conducted in acid and mildly calcareous soils collected from Bahia, Brazil, and Garden City, KS, respectively, for 2 days, 1, 2, and 5 weeks. After each period, soils were sectioned at different distances from the point of application, and soil pH, total P to assess P diffusion, and resin extractable P to assess potential plant-available P were measured. X-ray Diffraction (XRD) analysis was performed on extracted granules. **RESULTS/FINDINGS:** Phosphorus diffusion and potential P availability increased with time for all the treatments in both soils. Results of XRD in acid soil suggested that struvite and other P species in the manufactured struvite dissolved and diffused better than reclaimed struvite. In mildly calcareous soils, manufactured struvite had amorphous P species and was expected to have greater solubility. However, dissolved P species were reprecipitated as apatite-like mineral species with low solubility. **CONCLUSION:** The solubility and mobility of struvites were low compared to MAP. Reclaimed and manufactured struvite may enhance P use efficiency by releasing P slowly with time.

EVALUATION OF GRAIN SORGHUM GERMPLASM FOR HERBICIDE TOLERANCE

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BACKGROUND AND PURPOSE: Post-emergence grass weed management in grain sorghum poses a substantial challenge due to the limited availability of herbicide options. Herbicides like clethodim and quizalofop (ACCase inhibitors), and lactofen and flumioxazin (PPO inhibitors), effective against many post-emergence weeds, are usually avoided in sorghum to prevent crop injury. We hypothesize that natural genetic variability among sorghum genotypes may provide an opportunity to identify herbicide tolerance traits. The study aimed to assess herbicide tolerance across a diverse panel of sorghum genotypes. **METHOD:** More than 170 genotypes were grown in a greenhouse and when they reached the 3-4 leaf stage, they were treated with field-recommended doses (1x) of the selected herbicides. To date, ~150 genotypes were screened for clethodim and quizalofop tolerance while up to > a dozen genotypes were screened for lactofen and flumioxazin tolerance. **RESULTS:** The results indicated that none of the genotypes tested were found tolerant to clethodim and quizalofop as all the plants died in response to a 560 g ha^{-1} (1x) dose of these herbicides. However, three genotypes (GL1, GL2, GL3) survived 175 g ha^{-1} (1x) of lactofen, and two genotypes (GF1, GF2) withstood 73 g ha^{-1} (1x) of flumioxazin, compared to the susceptible genotypes. The surviving plants continued to grow normally. Further testing and dose-response experiments are underway to assess the tolerance levels of GL1, GL2, GL3, GF1, and GF2. Additionally, more genotypes are being tested for herbicide response. **CONCLUSION:** Successful completion of this research may have potential for new herbicide-tolerant trait development for broad-spectrum weed control in grain sorghum.

EFFECT OF DAMAGED STARCH ON WHEAT FLOUR TORTILLA QUALITY

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BACKGROUND AND PURPOSE: This research explores the influence of damaged starch on the quality of wheat flour tortillas, a crucial aspect of food science with significant implications for the baking industry. Prior studies have shown that starch characteristics can significantly affect the textural and sensory properties of wheat-based products. Our study aims to bridge the gap in understanding how damaged starch levels in wheat flour affect tortilla quality, focusing on aspects such as texture, shelf life, and sensory attributes. **METHOD:** We conducted a comprehensive analysis using various wheat flours with controlled levels of starch damage. The study involved comparing tortillas made from these flours through a series of standardized baking tests and quality evaluations, including texture analysis, rollability tests, and shelf-life assessments. **RESULTS/FINDINGS:** Preliminary findings indicate that tortillas made from flour with a medium level of starch damage exhibit superior qualities, including enhanced flexibility, better texture, and longer shelf life compared to those made with low or high levels of damaged starch. These results underscore the importance of optimizing starch damage in wheat flour to improve tortilla quality. **CONCLUSION:** The study's findings contribute valuable insights into the role of starch damage in wheat flour tortilla quality, suggesting that careful control of starch damage can significantly enhance product quality. This research has practical implications for the baking industry, offering guidelines for flour selection and processing to produce high-quality tortillas. Further research is recommended to explore the underlying mechanisms and to extend these findings to other wheat-based products.

ENVIRONMENTAL CHARACTERIZATION AND WEATHER-RELATED RAINFED MAIZE YIELD LIMITING FACTORS IN KANSAS, US

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BACKGROUD AND PURPOUSE: Most maize grown in the US, specifically in Kansas State, is carried out under rainfed conditions, susceptible to weather fluctuation. Thus, identifying regions with similar productivity and weather limitations in crop development allows tailored strategies for increased productivity. This study aimed to delimit regions with similar crop conditions, identifying the main climatic factors limiting maize yield in Kansas. **METHOD**: A comprehensive 1993-2021 database was compiled, including NOAA weather stations (n=206) and, from USDA reports, annual county corn yield and weekly Agricultural statistics district phenology reports. Four periods based on phenology data were defined: fallow, vegetative, critical, and grain filling period, adjusting climatic variables inside them. Then, followed a feature reduction, a clustering process allows to determine the consequent regions. Within each region, main climatic factors were revealed by a correlation analysis linked detrended yield to weather anomalies. **RESULTS**: Ten distinct environmental regions were identified across the state. Extreme degree days (EDD_CP) and Vapor pressure deficit (VPD_CP) during the critical period (± 15 days around silking) as the main climatic drivers of maize yield in most regions. Grain yield is negatively related to EDD_CP with an average yield penalization of 46 kg ha-1 (0.88%) for each one °Cd increased. Besides, EDD_CP and VPD_CP increased from the northeastern to the southwestern regions, indicating a spatial gradient of climatic limitations. **CONCLUSION**: Our approach is highlighted for using observed phenological data, which reflects the actual decisions made by farmers and crop development despite the bias created by other methodologies.

FEW-SHOT SEMI-SUPERVISED MULTIMODAL DEEP LEARNING MODEL FOR TWEET CLASSIFICATION

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This study aims to address the challenges posed by the overload of information on social media during crises, leading to retrieval of irrelevant information and hindering effective emergency response. **BACKGROUND AND PURPOSE:** Many research studies focus solely on either text or image analysis to identify crisis-related information useful for emergency response. However, utilizing both modalities allows us to leverage the complementary information they offer, potentially leading to significant improvements. We propose a novel approach leveraging both text and image data from social media posts to train a few-shot semi-supervised multimodal deep learning model for tweet classification. By employing semi-supervised learning, we utilize unlabeled datasets in the initial hours of a crisis when manual labeling is unfeasible, gradually improving the model's performance through iterative training cycles. This approach combines few-shot labeled data with pseudo-labeled data generated by the model itself, enhancing the model's capability to learn from limited labeled samples. **METHOD:** We aim to employ contrastive learning techniques, such as CLIP, in conjunction with semi-supervised methods, such as FixMatch and MixMatch, in few-shot settings. Our objective is to compare the performance of these models with the performance of supervised models that use labeled data for training. **RESULTS/FINDINGS:** We anticipate that the performance in few-shot scenarios will be comparable to the performance obtained in supervised scenarios, despite training the model with only a limited number of samples. **CONCLUSION:** Through this methodology, we seek to enhance the efficiency of emergency response systems by providing tools to extract actionable insights from social media data during critical events.

PRE-BREEDING EVALUATION OF PEARL MILLET GERMPLASMS FOR DROUGHT TOLERANCE IN DIVERSE ENVIRONMENTS

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BACKGROUND AND PURPOSE: Large-scale crop production causing significant yield reduction is a major problem by several environmental stresses. Drought and high temperature stresses are the potential threats due to limited water resources, erratic and uneven rainfall distribution and global climate change. Pearl millet, a climate-resilient dryland cereal crop can thrive in drought prone areas and poor soil conditions. It can produce a substantial amount of grain in areas receiving an average annual precipitation of < 250mm, where other cereal crops like maize, rice, sorghum, and barley are likely to fail. Identifying the drought tolerant germplasms by integrating classical and molecular pre-breeding approaches is the major objective of the study. **METHOD:** Field experiments were conducted using 192 pearl millet germplasms at three diverse environments in Kansas. Weather and agronomic data on drought related traits at different developmental stages were collected and statistical analyses were performed. **RESULTS:** Wide variability and genetic diversity among the germplasms were recorded with significant phenotypic differences for all the traits under study. Environmental interaction with germplasms was also evident between and within the test environments evaluated. The same field experiments will be repeated in summer 2024 for a detailed data analysis and to confirm the results. **CONCLUSION:** Potential drought tolerant germplasms will be identified to develop parental lines and hybrids for pearl millet improvement.

OPTIMIZING CORN IRRIGATION STRATEGIES: INSIGHTS FROM NDVI TRENDS, SOIL MOISTURE DYNAMICS, AND REMOTE SENSING

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BACKGROUND AND PURPOSE: In regions facing water scarcity, the limited availability of water affects both plant and soil moisture levels, posing challenges to corn crop yields. Particularly impactful during the summer growing season, this study systematically investigated the effects of varying irrigation rates on corn growth and yield outcomes. The primary aim was to identify patterns in vegetation health across different stages of corn development, canopy temperature map, soil moisture, weather data and yield. **METHOD:** The experiment involved three irrigation treatments—33%, 67%, and 100%—utilizing hybrid corn varieties. Employing a quadcopter equipped with a multispectral camera and a thermal camera sensor, the study integrated aerial perspectives to monitor vegetation health, enhance normalized difference vegetation index (NDVI), and provide temperature maps. The dataset encompasses soil moisture relationships, evapotranspiration rates, and yield results to comprehensively assess the effectiveness of each irrigation rate. **RESULT:** Results indicated that a 67% irrigation rate presents a promising alternative, maintaining robust vegetation health while striking a balance between water conservation and crop vitality. Soil moisture analysis validates efficient water uptake and adequate moisture levels. The combination of multispectral and thermal imaging contributed to a comprehensive understanding of vegetation health and soil moisture. **CONCLUSION:** 67% irrigation rate emerges as a potential solution for water-conscious farmers, offering a balanced approach between water conservation and crop vitality, with a potential yield up to 170 bu/acre. The integrated use of NDVI and thermal imaging provides farmers with data-driven insights to optimize their irrigation strategies.

RETROSPECTIVE ANALYSIS OF CORN GRAIN COMPOSITION: STARCH, PROTEIN, FIBER, OIL AND FATTY ACIDS PROFILE

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BACKGROUND AND OBJECTIVE: Corn, a staple cereal grain with global significance, offers diverse uses and nutritional benefits. Despite its essential role in food production, a detailed examination of how its composition has changed during seed filling over the years has been lacking. This study evaluated the shifting composition of corn across eight decades, analyzing six hybrids released between 1936 and 2018. **METHOD:** A corn field study was conducted in Wamego, Kansas in 2021. Using near-infrared spectroscopy (NIRs) and chemical analysis, we investigated changes in protein, fiber, oil, and starch content. The statistical analysis consisted of linear mixed-effects models to analyze the data and quantify how the composition of corn shifted over time. **RESULTS:** Our analysis revealed not only a genetic advancement in seed yield but also intriguing alterations in key nutritional components. Protein, fiber, and oil concentrations demonstrated a negative trend with the release year, whereas starch content exhibited a positive correlation. Additionally, we identified ten distinct fatty acids, observing significant fluctuations in their presence over time. Despite an overall increase in total oil production, there was a noteworthy decline in linoleic acid, essential for both human and animal diets. **CONCLUSION:** Our findings suggest that the reduction in the duration of the effective filling period have been key in influencing the corn grain's composition profile. This research contributes to a broader understanding of corn's evolution and highlight the importance of monitoring staple crop composition for global food security and nutritional health.

SYSTEM DEVELOPMENT FOR APPLICATION AND TESTING OF SPRAY-ON BIODEGRADABLE MULCH

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BACKGROUND AND PURPOSE: Plastic mulch films have long been a staple in agriculture, offering benefits such as conserving soil moisture, suppressing weed growth, and increasing soil temperature. However, their widespread use has raised concerns due to challenges associated with their removal and environmental impact. In the past decade, there has been a transition to biodegradable polymers. This shift is focused on developing biodegradable polymers that can be sprayed. Chicken feathers, which are abundant waste materials, are being used as a source of protein for biodegradable plastics. **METHOD:** The development of an application system for spray-on biodegradable mulch begins with the selection of pumps and nozzles suitable for handling the viscous nature of mulches and ensuring effective atomization. Given the need to apply mulch in substantial quantities to create a proper layer, the system comprises a positive displacement double diaphragm pump, a strainer, flood jet nozzles, hoses, and fittings. The Sotera 425 B pump and Teejet quick turbo flood jet nozzles were selected for application purposes. **RESULTS:** The pump achieved an average flow rate of approximately 13 GPM, and different flood jet nozzles were able to deliver from 1.5 GPM to 12 GPM without clogging. This entire spraying system was assembled on the FARM NG-developed Amiga platform for application. Further, a study is being carried out to determine optimal nozzle configuration based on travel speed, flow rate, and swath. **CONCLUSION:** The developed system sprayed mulch at the desired rate**.** Further, this system can be mounted on commercial sprayers or ATVs and used for spraying different mulches.

SPATIO-TEMPORAL VARIABILITY OF INTRA-FIELD PRODUCTIVITY USING REMOTE SENSING

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BACKGROUND: Understanding how crop productivity varies within fields over time is essential for effective farm management decisions. Furthermore, these decision-making processes can be enhanced using spatial data science and remote sensing (satellite data). **OBJECTIVES:** This study aims to develop a framework to evaluate the spatio-temporal variability of intra-field crop productivity through historical satellite data and climate data. **MATERIALS AND METHODS:** Historical satellite data and rainfall information from diverse fields across the United States (2016-2022) were analyzed. Daily precipitation data from CHIRPS dataset and spectral bands from Sentinel-2 were utilized to compute the Green Chlorophyll Vegetation Index (GCVI). Critical GCVI Peaks for different crops were identified, and corresponding GCVI images were extracted. Synthetic variables, representing different periods of accumulated rainfall before GCVI Peaks, were generated. Through spatially varying coefficient regression models, optimal cumulative rainfall periods and coefficients assessing intra-field variability were determined. **RESULTS:** The study reveals that a 30-day period before the GCVI peak significantly influences productivity (R^2 = 0.93, RRMSE = 9%). **CONCLUSION:** Interestingly, certain areas exhibit linear response to increased rainfall, while other areas, there is a limit to this. Future steps involve validating the framework in diverse agricultural environments to enhance its robustness and applicability.

EXPLORING THE IMPACT OF XYLANASE SOURCES AND DOSAGE ON RHEOLOGICAL PROPERTIES OF FLOUR AND BAKED PRODUCT QUALITY

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BACKGROUND AND PURPOSE: In breadmaking, improving the quality of white pan bread can involves the use of enzymes such as xylanases. These enzymes target specific components in wheat, breaking them down to enhance dough elasticity and extensibility, resulting in better-textured bread. This study explores how different sources and amounts of xylanase affect the dough and overall bread quality. **METHODS:** The study used bread wheat flour as a base and added six commercial xylanases from various sources (bacterial and fungal) and dosages. They measured dough properties using the Farinograph and analyzed stickiness and extensibility of the dough. Baked loaves underwent analysis for volume, internal structure, firmness at 1day post-bake, and crumb and crust color. **RESULTS/FINDINGS:** Results showed significant differences in how xylanases impacted dough and bread quality at different dosages. The source of xylanase influenced dough development time, with enzymes 4 and 6 showing distinct trends. Enzyme 6 notably increased absorption. For loaf volume, enzyme 4 tolerated overdosing well, and enzyme 5 performed consistently even when underdosed. Xylanases 1, 4, and 5 consistently reduced firmness, with a strong dosage-firmness relationship for enzyme 1. **CONCLUSION:** In conclusion, this study highlights the variability in xylanase performance in modifying dough and bread quality. These findings contribute to improving baking practices and enhancing our understanding of how enzymes influence bread quality.

UNRAVELING THE INFLUENCE OF PLANTING DATE, ROW SPACING, AND HERBICIDE PROGRAMS ON WEED MANAGEMENT IN SOYBEAN

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BACKGROUND AND PURPOSE: Kansas farmers have been planting soybeans earlier, and to account for this, weed control techniques for soybeans require changes. In 2023, research was conducted at two Kansas locations: Manhattan and Ottawa to find appropriate weed management practices to help farmers manage Palmer amaranth (*Amaranthus palmeri*) and waterhemp (*Amaranthus tuberculatus*) in early-planted soybeans. This study aimed to assess the impact of herbicide programs, planting date, and row spacing on light interception and *Amaranthus spp.* management in soybeans. **METHOD:** Enlist® soybeans in either 38 or76-cm rows and were planted either early (before the initial crop insurance date) or late (four weeks of early planting). The study employed a factorial arrangement of treatments encompassing two pre-emergence herbicide mixes (sulfentrazone + metribuzin or flumioxazin + metribuzin), two post-emergence herbicide mixes (2,4-D choline + glyphosate or2,4-D choline + glyphosate + S-metolachlor) at labelled field rates, and a nontreated and a weed-free control. Treatments were replicated four times at each location. Percent Palmer amaranth (Manhattan) and waterhemp (Ottawa) control was assessed four weeks after treatment (WAT) percent light interception was recorded eight WAT and weed biomass was gathered at R7 stage of soybean. Data were subjected to regression analysis, and an exceptionally low coefficient of determination was seen in linear, polynomial, and logarithmic models. **RESULT** suggested that the low percentage of variability in percent weed control and weed biomass was associated with light interception. **CONCLUSION** there was a minor impact of herbicide programs, planting date, and row spacing on light interception and weed management in soybeans.

RELATIONAL FACTORS ASSOCIATED WITH THE LIKELIHOOD OF MALE THERAPY ATTENDANCE

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BACKGROUND AND PURPOSE: To better understand associations of men accessing helping services, this study will investigate a variety of relational factors guided by the biopsychosocial theory. This study will examine adverse childhood experiences (ACEs), relational satisfaction, relational anxiety, relational avoidance, infidelity, consensual non monogamy, physical intimate partner violence, and psychological intimate partner violence. **METHOD:** This sample, comprised of 605 males, was sourced from the Prolific online survey platform, was nationally representative. An odds ratio was run to analyze likelihood of lifetime male therapy attendance. Logistic regressions were conducted to investigate the links between psychological, social, and biological factors and their connection to lifetime male therapy attendance. **RESULTS/FINDINGS:** Having ACEs was related to a 25% increase in ever attending therapy (AOR = 1.25, $p < .001$) and relational anxiety was associated with a 2% increase in reporting attending therapy (AOR = 1.02, $p = .004$). Relational satisfaction, relational avoidance, infidelity, consensual non monogamy, physical intimate partner violence, and psychological intimate partner violence were not significantly related to ever attending therapy. **CONCLUSION:** Higher ACEs scores had a significant increase in therapy attendance, which underlines the need for men attending therapy. A majority of the results having little or no significance highlights that many major life risk factors does not move the needle. The slim increase in therapy attendance in men with relational anxiety and no significant change in any other factor displays the need to target the male population futher, investigating potential barriers of therapy attendance, such as stigma and treatment tailoring.

EFFECTS OF FOOD AND HOUSING INSECURITY ON MENTAL HEALTH OUTCOMES

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BACKGROUND AND PURPOSE: Food insecurity (FI) and housing insecurity (HI) are major public health concerns. Research shows that FI increases levels of depression and stress (Pourmotabbed et al., 2020). In un-housed populations, HI levels correlate with higher levels of PTSD from experiences of intimate partner violence (Beijer et al., 2018). The purpose of this study was to assess what effect FI and HI have on additional mental health outcomes that have been understudied. **METHOD:** Data were taken from an online study of 371 adults conducted in 2022 (Keilholz et al., 2023). The current study included linear regressions with FI and HI as outcomes and the following mental health conditions as independent variables: PTSD, alexithymia, narcissism, psychopathology, alcohol use disorder, anxiety, and depression. **RESULTS:** Higher levels of FI were associated with a higher levels of PTSD ($\beta = 0.20$, $p < .001$), alexithymia ($\beta = 0.01$, $p < .01$), and depression ($\beta = 0.03$, $p < .001$). Levels of HI were positively associated with PTSD ($\beta = 0.03$, $p < .01$) and depression ($\beta = 0.004$, $p = .015$). **CONCLUSION:** These findings suggest that FI and HI are associated with mental health outcomes for adults. Further research is required to explore moderating factors for these results, such as access to mental health care, social support, and exposure to intimate partner violence.

UNIVERSITY STUDENTS' PERCEPTIONS OF SOYBEANS AND SOY-BASED FOOD PRODUCTS

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BACKGROUND AND PURPOSE: The soybean (*Glycine max*), introduced to the United States in 1765, is a complete protein source with all essential amino acids. Despite the rise in plant-based protein diets, university students' acceptance of soybeans remains underexplored. This research explores university students' perceptions, knowledge, and consumption patterns of soy foods as well as the impact of soy-based infographics. **METHOD:** Data was gathered from university students using a qualitative approach involving focus group discussions. Participants were recruited by displaying posters with QR codes in the dining centers and residence halls. Two focus groups of 5-6 participants were held. Discussions were guided by a structured questionnaire and were audio-recorded, transcribed, and analyzed using thematic analysis. **FINDINGS:** Six main themes emerged: (1) awareness of soybeans was shaped by either geographical or educational exposures, (2) knowledge of soybean's nutritional benefits was limited, though its role as a protein source was acknowledged, (3) preference for familiar foods was noted, yet openness to new soy-based food products existed, (4) participants were inclined towards incorporating soy in savory dishes and offered culinary ideas, (5) soy stigma was a concern, with a call for soy products to establish a unique identity, and (6) the effectiveness of clear, visually appealing infographics was emphasized. **CONCLUSION:** The study emphasizes educating university students on soybean's nutritional benefits. By focusing on education and product quality, soy can secure a unique, lasting place in the food industry. The findings will be used to develop soy-based food products for the Kansas State University Dining Centers.

DETERMINATION OF SEROPREVALENCE FOR SARS-COV-2 IN FARMED AND WILD WHITE-TAILED DEER

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BACKGROUND AND PURPOSE: After emerging in late 2019, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) spread rapidly through human-to-human transmission. White-tailed deer (WTD) are highly susceptible to SARS-CoV-2 and the virus prevalent throughout the United States with a high population density. Sustained transmission of SARS-CoV-2 in wild and farmed WTD poses a risk to humans in close contact with this species. **METHOD:** To address this concern, in the present study, a total of 312 serum samples were collected between 2018 - 2022 from Ohio (OH) (n= 126; wild WTD), Indiana (IN) (n= 60; farmed WTD), and Kansas (KS) (n= 126; wild and farmed WTD) and analyzed for the presence of SARS-CoV-2-specific antibodies. The testing was performed using two commercial (cRBD-ELISA and cN-ELISA), and one *in-house* (RBD iELISA) assay. Conventional virus neutralization tests (VNTs) were used as reference assays. **RESULTS/FINDINGS:** Our results indicated that 7.9 %, 1.7%, and 0% of wild WTD samples from OH, IN, and KS, respectively, were seropositive in the cRBD-ELISA, whereas 3.2%, 1.7%, and 6.3% of wild WTD samples from OH, IN, and KS, respectively, tested positive by the RBD iELISA. In addition, 4%, 5%, and 0% of wild WTD samples from OH, IN, and KS, respectively, were positive by the cN-ELISA. From the 110 tested farmed WTD samples, 95%, 86%, and 53% tested positive in the cRBD-ELISA, the RBD iELISA, and the cN-ELISA, respectively. **CONCLUSION:** The highest seropositivity among WTD was observed in farmed animals in the state of Kansas to SARS-CoV-2.

BIOLOGICAL SEX DIFFERENCES IN DISEASE SEVERITY, LETHAL DOSES, AND ANTIBODY RESPONSES AFTER INFECTION WITH H1N1 AND H3N2 INFLUENZA A VIRUSES IN A MOUSE MODEL

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BACKGROUND AND PURPOSE: Our objectives were to determine the lethal doses, compare morbidity and virus titers, and evaluate antibody responses between male and female mice after infection with H1N1 and H3N2 influenza A viruses (IAVs). **METHODS:** Adult (8-10 weeks old), male and female C57BL/6 mice were inoculated with 10^1 to 10^5 $TCID_{50}$ of H1N1 or H3N2 IAVs. Body mass and temperature were recorded every day until 14 days post inoculation or the humane endpoint of 25% body mass loss was reached. Mouse lethal dose (mLD_{50}) was calculated against both viruses. **RESULTS:** After infection, all male mice survived and recovered up to a dose of 10^2 $TCID_{50}$ for H1N1 and 10^3 $TCID_{50}$ for H3N2 IAVs while females recovered only after infection with up to $10^{1.5}$ $TCID_{50}$ of H1N1 and 10^2 $TCID_{50}$ of H3N2 IAVs. The mLD50 for males and female mice for the H1N1 virus was $10^{2.50}$ and $10^{1.53}$ $TCID_{50}$ respectively, while mLD50 for the H3N2 virus was $10^{3.57}$ for males and $10^{2.45}$ $TCID_{50}$ for females. When infected with $10^{1.5}$ $TCID_{50}$ of H1N1 and 10^2 $TCID_{50}$ of H3N2 IAVs, female mice lost significantly greater body mass compared to males. Experiments are ongoing to determine the differences in pulmonary pathology, cytokine responses, and lung virus titers. **CONCLUSION:** We have established a mouse model at KSU to study the biological sex differences during IAV infection. Adult females suffer greater morbidity and mortality after infection with different subtypes of IAVs. Biological sex and underlying mechanisms for the differential outcomes should be considered during the design of influenza vaccines and therapeutics.

ESTABLISHMENT OF A MOUSE MODEL OF DIET-INDUCED OBESITY TO STUDY THE EFFECTS OF THE INTERACTION OF BIOLOGICAL SEX AND OBESITY DURING INFLUENZA A VIRUS PATHOGENESIS

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BACKGROUND: Our objectives were to establish a mouse model of diet-induced obesity (DIO) for both sexes and to evaluate the interaction of biological sex and obesity during IAV infection in a DIO mouse model. **METHODS**: Male and female C57BL/6 mice were fed a high-fat diet (60%kcal) or a control diet (10%kal) for 14 weeks. Body mass was measured every week. A glucose tolerance test (GTT) was carried out on the 14^{th} week. In the 15^{th} week, they were infected with 10^3 $TCID_{50}$ of mouse-adapted H1N1 influenza A virus (IAV) and euthanized after 3 days. **RESULTS**: After 14 weeks, 100% of the male and 70% of female mice on a high-fat diet became obese. Both obese males and females had significantly greater blood glucose levels compared to control males and females. At the 15^{th} week, obese males and females had significantly higher visceral and subcutaneous adipose tissue weights compared to their counterparts on a control diet. After influenza virus infection, there was no difference in change in body mass at 3dpi between males and females in the control diet compared with obese males and females. Experiments are ongoing to determine lung virus titers, pulmonary pathology, differences in cytokines and adipokines, and sex steroid levels. **CONCLUSION**: We have established a mouse model of diet-induced obesity at KSU. While male mice develop obesity efficiently, females gain weight slowly and have around 30% non-responders. Future studies will explore the interaction of biological sex and obesity during IAV infection and vaccination.