THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

21st Annual Undergraduate Research Forum

Tuesday, April 9, 2024
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Nationwide and Ohio Farm Bureau 4-H Center

2024 CFAES Undergraduate Research Forum
Tuesday, April 9, 2024

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Dr. Ahmed Abdelnabi (Department of Food, Agricultural, and Biological Engineering)

Dr. Maria Nelly Arguello-Blanco (Department of Horticulture and Crop Science)

Dr. Nezhat Pinar Barkan (Department of Entomology)

Patricia Boley (Department of Animal Sciences)

Dr. Emily Buck (Department of Agricultural Communication, Education, and Leadership)

Dr. Tyler Carr (Department of Horticulture and Crop Science)

Dr. Katrina Cornish (Department of Horticulture and Crop Science)

Sandeep Dhakal (Department of Food, Agricultural, and Biological Engineering)

Dakota Dustin (Department of Food Science and Technology)

Dr. Maurice Eastridge (Department of Animal Sciences)

Dr. Thaddeus Ezeji (Department of Food, Agricultural, and Biological Engineering)

Anna Favalon (Department of Plant Pathology)

Dr. Srishti Gaur (Department of Food, Agricultural, and Biological Engineering)

Carla Gavilan (School of Environment and Natural Resources)

Dr. Soumya Ghosh (Department of Plant Pathology)

Daniela Gutierrez Yanez (Department of Plant Pathology)

Dr. Tracy Hawk (Department of Plant Pathology)

Dr. Dee Jepsen (Department of Food, Agricultural, and Biological Engineering)

Dr. Margaret Jodlowski (Department of Agricultural, Environmental, and Development Economics)

Sushma Katari (Department of Food, Agricultural, and Biological Engineering)

Dr. Wendy Klooster (Department of Horticulture and Crop Science)

Dr. Eugene Law (Department of Horticulture and Crop Science)

Dr. Joonbum Lee (Department of Animal Sciences)

Dr. Peiyang Li (Department of Food, Agricultural, and Biological Engineering)

Dr. Callan Lichtenwalter (Department of Animal Sciences)

Dr. Yu Ma (Department of Horticulture and Crop Science)

Dr. Luis Martinez Villegas (Department of Entomology)

Dr. Lorrayne Miralha (Department of Food, Agricultural, and Biological Engineering)

Dr. Ali Nazmi (Department of Animal Sciences)

Michelle Pham (Department of Entomology)

Dr. Benjamin Philip (Department of Entomology)

Dr. Krystal Pocock (School of Environment and Natural Resources)

Dr. Beenish Saba (Department of Food, Agricultural, and Biological Engineering)

Judges

Afsoon Sabet (Department of Entomology)

Dr. Hui Yu (Department of Animal Sciences)

Dr. Lingying Zhao (Department of Food, Agricultural, and Biological Engineering)

Dr. Rui Zheng (Department of Animal Sciences)

Animal Sciences – Animal Health (4 Projects)

Diagnostic Performance of Pregnancy Associated Glycoproteins and Transrectal Ultrasonography or Early Pregnancy in Sheep

Molly Cordonnier, Muhammad Saad, Caleb Rykaczewski, Dr. Alvaro Garcia-Guerra. Department of Animal Sciences.

Timely detection of pregnancy in ewes is instrumental for optimal production efficiency. Transrectal ultrasonography (TRU) allows early (≤30 days) pregnancy diagnosis, however, must be performed by a veterinarian. Pregnancy Associated Proteins (PAGs) are produced by the placenta and are detected in maternal circulation leading to their use for pregnancy diagnosis in ruminants. The objective of this study was to evaluate the performance of a rapid PAGs test and TRU for pregnancy diagnosis at 20 to 30 days after breeding in ewes. Dorset cross ewes (n=126) were synchronized using a short term protocol. On day 0 an intravaginal insert containing 0.3 g of progesterone (CIDR) was inserted. On day 6 the CIDR was withdrawn and prostaglandin $F_{2\alpha}$ administered. Ewes placed into paddocks with fertile rams fitted with marking harnesses and monitored twice daily (day 6 to 10.5) for signs of breeding. Blood samples were collected on days 20, 25, 30 after breeding, centrifuged and plasma stored at -20 ºC. Plasma samples were assayed for PAGs using the Alertys Rapid Visual Pregnancy Test (RVT), a commercially available on-farm test. In addition, TRU was performed on day 20, 25, and 30 using an ultrasonic scanner and a linear-array probe. Ewes were placed in dorsal recumbency, administered an enema of obstetrical lube and the probe introduced until the uterus was visualized. Pregnancy was diagnosed based in visualization of the conceptus (embryo and/or associated membranes). True pregnancy status was determined based on transabdominal ultrasonography at 125 days and lambing date. Data were analyzed using generalized linear mixed models. Sensitivity of TRU (97.8%) and RVT (93.3%) were not different and were not affected by examination day ($P>0.10$). Specificity (96.5%) of TRU was not affected by examination day ($P>0.10$), while specificity of RVT was less ($P<0.05$) on day 20 (27.8%) than on days 25 (66.7%) and 30 (83.3%). In addition, specificity of TRU was greater ($P<0.05$) than that of RVT at days 20 and 25, but not at day 30 ($P>0.05$). In conclusion, RVT has sensitivity comparable to that of TRU, however, because of low specificity its use before day 30 is discouraged.

Assessment of Anogenital Distance as a Biomarker for Puberty in Beef Heifers

Danielle N. Latif, S.E. Battista, J.C.L. Motta, B. J. Duran, Dr. A. Garcia Guerra. Department of Animal Sciences.

Anogenital distance (AGD) is a dimorphic trait defined, in females, as the distance from the anus and the clitoris. Associations between AGD and reproductive outcomes have been identified in many species making AGD a potential biomarker for reproductive performance. The objective of this study was to evaluate the association between AGD and puberty in heifers. Beef heifers (n=102) were enrolled in a prospective observational study. Anogenital distance and body weight (BW) were determined at 205 days of age and at breeding (BW only) when heifers were yearlings (363 to 450 days of age). Blood samples were collected for progesterone quantification biweekly from 205 until 300 days and weekly thereafter until breeding. Pubertal onset was defined as the age at which progesterone first exceeded 1 ng/ml. Mean AGD was 61.2±9.5 mm (range 38.1 to 82 mm). The AGD at 205 days was weakly correlated with BW at 205 days ($r=0.31$; $P=0.01$) and moderately correlated with yearling BW ($r=0.47$; $P<0.01$) and average daily gain ($r=0.43$; $P<0.01$). There was no correlation ($P>0.10$) between AGD and age at pubertal onset. Heifers were categorized, using quartiles, into long (≥67 mm), medium (≥56 mm & <67 mm) or short (<56 mm) AGD. There were no differences ($P>0.10$) in BW at 205 days between AGD groups, while yearling weight tended ($P<0.10$) to be greater for long (360±37 kg) than short AGD (336±36 kg) heifers. Average daily gain tended ($P<0.10$) to be greater for long (0.63±0.08 kg/day) than both medium (0.56±0.08 kg/day) and short (0.55±0.08 kg/day) AGD heifers. The age at breeding was greater ($P<0.05$) for long (415±8 days) than short AGD heifers (399±8 days), while medium AGD heifers (406±7 days) were intermediate. The percentage of heifers that reach puberty before breeding was greater ($P<0.05$) for long (77.0%) than short (39.5%) AGD heifers, while medium AGD heifers (64.7%) were intermediate. There was no difference ($P>0.10$) in age at onset of puberty between AGD groups. In conclusion, fewer heifers with short AGD at 205 days of age reach puberty before the onset of breeding which appears to be associated with reduced weight gain and age at breeding.

Animal Sciences – Animal Health

Effects of Supplemental Colostrum Intake to Jersey Calves after 24 hr of Birth on Health and Growth

Gabriella C. Rivera Fernández and Dr. Maurice L. Eastridge. Department of Animal Sciences.

The objective of this research was to determine the effect feeding colostrum supplements (CS) beyond the 24-hour gut closure period would have on Jersey calves, specifically its impact on serum protein concentrations and growth rate. Twenty calves were assigned to either the control or treatment group. Calves assigned to the control group (n=14) received regular milk replacer, while calves in the treatment group (n=6) received colostrum supplement added to their regular milk replacer twice daily for the next 14 days of life, each feeding containing 10 g of immunoglobulin G (IgG). Dams whose colostrum IgG level met or exceeded the minimum requirement (60 g/100mL IgG) were included in the study. Calf body weight and wither height were measured weekly, and fecal, and respiratory scores were recorded tri-weekly up until the time of weaning (56 days of age). Blood samples were drawn on days 1, 7 and 14 to assess serum protein concentrations. The serum protein levels of both treatment and control groups were high compared to the threshold of 5.5 g/100 mL. Administering CS to the calves did not alter serum protein concentrations during days 7 and 14. As expected, concentrations of serum protein declined with advancing age. Notably, without CS, the disparity in serum protein levels between the groups might have been more pronounced at day 14. This suggests a potential benefit of CS, particularly in scenarios where calves face environmental challenges, but additional animal numbers are needed to substantiate this observation. Additional data analyses are in progress.

Impact of Pumpkin Seeds on Parasite Load in Sheep

M. A. Tacuri Vera, B. J. Campbell, B. A. Wenner. Department of Animal Sciences.

Parasite management is a major concern for the sheep industry due to treatment cost and growing risk of parasite resistance to common medicines. Fall agritourism leads to many pumpkins going to waste after the season concludes. However, pumpkin seeds have demonstrated anthelmintic properties *in vitro*. Therefore, our objective was to observe changes in parasite load due to pumpkin seed supplementation, estimated by measuring body weights, fecal egg counts (FEC), FaMaCHa score (FAM) and packed cell volume (PCV). We hypothesized that the supplementation of pumpkin seeds (**PS**) would decrease the parasite load. Each treatment group had 5 pens of 2 sheep each (n=10) and all sheep were fed a common pelleted diet with chopped hay. The control group (**CON**)was supplemented 0.465 lb per hd/d of whole shell corn while the pumpkin treatment group supplemented 1 lb of PS per hd/d. These treatments were isocaloric and applied for 4 weeks. Analysis of the data included a fixed effect of pen and treatment, random effect of sheep, and repeated week. The FAM and log(FEC) did not differ between groups, with FAMs (1.08 and 1.02; P=0.17), and log(FEC) (2.94 and 2.96; P=0.90) for CON and PS, respectively, but the PCV was greater (P<0.01) for PS (38.7%) than CON (36.4%). Body weights of the sheep were decreased by PS (88.6 vs 93.4 for CON; P<0.01). However, when measured one month after the trial, there was a numerical evidence for compensatory gain as the daily weight gain for former PS sheep was (0.56 lb/d) compared to sheep formerly assigned to CON (0.42 lb/d; P=0.14). These data indicate that there was not a decrease in parasite load for the treatment group, but the lack of effect may be due to the decreased feed intake of the pumpkin seeds and behavioral variation across pens. More work is needed to find a preferred method of including pumpkin seeds in a diet to improve feed intake and treatment efficacy. Additionally, the variability of FEC urges experiments involving the measurement to include more regular collection intervals than biweekly as in this study.

Animal Sciences – Nutrition (3 Projects)

Interaction of Supplemental Branched-Chain Volatile Fatty Acids (BCVFA) and Dietary Rumen-Degradable Protein (RDP) on VFA and NH3 Concentrations in Continuous Culture

Abby Cornelius, A. White, Dr. Jeff Firkins. Department of Animal Sciences.

BCVFA are formed from the breakdown of branched-chain amino acids (BCAA) by rumen bacteria. Fibrolytic bacteria require BCVFA for fatty acid synthesis or making bacterial BCAA with ammonia. Bacteria ferment fiber and make VFA and previous work showed either positive or negative changes in VFA due to BCVFA, but only decreased ammonia. The purpose of this study was to determine how BCVFA dosing and RDP fiber breakdown and VFA and ammonia flow. Continuous cultures were inoculated with rumen fluid and fed high (10.0%) or low (8.50%) RDP and 0, 1.18, or 2.15 mmol/d of each BCVFA. The treatments were arranged in a 2x3 factorial in a 6x6 Latin square design. Periods had a 7 d adaptation and 4 d of sampling. Urea was infused for adequate culture concentration for the low RDP treatment. Ammonia content was determined using a colorimetric assay, and VFA were measured by gas chromatography. Statistics were run in SAS v9.4 PROC MIXED with fixed effect of treatment and random effects of period and fermenter. Contrasts were linear and quadratic doses of BCVFA with low and high RDP, respectively, and the main effect of RDP. By design, there was no evidence for a difference in ammonia flow due to BCVFA or RDP. Total BCVFA increased ($P<0.01$) with RDP with time interactions. Propionate was increased ($P=0.08$) by RDP, but acetate and butyrate had quadratic effects of BCVFA ($P<0.08$) in high RDP only. VFA produced by rumen bacteria supply 70% of a dairy cow's energy requirement, with propionate used more for gluconeogenesis and acetate and butyrate for fat production. Changes from BCVFA could affect milk production by altering the profile of VFA available to make glucose for lactose or fatty acids for milk fat. Since we kept the ammonia concentration above 5 mg/dL in all treatments, we can be sure that the effects on VFA profile are from BCVFA dosing and changes in RDP level.

Effect of Meal Feeding Frequency on the Behavior of Individually Stalled Horses over a 12 hr Period

Katherine L. Jones, Elizabeth R. Share, Karen Wimbush, Jessica Suagee-Bedore, Nettie Liburt, Pat Harris, and Dr. Sara L. Mastellar. Department of Animal Sciences.

Domestic horses are often fed at certain times of the day and do not necessarily have constant access to feed like their feral counterparts might have. Horses fed at certain times without constant access to feed can demonstrate more stereotypic behaviors and suffer from negative health effects. The hypothesis was that horses fed more frequently throughout the day would exhibit behaviors indicative of better welfare, including less stereotypic behaviors. Twelve horses were fed at three different frequencies (once, twice, or three times per day) for a week per frequency to evaluate the effect of that feeding frequency on horse behavior. On the fifth day of each treatment the horses were individually stalled, and video recorded for 24 hrs. The duration and frequency of behaviors for each horse were evaluated using an ethogram for 12 hours of video (7am-7pm). At the time of writing, video for only 4 horses has been evaluated in this ongoing study. Chi square tests in Microsoft Excel were used to determine treatment differences. Based on preliminary results, there was a significant difference between the time budgets for the three treatments ($P = 0.007$). When the horses were fed 3x they spent more time moving than when on the other feeding regimens. The horses exhibited more sleeping/lying behaviors and less standing alert behavior when fed more frequently throughout the day. When the horses were fed 1x they spent the least time pawing, an anticipatory behavior associated with feeding. These results suggest that horse owners should consider feeding multiple times per day to support horse welfare and that feeding two meals a day could provide a good middle ground for improved welfare as well as being more economically efficient.

Animal Sciences – Nutrition

The Effect of Overprocessing Dried Distillers Grain on Finishing Lambs
Brayden Thompson, Dr. Alejandro Relling, Dr. Braden Campbell. Department of Animal Sciences.

Dried distiller's grains (DDG) are a popular by-product used in the livestock feed industry as it is a cost-effective feedstuff that is rich in crude protein and minerals. However, it is also well reported that as the concentration of DDG in the diet increases, animal dry matter intake decreases, thus extending the feeding period. To further investigate this challenge, my project involved feeding two different diets, diet A (control DDG) and diet B (processed DDG), and observing the differences in average daily gain (ADG), dry matter intake (DMI), and gain to feed ratio (G:F) in finishing lambs. Both diets were the same except for the processing of DDG; whereas diet A used a commercial DDG source directly from the mill and diet B contained the same commercial DDG source that differed through additional heat processing. For DDG processing (diet B), 40% moisture was added to the DDG and heated at 150°C for 70 minutes. After the heating process, diet B was placed in a second oven at 56°C for two days to allow for humidity evaporation. Lambs, blocked by sex and weight, were housed in pens (2 to 3 lambs per pen, 6 pens per treatment) and were fed for 42 days. Lamb DMI was measured daily, and body weight was measured every 14 days. Data were analyzed using a mixed model in SAS considering diet as the fixed effect and pen and block as the random effects. The results of the study showed that there were no treatment differences ($P \geq 0.13$) in ADG, DMI, and G:F in growing, finishing lambs. Although no differences were reported under the conditions of the current study, producers should remain cautious when incorporating this ingredient into finishing diets as changes in by-product processing may negatively impact feed quality.

Entomology (3 Projects)

Estimated Moth Host Capacity in Urban Conservation Habitats
Addison Copen, Lucy Guarnieri, Michelle Pham, and Dr. Mary Gardiner. Department of Entomology.

The capability of urban greenspaces to harbor native pollinators is an important focus of organizations tasked with caring for and creating these sites. However, the majority of urban conservation efforts are designed to support bee communities rather than moth communities, so we wanted to determine the capability of these ecosystems to support moth larval communities. We conducted a survey of the most common vegetation species found at sixteen sites categorized as Metropark grasslands, FLOW pollinator habitats, or mowed turf across Franklin County, Ohio. These plant records were used to conduct a literature review to estimate the potential for moth larval diversity at each site. We found that Metropark grasslands and FLOW pollinator habitats could support significantly higher larval diversity compared to mowed turf fields. There is a potential for high species overlap between moth communities found in Metropark grasslands and FLOW pollinator habitats. Additionally, the mowed turf sites could support a completely unique community of larvae. These results suggest that both Metropark grasslands and FLOW pollinator habitats are important resources for moth conservation as larval refuges in urban ecosystems.

Entomology

Confirmation of a New Soybean Aphid Biotype

Tori Elek, Dr. Andy Michel, and Maggie Lewis. Department of Entomology.

Soybean aphid (*Aphis Glycines*; SBA) is an invasive insect pest of soybeans in Ohio, causing up to 40% decrease in overall yields when left unmanaged. Since its initial detection in the United States in the early 2000s, SBA has triggered a substantial increase in soybean insecticide use. Host plant resistance (HPR) provide an important, sustainable management option; soybean plants can be selectively bred to express the *Rag* (resistance to *Aphis glycines*) genes, which confer soybeans with natural resistance to SBA Some SBA biotypes which have adapted to survive and reproduce on soybean with *Rag* genes, threatening the longevity and durability of HPR as a sustainable management tool. In this study, we focus on investigating a newly discovered aphid biotype, which we have identified as Biotype 5 (B5). Originally found in Wooster, Ohio, these B5 aphids survived on soybeans containing *Rag1, Rag2,* and *Rag3* genes in preliminary screening assays. To confirm these results and more precisely quantify this resistance, we conducted a series of no choice experiments in which aphids were confined to different varieties of soybean (Susceptible, *Rag1* and *Rag2*, and *Rag1, Rag2,* and *Rag3*). We evaluated population growth rates in both nymph and adult life stages. Results indicated that B5 adult aphids were able to survive and successfully establish colonies on plants with *Rag1, Rag2 and Rag3* genes ($p<0.001$), supporting our hypothesis that this is a new biotype. The B5 adults were more successful in colonizing susceptible soybean than *Rag*, suggesting that virulence is incomplete and *Rag* genes may limit overall population density. The nymph experiments resulted in high mortality rates across all soybean varieties; the mechanism underlying this poor nymphal establishment is unclear, but possibly suggest that nymphs cannot effectively suppress host plant defenses. This study confirms that SBA are capable of adapting to more complex, pyramided *Rag* varieties, which emphasizes the importance of resistance monitoring and mitigating the possible threat to soybean crops.

Bee Fruitful and Multiply: Rearing, Mating, and Cold Storage of *Bombus Impatiens*

Claire Nagy, Morgan Christman, Dr. James P. Strange. Department of Entomology.

Bumble bees are eusocial insects and key pollinators for both wildflowers and food crops. The common Eastern bumble bee, Bombus impatiens, is abundant naturally and commercially in the United States, making it an ideal study species to further develop laboratory rearing, mating, and cold storage methods that can later be modified for imperiled and understudied species. Although B. impatiens is well-studied and commercially produced, there is a gap in accessible literature regarding baseline rearing, mating, and cold storage methods. In this study, we raised wild-caught B. impatiens gynes to record nesting success, colony development, mating duration, and cold storage survival in a laboratory setting. Of the 43 wild-caught gynes, 34.9% produced brood, known as colony initiation, and 25.6% produced at least one worker (colony establishment). Colony size ranged from 4 to 141 workers, with 63.6% of established colonies reaching at least 20 workers. 92 gynes were produced across ten colonies. Of these, 38.3% were observed mating, with mating times ranging from 2 to 133 minutes. A total of 52 surviving mated gynes were placed in cold storage, with 30.2% surviving the overwintering period of 7 weeks. The average weight of surviving gynes was significantly higher than the deceased gynes by 0.18 grams. These results indicate high success rates in colony initiation and colony establishment for bumble bees when compared to the literature. Overall, established colonies were highly successful in reaching 20 workers and producing many reproductive gynes. There is a need for improvements in timing for mating and cold storage methods due to a lower level of success. Overall, this study provides deeper insight into successful bumble bee lab rearing, mating, and cold storage practices that can be used to perform a range of laboratory and field experiments. It also provides a framework that can be modified to apply these methods for the conservation and research of imperiled bumble bee species.

Environmental & Plant Sciences (9 Projects)

Planting Depth of Soybean Varieties

Wyatt Bednar, Dr. Alex Lindsey. Department of Horticulture and Crop Science.

Soybeans are an example of an epigeal germinator, meaning the cotyledon will emerge from the ground as it emerges. This emergence makes it difficult to track the initial planting depth of the seed. In this experiment, parts of the soybean stem and roots will be compared to planting depth to find a possible correlation that can be used in future experiments to accurately quantify depth of planting. To quantify a method of knowing soybean depth in a field to help farmers know their planting depth. We hypothesize the root/shoot junction will be located at the actual depth of seeding. A greenhouse experiment with three replications was conducted in field soil using four soybean varieties and four planting depths (0.5, 1, 1.5, or 2 inch depth). After emergence, the distance from the soil surface down to the root-shoot junction was measured. This distance was correlated to the actual depth of planting. After two weeks, the underground hypocotyl length was close to the planting depth. After five weeks, every plant had a planting depth in the range of 0.5-1 inch, where most of the hypocotyl turned into the tap root. Although there was not a quantifiable pattern after two weeks, the seed depth was similar to planting depth. A grower will be able to measure underground hypocotyl length and estimate the planting depth after two weeks of growth.

Analyzing How the Agricultural Microbiome Impacts Soil Carbon Stability Under Different Management Practices

Hannah Bernstein, Afaf Abdelrahim, Dr. Virginia Rich. Department of Microbiology.

Increasing carbon storage in agricultural lands is becoming increasingly important as reducing carbon in the atmosphere will help mitigate climate change. Soil carbon sequestration is when more carbon is stored in the soil than what escapes the soil (Fierer and Walsh 2023). This is relevant as soil carbon has been steadily depleted from agricultural activities. Microbes play a role in this as they impact carbon storage and they are more effective at storing carbon than any other process. In the fight against climate change, regenerative farming practices have been reintroduced into agricultural land management. Tillage is a farming practice that helps prepare the soil for plant growth, usually conducted with a tractor using a plow implement. For this research project, till vs no-till was studied. Our approach to quantify the effect of tillage practices on soil microbial communities, at different depths and in different regions nationally, using 16s rRNA, ITS, and arbuscular mycorrhizal fungi amplicon sequencing. Soil samples were taken from Ohio, specifically in Coshocton, Pickaway, Wyandot, and Sandusky counties. Samples were taken at three different depths (0-10 cm, 10-30 cm, and 30-60 cm). At this time, soil sample analysis is in progress as sampling and processing of soil samples are still occurring. However, correlations between the relationship between microbial community composition and soil organic carbon can already be made.

Environmental & Plant Sciences

Investigation of a Pennycress Sucrose Synthase 1 Gene Mutant Under Waterlogging
Tara Creech, Rachel Combs-Giroir, Thiranya Wanigarathna, and Dr. Andrea R. Gschwend. Department of Horticulture and Crop Science.

Progress Report: Field pennycress (Thlaspi arvense) is a winter annual oilseed crop in the Brassicaceae (mustard) family. Pennycress is a promising biofuel cash cover crop for integration into corn and soybean fields in the Midwest. Under extended waterlogging stress, plants have shown symptoms of root damage, leaf chlorosis/yellowing, stunted growth, and yield reductions. Sucrose synthase is responsible for the reversible cleavage of sucrose into fructose and glucose. It is proposed to help mitigate anaerobic stress by offering a more energy-efficient process of supplying glucose for biological processes like glycolysis. Previous research found that the SUCROSE SYNTHASE 1 gene was significantly upregulated in 1-week waterlogged pennycress roots of tolerant accession MN106, suggesting a role in response to waterlogging. In this experiment, a pennycress line with a homozygous recessive knock-out mutation in the Sucrose Synthase gene (MN106_sus1) will be tested under waterlogging conditions at the seedling, bolting, and reproductive stages and compared to wild-type pennycress MN106. We hypothesized that MN106 wild-type plants will have a higher survival rate and taller plants after waterlogging than MN106_sus1. Six plants at the seedling stage, nine at the bolting stage, and six at the reproductive stage per accession were either waterlogged for 1 week (treatment) or watered normally (control). After 7 days of treatment, the control and treatment plants had their height taken in centimeters. The seedling survivability following one week of waterlogging did not differ between MN106 to sus1-583 pennycress accessions. We found that sus1-583 plants were on average 5.7 centimeters shorter than MN106 during the bolting stage, which was statistically not significant (P-value: 0.08). Wild-type MN106 was found to grow an average of 6.96 centimeters taller than sus1-583 following waterlogging at reproductive stage, which was statistically not significant (P-value: 0.99). This research will allow fellow researchers and farmers to further understand the significance of waterlogging effects on pennycress at different growth stages and how the genetics of the seeds planted can affect the plants' reaction to growing conditions.

Pasture Species Composition Under Differing Grazing Management
Grant DeBruin and Dr. David Barker. Department of Horticulture and Crop Science.

Many options exist for the management of pastures for grazing. Most philosophies focus on reaching one of two goals: 1) maximizing pasture dry matter production (often with lower quality), or 2) optimizing dry matter production and forage quality. The former method is often used for meadow hay and beef cattle, and the latter is commonly used for dairy cattle. One method of improving forage quality in mixed pastures is to increase the legume content, using rotational grazing management. This study sought to determine whether a fast, 10-14 day "rototinuous" management style or a slower, 20-28 day "rotational" method was more effective at retaining a common legume – red clover (*Trifolium repens*) – throughout the growing season in mixed grass and legume pastures grazed by sheep. The initial hypothesis was that the rotational management style would retain more clover throughout the growing season than the rototinuous method due to increased rest time between grazings. Pasture species composition was measured weekly from mid-May through mid-August using visual evaluation, where randomly placed quadrats were used to select areas for data collection. Measurements of the amount of clover present in each pasture were done both pre-grazing and post-grazing, and control quadrats were harvested, separated into grass and legume fractions, dried, and weighed every week to audit the accuracy of the visual evaluations. The red clover started similar for both treatments, at 35% of pasture mass. As the experiment progressed, the average amount of clover pre-grazing in the rotational pastures increased to 38% of mass, while the rototinuous pastures decreased to 10% of mass. These results suggest that a rotational grazing method is superior at retaining clover compared to a rototinuous method, and the greater amount of clover present in the rotational pastures can result in greater animal productivity and meat quality from harvested animals.

Environmental & Plant Sciences

Impact of Soil Moisture on Compaction and Plant Residue Decomposition at Waterman Lab

Ashley Malenfant, Dr. M. Scott Demyan, Jordan Pitt. School of Environment and Natural Resources.

Dynamics of soil moisture and soil strength are important factors influencing field workability but also feedback to soil physical and biological processes. The purpose of this study was to determine how soil strength and residue decomposition varied with soil moisture along a natural soil drainage class gradient from very poorly to well-drained (Kokomo, Crosby, and Miamian soil series) under corn and alfalfa at Waterman Laboratory. Penetration resistance (20 cm depth) was measured at eight time points between November and February and electrical conductivity once at the end of the experiment. In addition, green and rooibos tea bags were buried (8 cm) at the end of November for 90 days to determine decomposition rates. We used a mixed modeling approach through the *nlme* package in R Studio to test the fixed effects of soil, crop, and tea type (for decomposition) and time (for penetration resistance). Plant residue decomposition varied by tea, crop, and soil types. Green tea had a higher decomposition rate but did not vary between crops or soil. Rooibos had overall lower decomposition than green tea and was higher in Kokomo compared to Miamian soil under corn. Penetration resistance varied with time and electrical conductivity varied between soil types. Electrical conductivity was lower for Miamian soil at shallow depth but increased with depth. These results on how soil strength and decomposition vary across space and time can inform residue management for conservation agriculture and optimum workability timing.

Investigating the Impact of Temperature and Planting Date on Oomycete Diversity

Keely McQuain, Jenna Moore, Zak Ralston, Mesfin Bogale, and Dr. Horacio Lopez-Nicora. Department of Plant Pathology.

Damping-off, the death of seedlings during excessively damp and cool conditions, is often caused by soil-borne oomycete pathogens known as *Pythium* and *Phytophthora*. Soybean and corn planting dates are shifting to early to mid-April due to an increased spring temperatures, increased average precipitation, and earlier last freeze dates. As soybean planting dates are occurring earlier, seedlings are more likely to become exposed to cooler soil temperatures, which favors oomycete infection. Understanding the diversity of oomycetes at various temperatures can help growers determine the best management practices, such as cultivar selection and seed treatment, to prevent seedling damping-off and increase yield. The objective of this experiment was to determine the effect of temperature on oomycete diversity from soil collected at various planting dates. Soil was collected at 3 different field sites across Ohio 10 days after planting in both corn and soybean fields for five different planting dates. Soybean leaf discs were used to bait oomycetes at temperatures representing the soil conditions at VE, or seedling emergence. Leaf baits and soil were incubated for 48-hours at the temperature corresponding to each planting date and location. Leaf baits and soil were also incubated at room temperature as a baseline control. PARP and PBNIC selective media were used to plate leaf discs after baiting. Pure isolates were obtained and characterized morphologically and molecularly to species level. A total of 96 isolates were obtained from baiting at the temperatures corresponding to each planting date and location. Results for the different temperature treatments will be included in the final poster as characterization is ongoing. However, isolates already identified from the room temperature baiting for planting date 1 show that *Globisporangium ultimum*, *Pythium dissoctocum,* and *Pythium aphanidermatum* were most prevalent in soils at the 3 locations.

Environmental & Plant Sciences

Using Molecular Markers to Determine the Sex of Date Palm, *Phoenix dactylifera*
Francesca Pilutti, Dr. Andrea R. Gschwend. Department of Horticulture and Crop Science.

Date palm, *Phoenix dactylifera* L. (Arecaceae), is a globally important food crop. Date palm is considered to be one of the oldest cultivated fruit trees whose earliest use dates back to 5300 BCE in the Arabian Peninsula. Date palm remains especially economically and culturally important in Northern Africa and the Middle East (Tenberg, 2012). Crop improvement has been slowed due to challenges presented by date palm's physiology and life history. Date palms are dioecious perennials with pollen producing and fruit producing flowers being located on separate individuals. Flowers only appear once the plant is mature which takes 5-8 years (Khaled et al., 2019). The ability to quickly and accurately determine the sex of date palm seedlings would be incredibly beneficial to crop improvement efforts and agricultural practices. One method to sex seedlings that has shown great potential is using PCR based molecular markers. Several studies have developed sex-specific PCR primers, but there hasn't been proven efficacy across cultivars and populations (Intha et al., 2018). Recent work has been able to conclude that sex in date is determined by an X/Y chromosome system with the male being a heterozygote and female being homozygous (Torres et al., 2018). By designing primers to the sex determining region of the Y chromosome, PCR based molecular markers can selectively amplify male DNA. In order to test the efficacy of the molecular markers across populations different to the reference genome, seedlings from a Florida population of date palms were tested. The sex of the seedlings were able to be repeatedly determined using the designed PCR primers. This proves beneficial in food production systems as it reduces the time and cost of plant sex determination from a minimum of 5 years to a day in a laboratory.

Associated Effects of Grazing, Inundatin and Forage Mixtures on Soil GHG Emissions
Cassandra Stachler, Alexandre Fameli Mammana, Marilia Chiavegato. Department of Horticulture and Crop Science.

The Midwest is expected to experience increased inundation due to climate change. Areas heavily affected by inundation are pastures. Diverse forage mixtures can be used as a tool to decrease the negative effects of inundation and increase pasture productivity. Greenhouse gas (GHG) emissions are biological processes affected primarily by soil moisture and aeration. The objective of this study was to evaluate the emissions of carbon dioxide (CO_2), nitrous oxide (N_2O) and methane (CH_4), from grazed, inundation-prone soils, under 3 different forage mixtures. We hypothesized an increase in gas emissions from inundation-prone soils, for all forage mixtures. This study was conducted in Jackson, Ohio. Forage mixtures included a control (tall fescue and clover), cool season mixture (fescue, clover, orchard grass and bluegrass), and warm season mixture (Indiangrass and big bluestem). The field consisted of 3 replicates per forage mixtures treatment, replicated in inundated and non-inundated (total of 18 plots). GHG emissions from soils were collected 10 days post-grazing and the static chamber methodology was used. Soil and ambient temperature, and soil water content were monitored simultaneously. Data were analyzed in SAS, using PROC MIXED with chamber nested within replicate and treatment as the random term. Preliminary results from the 2023 early season suggest that inundation affected only CO_2emissions, on control treatment, with greater emissions in the non-inundated plots. Warm-season CO_2 emissions were lower in inundated plots, and N_2O emissions were greater in non-inundated plots. There was a common trend of CH_4sinks among all treatments. The early season was characterized by high temperatures and no visible flooding (despite the long history of inundation in the area), which could have decreased overall fluxes. Soil water content was the main driver of emissions, and higher in warm-season treatment and inundated plots across treatments. Results from 2023 late season and 2024 season are needed to provide further conclusions. After this experiment, the results will support identification of sustainable grazing management practices in inundation-prone pastures.

Environmental & Plant Sciences

Evaluation of Liquid Organic Fertilizers for Containerized Production of Leafy Greens in a Controlled Environment

Oliver Watson, Dr. Uttara Samarakoon, Milon Chowdhury. ATI Plant Science Engineering Technologies.

Global population is projected to reach 10 billion by 2050, meaning farmers will have to produce around 70% more food to keep up with demand. While demand for agricultural land is increasing, soil degradation is decreasing arable land available for growing food, and climate change is creating conditions plants have not yet adapted to. Controlled environment agriculture (CEA) can increase efficiency, decreasing water usage, space, and time constraints. Organic farming methods, such as organic substrates, fertilizers, pesticides, and biological control, are gaining popularity in CEA due to economic benefits and environmental sustainability. However, there is limited research-based information for producers in CEA. Our past research shows substrate-incorporated granular fertilizers are less effective than liquid organic fertilizers. Further, growers prefer water soluble fertilizers because it is common industry practice in CEA. Many liquid organic fertilizers are commercially available with widely different ingredients, sources, and nutritional compositions. As a result, selecting a suitable fertilizer can be complicated for hydroponic growers. The goal of the current study was to evaluate effectiveness of three liquid organic fertilizers (selected based on nutritional composition) for growing lettuce in containerized hydroponic systems under a controlled environment. Lettuce 'Green butter' was grown in two substrate-based hydroponic systems (i.e. Dutch bucket and containerized production), and Grow Big, Pre-Empt, and Aqua Power fertilizers were evaluated. Fertilizers tested are derived from earthworm castings, fermented molasses, and fish emulsion respectively. Five plants were sampled for shoot and root evaluation 14 and 28 days after transplantation. Grow Big showed consistently higher or equal growth parameters than Pre-empt and Aqua Power fertilizers, with shoot dry weights 23 and 50% higher than Pre-empt and 14 and 35% higher than Aqua Power in containerized production and Dutch bucket systems respectively. Additionally, Grow Big had a 126% higher average root fresh weight and 47% higher root length in containerized production compared to Dutch bucket systems. All plants grew on a similar timeline to synthetic fertilizers. Results indicate Grow Big is more effective for growing lettuce in a greenhouse environment than Pre-empt and Aqua power fertilizers, and that containerized production yields better growth parameters than Dutch bucket systems.

Food Science (7 Projects)

Developing Prediction Models Using a Handheld Near-Infrared Device to Assess the Drying Process and Storage of *Cannabis Sativa*

Eric Armstrong, Cameron Jordan, and Dr. Luis Rodriguez-Saona. Department of Food Science and Technology.

Drying is the most critical post-harvest operation of cannabis, as it impacts the safety and shelf-life of the product, as well as changes in secondary metabolites, including essential oils, cannabinoids, and sterols. Current methods for moisture and water activity analysis are destructive and time-consuming. Here, we report using a handheld near-infrared spectroscopy (NIRS) for rapid measurement of moisture content (MC) and water activity of hemp to assess the quality during postharvest operations. Hemp samples were placed in desiccators containing different saturated salts that gave relative humidity ranging from 30% to 80%. After 2 weeks of equilibrium, the NIR spectra of hemp samples were measured by using a handheld device. The moisture content and water activity were determined by reference methods. Moisture isotherms showed a sigmoidal relationship with a monolayer value of 8.39% db. Partial Least Squares Regression (PLSR) showed excellent predictive models for moisture (SEP 0.5%) and water activity (SEP 0.02). A handheld NIR device allowed rapid monitoring of the water content in hemp, providing a real-time tool for monitoring the quality of hemp during critical drying and curing operations.

Food Science

The Relationship between Anthocyanins and Tannins to Sensory Traits of Various Apples

Rachel Barrett, Lydia Balogh, and Dr. Jessca Cooperstone. Department of Horticulture and Crop Science.

Apples (Malus × domestica Borkh) are an important fruit for the United States economy as they are the number one fruit consumed by Americans. There are various phytochemicals in apples that offer potential antioxidant, anti-inflammatory, and anti-cancer benefits for humans. These include anthocyanins and tannins, both which are often perceived as having bitter or astringent taste in many foods, though the effect of these compounds on flavor in apples is not defined. Understanding the relationship between phytochemical content and consumer sensory traits is of interest as it has important implications on creating an apple higher in phenolics. A parallel study has been conducted to evaluate consumer sensory liking on 33 apple selections. The aim of this study was to quantify anthocyanins and tannins in these diverse apples and determine if there is a correlation between overall phytochemical class content and consumer liking. Correlation analyses show no significant relationships between total anthocyanin or tannin content and overall flavor liking of the selected apples. These data suggest that it is possible to increase anthocyanin and tannin content in apples without sacrificing consumer liking.

Application of Sensors for the Non-Invasive Determination of Strawberry Quality

Murphy Carroll, Celeste Matos-Gonzalez, Dr. Luis Rodriguez-Saona. Department of Food Science and Technology.

Traditional methods for analyzing the maturity of strawberry fruit have constraints due its destructive nature and time consumption. Recent advances in miniaturized optical technology have enabled the development of handheld, inexpensive sensor solutions based on cutting-edge Micro-Electro-Mechanical Systems (MEMS) technology. This fundamental innovation has enabled a new generation of infrared spectrometers for integration into handheld-size sensor systems used in field measurements at low cost. The goal of this study is to develop prediction algorithms for monitoring key compounds (soluble solids, titratable acidity, target specific organic (malic and citric) acids, and pigment) in intact strawberry fruits using the spectra obtained from a handheld FT-NIR device. Strawberry fruit samples (n~250) of different commercial brands were purchased from local grocery stores and their FT-NIR spectra collected. The soluble solids (refractive index), acidity (titration), organic acid profiles (HPLC), and anthocyanin (UV-Vis spectrophotometry) levels of strawberries were determined by reference methods, and pattern recognition analysis (Partial Least Squares Regression, PLSR) was used to develop prediction algorithms. We found a large compositional diversity in the samples, with levels of soluble solids (5.1 – 10.6 °Brix), titratable acidity (0.4 – 1.1 g/100g), citric (0.4 – 1.12 g/100g) and malic (2.9 – 188 mg/100g) acids, and anthocyanin (0.0 – 34.1 mg/100g). PLS regression models using the spectral region between 1350 and 2500 nm, gave correlation coefficients ranging from 0.89 (anthocyanin) to 0.97 (Brix) and low prediction errors that would allow for quality assurance applications. Our outcomes have outperformed results in the literature using field-deployable devices, i.e., benchtop FT-NIR, hyperspectral imaging, and Visible-Short Wave Near Infrared technologies. By using a handheld FT-NIR device, our prediction algorithms would provide critical quality information quickly (15 sec) and in the field, decreasing the time and cost of testing strawberry fruits and standardize the quality of fruit delivered to consumers. Widespread adoption of these smart and easy-to-use handheld systems will improve the strawberry industry's ability to make informed decisions to enhance the quality reaching consumers.

Food Science

Effect of a Prebiotic Galacto-oligosaccharides Mixture on the Growth of Probiotics

Paige Consolo, Silvette Ruiz-Ramirez, and Dr. Rafael Jimenez-Flores. Department of Food Science and Technology.

The objective of this research was to study whether the prebiotic product by β- galactosidase from Lb. helveticus OSU-PECh-4A had a comparable prebiotic effect on distinct lactobacilli and bifidogenic strains to commercially used GOS products. We utilized Three de Man, Rogosa, and Sharpe (MRS) with no carbohydrate, lactose, commercial GOS (Bimuno), and GOS mixture from β-galactosidase isolated from Lb. helveticus OSU-PECh-4A to compare the prebiotic effects. We examined the optical density and growth rate within the broths for Limosilactobacillus reuteri, Lactobacillus rhamnosus, Lactococcus lactis, and Bifidobacterium longum subsp. infantis to determine the growth over time and the maximum growth rate within 22 hours. The optical density and maximum growth rate were higher for all probiotics in lactose, demonstrating a preference for lactose as a carbohydrate source. L. lactis and Lcb. rhamnosus grew at a similar rate in the presence of the prebiotic product by β-galactosidase from Lb. helveticus OSU-PECh-4A and the commercial prebiotic product. Based on the results, the prebiotic capacity of the GOS mixture and its potential as an ingredient in the formula sector was demonstrated. Our proposed GOS mixture exhibited a prebiotic effect comparable to the commercial GOS product Bimuno, presenting a significant contribution to the future of prebiotic products derived from probiotic-derived enzymes.

Targeted Mitigation of Antibiotic Resistance Transmission from Animal Hosts to Consumers via Vegetable Products

Nick Fox, Yutong Li, E. Rogers, Jane Fu, Dr. Melvin Pascal, Dr. Michael Cressman. Hua Wang (Corresponding Author). Department of Animal Sciences and Department of Food Science and Technology.

Antibiotic resistance (AR) is a critical global health issue with far-reaching implications for healthcare, agriculture, and society as a whole. Recent data from the Wang lab revealed high prevalence of antibiotic resistance in traditionally fermented foods. The objective of this study is to examine: 1) the prevalence and abundance of antibiotic resistant bacteria in vegetables associated with different production practices, and 2) monitor the effect of post-harvest processing methods, such as sanitizers, exemplified by an electrolyzed water wash, on mitigating these AR bacteria from raw vegetables. In this study, green onion was planted in triplicate within three different types of soil: traditional potting soil, potting soil containing poultry feces (acting as fertilizer), and potting soil containing autoclaved poultry feces. Each soil type was potted with replicates. Microbial assessments of the harvested plants were then conducted by plating the green onions on Brain Heart Infusion (BHI) and Luria Broth (LB) agar plates, with and without the supplementation of representative antibiotic, tetracycline or ampicillin. Samples of green onion washed with electrolyzed water, pH of 4.4, for 5 minutes were further assessed by plate counting for the efficacy of the treatment. We found that the electrolyzed water treatment effectively inactivated pure cultures of *E. coli* and *Lactobacillus* sp. strains by at least 4 logs, and antibiotic resistant (AR) bacteria from purchased retail green onions by at least 2 logs. The abundance of AR bacteria in green onions grown in potting soil with and without autoclaved feces was low, but 1-2 logs higher in soil with poultry feces. Electrolyzed water treatment also effectively mitigated total, as well as AR bacteria, in harvested green onions. Our data illustrated the potential transmission of AR bacteria from fecal fertilizer, and the effective mitigation of microbial risks in raw vegetables by electrolyzed water. The data pave the way for interrupting the ever- escalating circle of AR transmission via the chain of host feces, plants, food and host gut/feces by targeted mitigation.

Food Science

The Salty Chemistry of Anhydrous Milk Fat and Corn Oil

Talia Katz, Shoshana Ginsburg, Dr. Rafael Jimenz-Flores. Department of Food Science and Technology.

Fats and oils play a crucial role in flavor and function. Fatty acids are an important dietary component providing both energy and vitamins. However, the type of fat used can have a drastic impact on human health. In recent years, consumption of polyunsaturated fatty acids (PUFA), which can come from plant oils, has increased due to their health benefits. Due to these health benefits, many plant oils have seen incorporation into butter blends, resulting in a more spreadable butter. Combining plant-based oils, and salts with anhydrous milk fat (AMF) alters the structure of the butter fat, allowing for unique chemical characteristics, ultimately producing a more desired product for the consumer. While oils such as canola and olive have been studied, the ability to use corn oil to create a blend is still to be discovered. Corn is a major crop and product within the United States, however, ironically, since it is so widely used it is also a major waste product. To minimize waste and use waste product of the corn industry, the oil derived could be used in the dairy industry. In the presence of corn oil, additional nucleation of the AMF occurs creating larger and more defined butter crystals while also decreasing the amount of energy required for melting and crystallization ($p<0.05$). Additionally, the presence of corn oil reduces beta crystal formation while retaining beta prime and alpha crystals. However, the addition and presence of salts in AMF promotes beta crystal formations, sometimes rendering the butter harder. The presence of salts in butter oil and butter-corn oil blends increased the size and number of prominent crystals. This study uses analytical techniques to gain a greater understanding of the chemistry-based changes that occur when calcium chloride, sodium chloride, and corn oil are added to butter. This work is imperative to understand how these additives affect AMF for future consumer applications.

Production Optimization and Physicochemical Characterization of Epoxidized Coffee Oil

Sakura Sugiyama, Jeffrey Eiseman, Dr. Yael Vodovotz and Dr. Emmanuel Hatzakis. Department of Food Science and Technology.

The use of coffee oil to form biopolymers via epoxidation grants a novel use of spent coffee grounds, a waste product. One common method of epoxidation uses hydrogen peroxide and an organic acid such as formic acid. While the use of formic acid grants greater yield, acetic acid is a desirable alternative due to its lower cost and reduced corrosivity, making it a better fit for metallic industrial reactors. The objectives of this project were to optimize several factors of the epoxidation process of coffee oil, including reaction time and the use of acetic or formic acid. Additionally, the formation of a middle layer during extraction of the epoxide product was observed and its effects on product yield were examined. It was hypothesized that acetic acid would yield a less complete epoxidation, and that middle layer formation would have a significant effect on the product yield. The epoxidation was done using coffee oil, hydrogen peroxide, and either 85% formic acid or glacial acetic acid. The success of the epoxidation was evaluated by process yield, measured by the mass of epoxide relative to the mass of coffee oil, as well as by reaction completion, which was determined using Nuclear Magnetic Resonance (NMR) Spectroscopy. Increasing the reaction time resulted in a higher degree of conversion for the formation of epoxides using both formic and acetic acid. However, it was also weakly associated with an increase in middle layer formation, as well as a decrease in product yield for epoxide processed with formic acid. This middle layer formation was not observed at any reaction time when using acetic acid. The reaction required 16-24 hours to reach similar degrees of completion using formic acid, whereas similar results were obtained using acetic acid after 20-24 hours. These results indicate that acetic acid may serve as a suitable alternative for formic acid, as it is capable of achieving a similar reaction completion, while also increasing product yield as it is less prone to middle layer formation.

Other (2 Projects)

Curbing Sediment

Henry Schuellerman, Dr. Ryan Winston, Halina Steiner, Dr. Lisa Burris, Dr. Alec Grimm. Department of Food, Agricultural and Biological Engineering and Department of Civil Environmental and Geodetic Engineering.

As urbanization occurs, the resulting increase in impervious surfaces and soil compaction reduces the infiltration of stormwater into soils. Further, urban runoff delivers pollutants efficiently to streams and continues to cause a multitude of water quality concerns. Stormwater control measures (SCMs) are often implemented by municipalities to curtail these negative impacts on water quality; however, infiltration-based SCMs, including bioretention and permeable pavement, may become clogged with stormwater-borne sediment over time, greatly reducing their efficacy. Thus, pre-treatment devices are installed upstream of these SCMs to remove sediment and lengthen maintenance intervals. In urban environments, space constraints make the addition of SCMs difficult and the installation of pre-treatment measures even more challenging. Thus, a new pre-treatment system, designed to fit within an existing roadway, was tested at laboratory scale; roughness was added to the curb and gutter, with varying degrees of spacing, shape, and depth of indentations, with the intention of reducing the water velocity to trap sediment particles. The best performing designs removed >80% of sediment in simulated stormwater. In the current research, the most effective gutter roughness design was implemented on a 60-meter section of Carmack Road on Ohio State University's main campus. By using the standard curb and gutter on the opposite side of the street as a control for the experiment, we are evaluating performance relative to the current design standard. Effluent samples from both the treatment and innovative curbs will be tested for nutrient, metals, and total suspended solids (TSS) concentrations to understand real-world benefits of this novel pre-treatment. With routine maintenance and street sweeping, the modified curb and gutter design may be a promising pre-treatment device that can efficiently remove pollutants in any urban environment.

Historical Redlining and Urban Heat in Columbus, Ohio

Nancy Zhu, Dr. Kelsea Best. Department of Civil Environmental and Geodetic Engineering

Redlining was a discriminatory housing policy established by the Home Owners Loan Corporation (HOLC) during the 1930s that assigned investment risk grades to neighborhoods, which influenced ability to access mortgage financing. Redlined areas, or areas assigned a "D" grade, typically overlapped with Black, immigrant, and low-income communities, and resulted in disinvestment and lack of resources within these communities. The legacy of disinvestment and lack of resources in redlined areas contributed to a variety of social outcomes that persists today, including lower quality infrastructure, higher rates of poverty, limited access to health resources, and high unemployment, all of which influence community vulnerability to environmental issues such as climate change. This is concerning as temperatures continue to rise and pose increasing threats to human health. Here, we investigate whether redlined areas in Columbus, Ohio experience unequal exposure and susceptibility to extreme heat. At the census tract level, we layer a historic HOLC map of Columbus, Ohio with the 2020 CDC Social Vulnerability Index (SVI) data to summarize the demographic and socioeconomic characteristics across the four-category rating system. We average morning, afternoon, and evening spatial heat index (which combines temperature and humidity) data from 2022 derived from the NOAA Urban Heat Island Mapping Campaign across census tract boundaries. We then combine this data and conduct statistical analysis including linear regression to examine the associations between redlining and differences in heat exposure in Columbus, Ohio. We further investigate how different dimensions of social vulnerability (including race, income, housing, and health) influence this relationship between redlining and heat. We anticipate finding that there is a significant difference in the value of heat index experienced between communities across different grades. We also anticipate that our results will reveal compounding inequities related to historic marginalization, current vulnerability, and increased exposure to extreme heat. These results will help understand how heat is distributed in the Columbus community to determine equitable solutions to allocate for communities to mitigate the impacts of climate change on human health.

Social Sciences (6 Projects)

An Exploration of Climate Change and Climate Self-Efficacy

Mackenzie Hoog, Sheriden Schuerman, Dr. Cara Lawson. Department of Agricultural Communication, Education and Leadership.

Introduction & Literature Review- Throughout the world, climate change is leaving people at risk when it comes to navigating the effects, such as increased and more intense extreme weather events. Self-efficacy refers to an individual's belief in their capacity to execute behaviors necessary to produce specific outcomes. Understanding climate self-efficacy is crucial because it directly influences an individual's beliefs, attitudes, and actions regarding climate change. A sense of climate self-efficacy can empower individuals to foster a sense of agency, which can help drive meaningful change and address the challenges posed by climate change. Climate experience has also been shown to play a role in various climate change perceptions. The purpose of this study was to investigate the potential relationship between climate change experience and climate change self-efficacy. Methods- A survey was developed by the researchers and distributed through Qualtrics Research Services. Quotas were established for state, gender, and community type. Data were collected from November 7 – December 8, 2023, yielding a final sample of 2,191 adults from throughout the United States. Data were analyzed using inferential and descriptive statistics.Results- Participants had moderate levels of climate experience overall ($M = 3.3$, $SD = 1.2$) and moderate levels of climate self-efficacy ($M = 3.7$, $SD = 1.0$). Additionally, a significant positive correlation was found between climate change experience and climate change self-efficacy, suggesting that as climate change experience increased, climate self-efficacy levels increased as well ($r = .62$, $p < .05$).Conclusions- The findings in this study suggest climate change experience appears to play a role in self-belief and confidence in addressing climate change. As these findings indicate, individuals who had more experience with climate change tended to be more confident in their ability to address climate change issues. This study adds to the existing literature on climate change perceptions by highlighting the role of personal experience in individuals' beliefs toward climate change action. As individuals seek to navigate the risks of climate change, climate self-efficacy will likely be a key factor regarding climate risk response and behavior.

Effect of Automatic Enrollment in a Composting Program on Student Sustainability Behaviors

Molly Lowe, Molly Sheridan, Dr. Brian Roe. Department of Agricultural, Environmental, and Development Economics.

Automatic enrollment in composting programs can promote behavioral spillover habits. These spillover habits can be positive, the adoption of a pro-environmental behavior, or negative, stopping pro-environmental behaviors. The purpose of this research is to determine if direct enrollment in a composting program in residence halls changes individuals composting behavior along with its effect on spillover habits. Two residence halls will be surveyed, one in a direct enrollment composting program, the other not directly enrolled in a composting program. These respondents will be surveyed three times, once at the beginning of the program, once at the end of the program, and once a couple months after the end of the program. It is hypothesized that the students in the direct enrollment program will compost more than those not in the program, the amount of education relating to the composting will be positively related to their composting behaviors, and students enrolled in the composting program will experience pro-environmental behaviors.

Social Sciences

Supports & Barriers Related to Career Choice of First-Year CFAES Students
Lauren Mellott & Dr. Kellie Claflin. Department of Agricultural Communication, Education, and Leadership.

The purpose of this pilot study is to examine the factors of career choice of first-year college students enrolled in CFAES. The research questions are: (1) what are the academic and coping self-efficacy, outcome expectations, academic interest, educational goals, and supports and barriers of CFAES students, (2) what are the relationships between SCCT constructs and demographics? This study was framed by Social Cognitive Career Theory (SCCT), which connects self-efficacy and outcome expectations to the development of personal career interests. A Qualtrics survey instrument was distributed to first-year CFAES students enrolled in FAES 1100 in autumn 2023. Data was analyzed using SPSS using descriptive and inferential statistics. All constructs met reliability thresholds. The majority of students who responded were 18 years old, female, white/Caucasian, attended a comprehensive high school, were from a suburban area, and did not take a high school agriculture course. Animal science was the most represented major with 57% of students listing it as their primary major. Overall, participants were fairly confident in their ability to complete a degree in their major/CFAES, with a moderate amount of supports, which will lead to positive career outcomes. When examining relationships by demographic categories, there was a statistically significant difference between non-white/Caucasian and white/Caucasian students in the areas of supports ($F(2, 160) = 4.185$, $p = 0.17$) and barriers ($F(2, 160) = 13.56$, $p = <.001$). Additionally, there was a statistically significant difference between groups with the place that a student grew up for barriers ($F(2, 160) = 1.92$, $p = .002$). Finally, there was a statistically positive significant relationship between the outcome expectations ($t(161) = 2.540$, $p = .012$)and educational goals ($t(161) = 2.575$, $p = .004$) if a student had taken high school agriculture courses. These findings indicate that the majority of first-year CFAES students who were enrolled in FAES 1100 in autumn 2023 have positive self-efficacy and outcome expectations related to their future careers and college experiences. However, there are additional aspects to study including predictors of SCCT including demographic categories. This pilot data provides a foundation for future research.

Previous Trauma Impacts Human Behavior During Equine Assisted Services
N. Pickard, N. Lorig, and Dr. K. Cole. Department of Animal Sciences.

The National Council for Behavioral Health estimates that 70% of adults have experienced some type of trauma in their lifetime. Trauma can be broadly categorized as psychological trauma (e.g., witnessing a death) or physiological trauma (e.g., traumatic brain injury). Symptoms of trauma may include anxiety, depression, and avoidance of associations to trauma. Recent research has suggested that participation in Equine Assisted Services (EAS) may reduce symptoms associated with trauma in a variety of populations. The objective of this study was to evaluate the influence of previous trauma on human behavior during EAS. Participants (n=36; 18-55 yr) completed the Posttraumatic Checklist for DSM-V (PCL-5) to assess previous psychological trauma and The Ohio State University Traumatic Brain Injury Identification (OSU TBI-ID) to assess previous physiological trauma. Participants completed four consecutive, weekly 30-minute sessions with an equine of their choice at The Ohio State University Equine Facility. Each session was video recorded to quantify behaviors using scan sampling every 30 s. Data were analyzed using PROC MIXED of SAS v 9.4. No differences were observed in the frequency of standing behavior between trauma groups or sessions ($p > 0.05$). However, participants with both previous psychological and physiological trauma were observed walking more frequently during sessions compared to participants with no previous trauma or only psychological or physiological trauma ($p < 0.05$). Similarly, participants with both psychological and physiological trauma were observed touching the equine more often compared to participants with no previous trauma or only psychological or physiological trauma ($p < 0.05$). These findings suggest that human behavior during EAS may be influenced by an individual's previous trauma. These behaviors may influence the interactions between humans and equine during EAS sessions and subsequent outcomes. Further analyses will evaluate these findings in relation to both human and equine biopsychosocial responses during EAS.

Social Sciences

An Exploration of Perceptions Related to Farmers' Roles in Climate Change Issues

Sheriden Schuerman, Mackenzie Hoog, Dr. Cara Lawson. Department of Agricultural Communication, Education, and Leadership.

Climate change refers to variation in weather events and includes measures such as temperatures, precipitation amounts, and numbers or severity of storms. The risk associated with climate change can vary between groups of individuals. Farmers, for example, perceive risk associated with climate change in terms of impacts to property, policy implications, social risks, and business pressures related to profitability and labor. However, little is known about perceptions of farmers from those not involved in agriculture.

Attribution theory guided this study as it allows for the investigation of causal interpretations applied by individuals to explain happenings within their environments. It is used to interpret outcomes through justification favors of individuals that may or may not be explainable. In this study, attribution theory was used to determine and interpret differences in perceptions of farmers regarding their roles in climate change effects. A survey was developed by the researchers and distributed through Qualtrics Research Services. Quotas were established for state, gender, and community type. Data were collected from November 7 – December 8, 2023, yielding a final sample of 2,191. The participants were 18 years and older from throughout the United States. Data were analyzed using inferential and descriptive statistics.

Participants presented mostly neutral responses to the items in the measure overall. There was a small, significant difference by region of perceptions of farmers' roles in climate change, with differences between perceptions in the West and Midwest regions. As those in agriculture seek mitigation strategies to adapt to climate change, an understanding of perceptions about farmers in this area will be key. The data suggest U.S. residents appear to hold a largely neutral stance on the issue. Across regions, only one significant, but small, difference in perceptions emerged, suggesting no region was partial to extreme opinion toward farmers' roles in climate change. As agricultural communicators, the neutral perceptions that emerged from this study may present a unique opportunity to encourage greater understanding of both farmer and rancher roles in climate change to a population in a possible state of open-mindedness and neutrality.

Securing the Future of the Farm: Impacts of Farm Succession Planning

Ryanna Tietje, Dr. Margaret Jadlowski, David Marrison. Department of Agricultural, Environmental, and Development Economics.

Over the last two decades, average age of farm operators has trended upwards while farm consolidation has accelerated, often because many individual operations face uncertainty about their future. One driver of that uncertainty is barriers to farm succession planning. This study works to explore these and to provide insight about how operations in Ohio plan to transition from one generation to the next. Ultimately, this work will describe how these plans (or lack thereof) impact the growth potential and financial stability of Ohio's farms. In this study, I analyze factors impacting whether or not an operation has a succession plan; we also estimate the relationship between succession planning and operational performance. The models control for variables that may impact both the presence of a succession plan and the farm's future financial stability. Through a self-designed survey of Ohio's farmers, I collect data from the primary operators from different types of operations across the state. The survey tool is based on previous research in the literature and includes questions about the respondent's demographic information, family, connection to the operation, and characteristics of the operation. Key sections of the survey are those that ask the operator to evaluate his/her future plans and to provide detailed information about the nature of the succession plan. These details represent a clear advancement from the earlier literature, which has typically relied on a binary measure of farm succession planning. The survey was distributed through extension and personal networks to a range of agricultural operations across the state. I summarize the data that has been collected from the survey using descriptive statistics, including difference-in-means tests and other distributional analysis. The relationships of interest, such as those between the presence of a farm succession plan and farm financial outcomes, are analyzed using linear regression methods, including probit models, logit models, and ordinary least squares. Initial results indicate a strong correlation between farm financial stability and quality of a farm succession plan. Unsurprisingly, there is also a strong relationship between an operation's performance and presence of successors. Next steps will be to disentangle the direction of this effect.