Research and the State

GRADUATE STUDENT POSTER SESSION

Program Booklet

Tuesday, October 28, 2014
K-State Student Union

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

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Program Schedule

POSTER PRESENTATIONS AND JUDGING

9:00 am to 11:00 am
K and S Ballrooms

Research posters will be presented by approximately 40 K-State graduate students representing six academic colleges and 18 graduate programs. The top 10 presenters will be selected by K-State Faculty judges to participate in the Capitol Graduate Research Summit (CGRS) being held in Topeka in the spring.

AWARDS CEREMONY

1:00 pm
Big 12 Room

The top 10 graduate student poster presenters selected to represent K-State by presenting their posters at the 12th annual Capitol Graduate Research Summit (CGRS) in spring 2015 will be announced at the awards ceremony. These 10 students will be presented with a monetary award to recognize their achievement.

About the GRS

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

Poster Titles and Presenters

GROUP 1

1. **HOW DOES SEASONAL VARIATION AFFECT BLACK WALNUT FLAVOR PROFILE?**
   Catherine Lynch

2. **A DESCRIPTIVE SENSORY TOLERANCE TEST FOR COOKED PORRIDGE FROM NOVEL SORGHUM-BASED FORTIFIED BLENDED FOOD**
   Sirichat Chanadang

3. **FLAVOR OF RAW PECAN CULTIVARS GROWN IN KANSAS**
   Shelby Magnuson

4. **VALIDATION OF BAKING AS A KILL-STEP TO REDUCE *SALMONELLA* DURING HAMBURGER BUN MANUFACTURING, AND EVALUATION OF *ENTEROCOCCUS FAECIUM* ATCC 8459 AS A NON-PATHOGENIC SURROGATE INDICATOR FOR PROCESS VERIFICATION**
   Elizabeth Holmgren

5. **IRON BIOAVAILABILITY OF SORGHUM, COWPEA, CORN AND SOYBEAN FORTIFIED BLENDED FOODS**
   Kavitha Penugonda

GROUP 2

6. ~~**USING SPECTRAL RESPONSE PROPERTIES TO IDENTIFY AND CHARACTERIZE INFESTATIONS OF *DECTES TEXANUS* IN SOYBEAN**~~
   ~~*Alice Harris*~~ *****WITHDREW*****

7. **HESSIAN FLY, *MAYETIOLA DESTRUCTOR*, RESPONSE TO DIFFERENT COLORS OF LEDS**
   Ryan Schmid

8. **EVALUATION OF POULTRY LITTER APPLICATION BEST MANAGEMENT PRACTICES (BMPs) TO MINIMIZE PHOSPHORUS LOSS USING THE APEX MODEL**
   Ammar B. Bhandari

9. **A WINDBREAK INVENTORY AND ASSESSMENT FOR KANSAS: REMOTE SENSING, GIS AND FIELD SURVEY APPROACH**
   Kabita Ghimire

10. **WATER USE OF COVER CROPS**
    Matti Kuykendall

11. **TEMPERATURE CONDITIONING OF SOYBEAN SEEDLINGS INFLUENCES EXPRESSION OF RESISTANCE TO SOYBEAN APHID (*APHIS GLYCINES*) BIOTYPE 1**
    Ashley Hough

GROUP 3

12. **PREPARATION AND APPLICATIOIN OF CHITIN AND CELLULOS BASED NANOFILLERS FOR BIODEGRADABLE PACKAGING**
    Jingwen Xu

13. **PHYSICAO AND CHEMICAL PROPERTIES OA UNDECYLENIC ACID MODIFIED SOYBEAN PROTEINS**
    Haijing Liu

14. **EXTRACTION OF VALUE ADDED CHEMICALS FROM BIOREFINARY RESIDUES**
    Yanguang Liu

15. **EVALUATING THE USE OF LONG-TERM CONDITIONING OR EXTRUSION TO EXTRACT NUTRIENTS FROM LOW ENERGY FEEDSTUFFS IN FINISHER PIGS**
    Grace Bokelman

16. **EXPLORATION OF NATURAL DYES FROM NATIVE KANSAS WALNUT, OSAGE ORANGE, AND CEDAR SAWDUST ON COTTON YARN FOR USE IN A HAND-WOVEN GARMENT.**
    Kelsie Doty

17. **COMPARATIVE ANALYSIS OF WASTE MANAGEMENT AT KANSAS STATE UNIVERSITY AND THE UNIVERSITY OF GHANA, LEGON**
    Matt DeCapo

18. **EVALUATION OF SORGHUM AND ITS MUTANTS FOR EFFICIENT GRAIN AND BIOFUELS PRODUCTION**
    Yadhu N. Guragain

GROUP 4

19. **CHARACTERIZING DIFFERENCES IN SHIGA TOXIN-PRODUCING *Escherichia coli* (STEC) ATTACHMENT TO PRE-RIGOR AND CHILLED BEEF CARCASS SURFACES**
    Carla Schwan

20. **EFFECTIVENESS OF VARIOUS CHEMICAL MITIGATION STRATEGIES ON POST-PROCESSING CONTAMINATION OF PEDV IN FEED AND FEED COMPONENTS**
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GROUP 5

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Michael Reichenberger

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Nathaniel S. Edwards

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Mohamed Ismail

GROUP 6

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Yijing Li

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Whitney K. Jeter

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Curtis Maughan

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Jessica D. High

Poster Abstracts

GROUP 1

1

HOW DOES SEASONAL VARIATION AFFECT BLACK WALNUT FLAVOR PROFILE?

Catherine Lynch, Kadri Koppel, and Delores Chambers
Department of Human Nutrition, College of Human Ecology

BACKGROUND AND PURPOSE: The objective of this study was to determine how growing season impacts the flavor profile of black walnut cultivars, an abundant crop in eastern Kansas. Understanding how growing season impacts flavor profile is important for growers, as it can help them compare the importance of growing conditions versus cultivar. **METHOD:** Seven black walnut cultivars from two different growing seasons (2011 and 2013) were analyzed using descriptive sensory analysis. A trained panel developed a lexicon for the black walnuts and scored the intensity of 22 flavor attributes for each cultivar. **RESULTS AND CONCLUSION:** Four flavor attributes (black walnut ID, overall nutty, fruity-dark, and rancid) had an interaction effect of year and cultivar, while six attributes showed a main effect of only year/growing season (brown, caramelized, floral/fruity, piney, musty/dusty, and oily). In general, black walnut flavor attributes had higher intensities in 2011 than in 2013. These results suggest that growing season/conditions may influence flavor profile more than cultivar. This research also shows that some cultivars (e.g. Emma K) may be more susceptible to changes in growing conditions than other cultivars. This is especially important for growers to understand when they are considering what cultivars to select, as they want to ensure a quality product every year.

Relevance of Research to State-Related Topic(s)

Black walnuts are an abundant crop in eastern Kansas. Black walnut processors purchase millons of pounds of black walnuts each year from various hulling stations in Kansas (Kansas Forest Service). The Kansas Forest Service has also stated that, "As a species, the black walnut already is the most economically valuable tree in the state." Understanding how growing season affects the flavor profile of black walnuts will help guide growers when deciding which cultivars to select to ensure they are producing a product that consumers like and producers will buy. Thus, this research will help enhance competitiveness of growers and will help maintain sustainability of black walnut farming in Kansas.

A DESCRIPTIVE SENSORY TOLERANCE TEST FOR COOKED PORRIDGE FROM NOVEL SORGHUM-BASED FORTIFIED BLENDED FOOD

Sirichat Chanadang and Edgar Chambers IV
Department of Human Nutrition, College of Human Ecology

BACKGROUND AND PURPOSE: Products must be tolerant to many conditions, particularly when those products are prepared by consumers because they may not follow the food preparation instructions. Fortified blended food (FBFs) are used as a source of nutrition for disaster or famine relief in developing countries and sorghum is looked at as a potential alternative to wheat and corn based products that are currently being used as FBFs. Porridge products are the most common dishes prepared from FBFs with a wide range of solids content, cooking times and variations in added ingredients such as sugar and fruit. This study was intended to evaluate the tolerance to preparation variations for a porridge product made as a FBF intended for food aid **METHOD:** Whole Sorghum Soy Blend (WSSB), a fortified, extruded, ground cooked cereal was selected as the FBF for this study. Descriptive sensory analysis was performed to evaluate the tolerance of porridge products made from variations in ingredients and cooking procedures. **RESULTS AND CONCLUSION:** In this study, most sensory properties were only marginally affected by variations in ingredients or procedures. However, large differences in some properties occurred as expected such as thickness when solids content varied or sweetness and fruit flavor when fruit was added. Tolerance testing showed that the sensory properties of WSSB had high tolerance to variations in cooking procedures, which is positive in terms of product use and development. It also means that the product can be modified during preparation by consumers without having a major impact on most sensory properties.

Relevance of Research to State-Related Topic(s)

Sorghum, which is widely grown in Kansas, is viewed as a potential alternative to wheat and corn based products that currently are used as FBFs. Sorghum is mostly a non-GMO crop, which allows it to be used in many countries around the world that have banned the use of GMO products. The results from this study showed that porridge products from WSSB had high tolerance to variations. Thus, this product can be used by diverse people in diverse conditions. Furthermore, this product can increase the demand of using a Kansas grown commodity (sorghum) for value-added food application. This blend also provides good nutrition and requires lower fuel to prepare the porridge products, which can increase its cost competitiveness compared to FBFs currently used in feedings programs.

3

FLAVOR OF RAW PECAN CULTIVARS GROWN IN KANSAS

Shelby Magnuson and Kadri Koppel
Department of Human Nutrition, College of Human Ecology

BACKGROUND AND PURPOSE: Kansas is one of fewer than 20 states with commercial production of pecans although it lags far behind other major producers. The neighboring state of Oklahoma saw a dramatic rise in the value of its pecan production (from 11.4 to 24.7 million dollars) from 2011 to 2012 (Agricultural Marketing Research Center, 2013). Previous research has primarily focused on nutritional properties of pecans with little research done on flavor properties. However, Lombardini et al. (2008) showed that flavor and taste properties are the most important factors for consumers when eating pecans. Thus, the objective of this study was to understand flavor differences in raw pecan cultivars to help in determining future cultivars that should be recommended for planting by growers in the state. **METHOD:** Flavor profiles, which included intensities of 20 flavor attributes were developed by trained sensory panelists. Sixteen pecan cultivars from the 2013 growing season were analyzed using this descriptive analysis method. **RESULTS AND CONCLUSION:** Significant differences were found in the intensity for eight of the 20 flavor attributes (overall nutty, nutty buttery, caramel, woody, overall sweet, oily, astringent, and bitter) for the 16 cultivars. Results from principal component analysis and cluster analysis indicate that two cultivars (Lakota and Giles) are different from the other 14 cultivars. These two cultivars also have the highest intensity scores for undesirable attributes (bitter and astringent). It is recommended to decrease the usage of these two cultivars.

Relevance of Research to State-Related Topic(s)

Though the majority of US pecan production occurs in southeastern and southwestern states, production is expanding in Illinois, Kansas, and Missouri to a commercial level (Reid and Hunt, 2000; Reid, 1995). An estimated 8500 acres in southeastern and eastern Kansas is used for the growing of pecans in Kansas to provide additional income for small farmers (Jia et al., 2005). Various cultivars can be used for different specific applications. By characterizing flavor attributes of pecan cultivars, this project can be used as a guide for tree nut growers to select cultivars that are most appropriate for sale and use in food applications. Additionally, this project provides information that growers can use when selling their pecans to manufacturers, enhancing their competitiveness and maintaining sustainability and increasing pecan farming in Kansas.

4

VALIDATION OF BAKING AS A KILL-STEP TO REDUCE *SALMONELLA* DURING HAMBURGER BUN MANUFACTURING, AND EVALUATION OF *ENTEROCOCCUS FAECIUM* ATCC 8459 AS A NON-PATHOGENIC SURROGATE INDICATOR FOR PROCESS VERIFICATION

Lakshmikantha Channaiah[1], **Elizabeth Holmgren**[2], Randall Phebus[2], Harshavardhan Thippareddi[3], and George Milliken[4]

[1]Microbiology Department, AIB International; [2]Food Science Institute, College of Agriculture; [3]Food Science and Technology Department, University of Nebraska-Lincoln; [4]Department of Statistics, College of Arts and Sciences

BACKGROUND AND PURPOSE: New FDA regulations defined in the Food Safety Modernization Act require commercial bakers to validate that their thermal processes provide a ≥ 5 $\log_{10}$ reduction in relevant pathogenic bacteria. For hamburger buns, *Salmonella* in raw ingredients poses the most substantial food safety risk. **MATERIALS AND METHODS:** Flour was inoculated with three *Salmonella* serotypes (Typhimurium, Newport or Senftenberg) and re-dried to achieve a 7 log CFU/g level. Dough was formed using a mixer with fork agitator attachment. Inoculated dough was hand rolled into 71g balls, placed into cooking pans, and proofed (~110ºF, ~81% RH) to achieve a 32 mm rise. Samples were taken from flour prior to mixing, dough after mixing, and buns after proofing to enumerate pre-baking *Salmonella* levels. Buns were baked at 425ºF in a convention oven for 9, 11, and 13 minutes, with internal bun temperature profiles recorded. Post-bake samples were immediately homogenized in chilled peptone buffer to prevent continued thermal destruction. Surviving *Salmonella* populations were enumerated using selective and injury-recovery media. Similar inoculated studies were conducted using *Enterococcus faecium* ATCC 8459, a non-pathogenic surrogate indicator, as the inoculum. **RESULTS:** Pre-bake bacterial concentrations were not significantly different ($p>0.05$), nor were bacterial concentrations of post-bake treatments ($p>0.05$). The pre-bake to post-bake microbial reductions were at least 6 $\log_{10}$ CFU/g for all baking times. *E. faecium* demonstrated greater thermal resistance than *Salmonella* spp., making it a suitable surrogate for validation of commercial baking operations. **CONCLUSION:** These findings should help prepare the baking industry for future process validations with additional product types and assist with FSMA compliance.

Relevance of Research to State-Related Topic(s)

In upcoming years, the federal government will be fortifying its stance on food safety. According to the Centers for Disease Control and Prevention (2011), food acquired infections of nontyphoidal *Salmonella* spp. result in an estimated 19,336 hospitalizations each year, and these infections are ranked as the second leading cause of domestically obtained foodborne illness. If Kansas food production facilities are to continue to be competitors in the market, they will need to validate the safety of their production processes. This study confirms that a nonpathogenic indicator organism, *Enterococcus faecium*, can be employed in commercial operations to verify that the food safety systems currently in place are effective. Methods of inoculation were performed at a higher concentration than day-to-day contamination but utilized a route directly applicable to industry norms. Finalization of this study is expected to mark the beginning of a series of validation projects for other baked food matrices.

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IRON BIOAVAILABILITY OF SORGHUM, COWPEA, CORN AND SOYBEAN FORTIFIED BLENDED FOODS

Kavitha Penugonda[1], Sajid Alavi[2], Brian L. Lindshield[1]

[1]Department of Human Nutrition, College of Human Ecology; [2]Department of Grain Science and Industry, College of Agriculture

BACKGROUND AND PURPOSE: Fortified blended foods (FBFs) are widely used for food aid. Corn and soybeans are the common components of FBFs. Resistance to genetically modified (GMO) foods led to interest in non-GMO commodities like sorghum and cowpea. Additional advantages of these two commodities are that they are drought-tolerant, cost-effective and consumed globally. Both sorghum and cowpea are rich in iron; however their iron bioavailability is poor due to the presence of the anti-nutrients. A food processing technique, extrusion cooking reduces the anti-nutrients in foods. Hence, we developed extruded sorghum, soybean and cowpea FBFs. The objective of our study was to determine whether the iron bioavailability from extruded sorghum-cowpea and sorghum-soy FBFs is equal/ better than non-extruded corn-soy FBFs. **METHODS:** Eighteen different FBFs; sorghum-cowpea (n=8), sorghum-soy (n=5) and corn-soy (n=5) were prepared and iron bioavailability was assessed using the in-vitro digestion/Caco-2 cell model. Iron bioavailability was determined by measuring Caco-2 cell ferritin (ng ferritin/mg cell protein) formation in response to 12 hour treatment with aqueous fraction collected from digested FBFs. Control cells were collected at time zero, to measure basal ferritin content. **RESULTS:** There was no significant difference in ferritin levels between newly developed extruded sorghum-cowpea, sorghum-soy, and traditional corn-soy FBFs. Ferritin was higher in all the blends compared to control with the exception of whole sorghum-soy (high fat) blend + antioxidants. Whole sorghum-soy (low fat) blend had significantly ($p<0.05$) higher ferritin levels compared to whole sorghum-soy (high fat) blend + antioxidants. **CONCLUSION:** Iron bioavailability of extruded sorghum-cowpea, sorghum-soy FBFs is comparable to traditional corn-soy FBFs.

Relevance of research to State-related Topic(s)

Kansas is the top producer of sorghum in the US. Even though the per capita sorghum consumption is lower in the US, it is a staple food in many parts of the world. Sorghum is drought-tolerant, cost-effective, adapts to different climates and is a non-GMO grain. We wanted to determine whether sorghum can provide similar/better nutritional value to corn and as such be used as an alternative to corn in FBFs. Our study addresses one of the Kansas key topics "from farm to fork", as our research focuses on selection, cultivation, and improving the nutritional quality of sorghum through processing. Our study finding equal iron bioavailability of sorghum compared to corn in FBFs may increase demand for sorghum exports in future and increase the markets for Kansas sorghum growers.

6

GROUP 2

*****WITHDREW*****

USING SPECTRAL RESPONSE PROPERTIES TO IDENTIFY AND CHARACTERIZE INFESTATIONS OF *DECTES TEXANUS* IN SOYBEAN

Alice Harris and Brian McCornack
Department of Entomology, College of Agriculture

BACKGROUND AND PURPOSE: The soybean stem borer, *Dectes texanus* Leconte (Coleoptera: Cerambycidae) has become an important pest in Kansas soybean. Currently, farmers rely on field level inspections to identify adult *D. texanus* presence and/or severity of an infestation, which can be time-consuming or inaccurate especially when there is no established sampling plan. In order to combat this problem the use of remote sensing platforms, particularly aerial imagery, has shown promise in its ability to track and monitor plant health via detectable changes in spectral responses, vegetation phenology curves, and associated phenology metrics (VPM). The objective of this study was to investigate the VPM's of soybean infested with different densities of *D. texanus* (stem feeders) and pests with different feeding habits (leaf chewers). **METHOD:** During 2013 and 2014, 50 whole-plant exclusion cages were placed in a soybean production field at the Ashland Bottoms Research Farm. Plants were in a randomized complete block design (n = 10) with five treatments (increasing numbers of adult *D. texanus*). A modified Cannon S100 camera was used to capture near-infrared images of each cage from June through September. Using AgPixel software, the normalized difference vegetative index (NDVI) and green normalized difference vegetative index (GNDVI) were calculated from the near-infrared images to create vegetation phenology curves. **RESULTS/FINDINGS:** Using the VPM's we anticipate quantifying the physiological impact of *D. texanus* when feeding on soybean and at what infestation level such feeding is detectable. **CONCLUSION:** This leads to better understanding of *D. texanus* biology, which will aid in developing and implementing site-specific management strategies.

Relevance of Research to State-Related Topic(s)

Soybean is a significant crop of Kansas with a production value exceeding $1.5 billion in 2013, making it important to monitor pest populations (e.g., *D. texanus*) that may influence growth and development. Plant health is an important indicator to trouble in crops and as *D. texanus* becomes a frequent problem in Kansas soybeans, contemporary methods, such as non-invasive remote sensing platforms for monitoring plant health, were investigated to aide in the development of new management strategies this pest. Using these types of monitoring/detection methods, farmers are now able to conduct real-time assessment of seasonal crops; providing valuable information on crop health, biomass, presence of pest populations, and possibly yield. Our research will provide valuable information based on crop health, allowing farmers to make timely and precise management decisions, ultimately leading to management practices which may reduce pesticide use in the environment and treatment cost to the farmer.

7

HESSIAN FLY, *MAYETIOLA DESTRUCTOR*, RESPONSE TO DIFFERENT COLORS OF LEDS

Ryan Schmid[1,2], Darren Snyder[1,3], Lee Cohnstaedt[1,3], and Brian McCornack[1,2]

[1]Department of Entomology, College of Agriculture; [2]Plant Biosecurity Cooperative Research Centre, Bruce, ACT, AU; [3]USDA-ARS, Manhattan, KS

BACKGROUND AND PURPOSE: The Hessian fly, *Mayetiola destructor* (Say) (Diptera: Cecidomyiidae), is a major pest of wheat, reducing yields in Kansas since the early 1900's. However, distribution is spotty across the state, even varying between neighboring fields. Existing traps utilizing the Hessian fly female sex-pheromone are an effective and efficient surveillance strategy to monitor for male Hessian fly activity, but these traps do not always reveal the true level of Hessian fly infestation. To better monitor Hessian fly infestation levels, trap design needs to incorporate attractants of both sexes. Before traps can be improved, knowledge of Hessian fly behavior is required. The purpose of this research was to examine behavioral attraction of the Hessian fly to light emitting diodes (LEDs) of different colors. **METHOD:** Hessian fly attraction was tested in a four-leaf, clover-shaped arena, which contained a different color LED within a collection cup in each of the four cloverleaves. LED colors used were blue, green, amber, and red. Flies were released from the arena center and left overnight, ~17 h. **RESULTS:** There was a significant difference in behavioral attraction of the Hessian fly among the different color LEDs ($F_{3,8} = 36.79$, $P < 0.001$). Hessian fly adults chose green 64% of the time, blue 32%, amber 5%, and red 0%. **CONCLUSION:** These results are the first to show that the Hessian fly prefers green light produced by an LED. Ultimately these results will be incorporated into new trap designs, improving trap attractiveness and effectiveness at monitoring changes in Hessian fly populations at the field level.

Relevance of Research to State-Related Topic(s)

Wheat is a major commodity in Kansas, affecting a large portion of the rural population's livelihood. During the past five years on average Kansas produced 328 million bushels of wheat, worth nearly $3 billion annually, making Kansas the leading wheat producer in the United States. The Hessian fly first threatened Kansas wheat production in 1908, when 41 counties reported 5-50% injury of their winter wheat crop. The Hessian fly continued to be a major pest of wheat until the 1940's, when new management control practices reduced the severity of outbreaks. However, recent outbreaks have become more frequent due to outdated pest management practices. Our study takes a proactive approach to controlling Hessian fly outbreaks by monitoring for this pest across Kansas with traps, allowing wheat producers to use real time information to make management decisions, thus protecting the valuable commodity of wheat and the livelihood of much of rural Kansas.

8

EVALUATION OF POULTRY LITTER APPLICATION BEST MANAGEMENT PRACTICES (BMPs) TO MINIMIZE PHOSPHORUS LOSS USING THE APEX MODEL

Ammar B. Bhandari[1], Nathan O. Nelson[1], Claire Baffaut[2], Daniel W. Sweeney[1], Mike Van Liew[3], G. M. M. M. Anomaa Senavitrane[4], John A. Lory[4], Gary M. Pierzynski[1], and Philip L. Barnes[1]

[1] *Department of Agronomy, College of Agriculture*; [2]*USDA-ARS Cropping System and Water Quality Unit*; [3]*University of Nebraska*; [4]*University of Missouri*

BACKGROUND AND PURPOSE: Developing best management practices to decrease phosphorus (P) loss from agricultural fields is an important environmental and agricultural priority. However, field-scale studies to evaluate P loss are expensive and time consuming and results are highly dependent on the weather patterns. Simulation models offer an alternative method to evaluating BMP performance and are not subject to the same time, expense, or weather constraints of field studies. The objective of this study was to determine the optimal timing, frequency, and rate for poultry litter applications to row-crop production systems using the Agricultural Policy/Environmental Extender (APEX) model. **METHODS:** The APEX model was calibrated and validated for runoff, sediment, and P loss from a clay-pan soil in South-East Kansas based on the Nash Sutcliffe efficiency (NSE), coefficient of determination (r2), and percent bias. The fully calibrated model was used to evaluate the effect of litter application timing (spring vs. fall), frequency (one, two, or four applications in a four-year rotation), and rate on P loss. APEX calibration provided satisfactory event-based calibration for runoff, sediment loss, and phosphorus loss. The calibrated model was used to simulate P loss for 100 different weather scenarios for each combination of rate, timing, and frequency. **RESULTS & CONCLUSION:** The results indicated that applying poultry every year, and once in crop rotation would risk higher nutrient loss compared to applying every other year. The results can be used by producers in the region to help them minimize P loss to receiving waters when applying poultry litter.

Relevance of Research to State-Related Topic(s)

Decreasing P loss from agricultural fields is an important environmental and agricultural priority. When P enters surface water it promotes algal growth and leads to eutrophication, which is a major cause of water quality degradation. High P concentrations can also promote toxin production from harmful algal blooms (HAB) (Hudnell, 2010). In 2011, there were 34 reports of human or animal illness from HABs in Kansas, resulting in two people being hospitalized and five animal deaths (KDHE, 2012). Failure to control P export from agriculture may also promote the creation of regulations that restrict P fertilizer use. Our research will improve phosphorus management tools and assist researchers and conservationists to better estimates P loss, identify critical source areas of P export, and target conservation practices more effectively and efficiently, thus addressing water quality concerns associated with agricultural fields in Kansas.

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A WINDBREAK INVENTORY AND ASSESSMENT FOR KANSAS: REMOTE SENSING, GIS AND FIELD SURVEY APPROACH

Kabita Ghimire[1], Robert. L. Atchison[2], Douglas G. Goodin[1], and J.M. Shawn. Hutchinson[1]
[1]Department of Geography, College of Arts and Sciences; [2]Kansas Forest Service, Manhattan, Kansas

BACKGROUND AND PURPOSE: Windbreaks are strips of trees or shrubs maintained to demarcate property boundaries and to alter wind flow near agriculture fields and farms buildings. The goal of this project is to assist foresters with future windbreak renovation planning and reporting by identifying windbreaks location in Kansas. **METHOD:** We used remote sensing techniques known as object-based image analysis to identify windbreaks. We also conducted a field survey to assess the structure, composition and characteristics of selected windbreaks in the region. We visited 181windbreaks in the field covering about 309 acres (125 hectares) from seven study counties. **RESULTS AND CONCLUSION:** We identified 3515 windbreaks location in seven counties in Northwestern Districts of Kansas Forest Service. The survey data suggested that 69% of the windbreaks were in good condition, 21% in fair condition and 10% were in poor condition. Field windbreaks covered about 45% of the surveyed windbreaks. Farmstead windbreaks were about 37 percent and the remaining 18% served for livestock. Among the studied windbreaks, 53% consisted of single species and remaining 47% were multi species windbreaks. Twenty different species of trees were documented during the survey. Cedar (*Juniperus sps)* was the most common tree species. It was reported from 75% of the surveyed windbreaks. The other common tree species were Cottonwood (*Populus sp.),* Siberian elm (*Ulmus pumila*), Honey locust (*Celtis sps)*, and Oak *(Quercus sps).* We recorded invasive species from only one windbreak.

Relevance of Research to State-Related Topic(s)

Windbreaks provide a number of environmental benefits. They are valuable resources for conserving soil and providing crop protection in Kansas and in other Great Plains States. Reports from various agencies estimated that over 44% of Kansas windbreaks are in decline and in need of renovation. But no data existed on their exact location or specific condition. At the beginning of our study in 2009 there was virtually no windbreak renovation practice being implemented through EQIP in Kansas. There is a little good science to efficiently document windbreak's exact location, size and specific condition. Therefore, it was timely to develop methods for the rapid identification of windbreaks location. While a variety of windbreaks surveys have been conducted in the past, none performed in Kansas have ever used a remote sensing approach. The method developed can be applied to identify the location of windbreaks in other parts of the Great Plains region.

10

WATER USE OF COVER CROPS

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BACKGROUND AND PURPOSE: Water is the primary factor limiting cropping systems across Kansas. Cover crop mixes have been marketed as a means to conserve water in no-till cropping systems following wheat harvest, though evidence is lacking to justify this claim. The objective of this research is to determine water use of individual cover crop species, mixtures, and fallow to find the least water consumptive system. Impact of cover crops on subsequent corn yields is also to be determined. **METHODS:** Ten cover crop treatments were tested: six single species, two-three component mixes, a mix of six, and a mix of nine. The cover crops were planted immediately following wheat harvest in Manhattan, KS, and were terminated in late September at flowering of most species. Volumetric soil water content was measured using a neutron probe, with readings taken approximately weekly during the cover crop growing season and monthly up to and throughout corn growth. **FINDINGS:** Results from 2013 showed no significant difference between water use of cover crop mixtures and single species. Cover crops depleted the soil profile by a maximum of 1.46 inches, while fallow was able to gain 1.33 inches of water at the time of corn planting. At the time of corn harvest, there was no significant difference in soil water content across all treatments. **CONCLUSION:** Cover crop mixes did not conserve more water than single species, and the fallow treatment was found to be the least water consumptive. Impact on corn yields was yet to be determined at the time of abstract submission.

Relevance of Research to State-Related Topic(s)

One of the goals of the Kansas Water Plan highlights the need for conserving and extending the High Plains aquifer, which is vital to the Kansas economy. Utilizing cropping systems which will conserve our limited water resources is and will continue to be essential in Kansas. Cover crops have the potential to aid in the transition towards less irrigation by improving soil health, soil conservation, and water infiltration. Integrating cover crops into Kansas cropping systems will require water consumption short term, but their benefits will likely encourage greater water conservation long-term.

11

TEMPERATURE CONDITIONING OF SOYBEAN SEEDLINGS INFLUENCES EXPRESSION OF RESISTANCE TO SOYBEAN APHID (*APHIS GLYCINES*) BIOTYPE 1

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BACKGROUND AND PURPOSE: The *Rag1* gene has been shown to confer resistance to biotype 1 soybean aphids (SBA) *Aphis glycines*, but little is known about whether plant exposure to temperature alters the expression of resistance. **METHOD:**To test for indirect plant-mediated temperature effects on SBA, individual soybean seedlings (V-0 stage) containing *Rag1* resistance were exposed to either low (20˚C) or high (30˚C) temperature for different durations (0, 3 or 5 days) at 25˚C prior to infestation with a single neonate aphid. We hypothesized that conditioning plants to high temperatures would cause resistance to break down, and that the effect would be enhanced by longer exposure. Four aphid responses were evaluated: pre-adult development time, survival to adult, lifetime progeny produced per female, and adult longevity. **RESULTS/FINDINGS:** When plants were conditioned at 20˚C, there were no statistically-significant effects of conditioning duration on SBA development or adult longevity. However, percent survival and numbers of progeny decreased significantly as plant conditioning time increased, suggesting that the expression of *Rag1* resistance is modified by the length of plant exposure to low temperature. In contrast, at 30˚C conditioning time had no effect on any aphid response, and survival was significantly lower compared to any of the treatments at 20˚C. **CONCLUSION:** These results suggest that SBA may be responding directly to abiotic stress. However, we cannot discount that high temperature did not have an effect on resistance, which may have occurred quickly after plants were transferred. Thus, it is possible that SBA responses are a result of both temperature and plant resistance effects.

Relevance of Research to State-Related Topic(s)

In terms of crops, soybeans are the third largest commodity in Kansas. Both susceptible and resistant cultivars have been bred for soybeans; my research focuses on a resistant cultivar of soybean containing the *Rag1* gene, which detrimentally affects biotype 1 soybean aphids (*Aphis glycines*), an invasive species that arrived in Kansas in 2002. Although soybean aphids are not considered a major pest of soybeans in Kansas, they have the potential to reach a higher status if they overcome resistance. One way this occurs is resistance breaking down at certain temperatures, but little is known about temperature affecting *Rag1* resistant soybeans. By providing more information for farmers, it will help them make better management decisions in order to prevent insect damage, save money, and produce a higher soybean yield. Host plant resistance also provides an environmentally safe alternative for controlling pests without harming non-target organisms, such as pollinators and natural enemies.

GROUP 3

12

PREPARATION AND APPLICATIOIN OF CHITIN AND CELLULOS BASED NANOFILLERS FOR BIODEGRADABLE PACKAGING

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BACKGROUND AND PURPOSE: Nanocrystalline cellulose (NCC) is the most abundant polymer in nature and chitin nano whiskers (CNW) is the second. Poly (lactic acid) (PLA) and Poly (butylene succinate) (PBS) are two common polymers in food packaging. **METHOD:** Raw chitin was boiled to remove and washed with distilled water. Purified chitin was then hydrolyzed and was diluted and dialyzed, followed by ultrasonic treatment, centrifugation and lyophilized for improved dispersion, separation and drying of the resultant chitin whiskers. For nanocrystalline cellulose, cotton linter was dispersed in acid, and centrifuged, dialyzed and lyophilized to obtain NCC. Both nanofillers were used to reinforce PBS and PLA at loading levels of 1, 2, 3, 4 and 5 wt% to produce biodegradable nanocomposites using melt extrusion. **RESULTS AND CONCLUSION**: Transmission electron microscopy results CHW and NCC were in nano-scale. At a loading level of 3% NCC, PBS-based nanocomposite showed simultaneous enhancement of strength and elongation compared to the neat PBS.

Relevance of Research to State-related Topic(s)

Biodegradable polymers for packaging applications are of great interest to industry because of environmental concerns with conventional plastics. Nanofillers can play an important role in biopolymer based nanocomposites for improvement of barrier and mechanical properties. The study suggested that NCC and CHW can be used as nanofillers in combination with biodegradable polymers and contribute to reduced environmental impact of food packaging.

13

PHYSICAO AND CHEMICAL PROPERTIES OA UNDECYLENIC ACID MODIFIED SOYBEAN PROTEINS

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BACKGROUND AND PURPOSE: Soybean protein has showed great potential as renewable and environmental friendly adhesives. However, the poor water resistance of soybean protein adhesive has limited its application as high performance wood adhesive. We hypothesized that Fatty acids with hydrophobic carbon chains and reactive carboxyl groups are ideal to be biobased modifiers for soybean protein. This work focuses on development and characterization of undecylenic acid modified soybean proteins. **METHOD:** The reaction between amine groups from amino acid residues and carboxyl groups from fatty acids was proposed to be the main chemical pathway for grafting. Ninhydrin test and Fourier transform infrared spectroscopy (FTIR) were used to confirm the reaction. Differential Scanning Calorimetry (DSC), Atomic Force Microscopy (AFM), Thermo Gravimetric Analysis (TGA), and Shear Adhesion Test were carried out to characterize the thermal and mechanical properties of modified protein adhesives. **RESULTS AND CONCLUSION:** UA was successfully grafted on soybean protein through reaction between –COOH and $–NH_2$. UA modified SPI adhesives had higher viscosity and elastic modulus and different decomposing temperature. The oily nature and long hydrophobic alkyl chains of UA mainly contribute to the significant water resistance improvement of SPI adhesives.

Relevance of Research to State-related Topic(s)

Nowadays, formaldehyde-based resins are the dominated adhesives used in wood products. Such adhesives not only damage environment but are also a human carcinogen. The demand to find a renewable and environmental friendly substitution for petrochemicals is urgent. Soybean protein is a promising bio-degradable adhesive for wood composite industries. But the low water resistance has limited its use. Our research investigated soybean protein adhesive with improved water resistance. The results of our experiments will accelerate the application of soybean protein as a better wood adhesive.

14

EXTRACTION OF VALUE ADDED CHEMICALS FROM BIOREFINARY RESIDUES

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BACKGROUND: Lignocellulosic biomass is a sustainable feedstock for the production of biofuels and chemicals. During the biomass processing, large quantities of byproducts are generated. Currently, these byproducts are used for low value applications, including as a boiler fuel. These byproducts are potential sources for the valuable chemicals such as antioxidants, colorants, preservatives, and biocides. **PURPOSES:** To obtain value-added products from biomass residues; to perform and optimize extraction process; to identify value-added chemicals in the extractives using GC-MS. **METHODS:** In this research, two types of biomass byproducts were evaluated for the presence of valuable chemicals. The first byproduct was a residual solid obtained after the release of fermentable sugars from the pretreated biomass, and the second byproduct was the commercially available lignin (Protobind-1000). The potential chemicals from the byproducts were extracted in various organic solvents and analyzed by GC_MS. Different types of organic solvents and extraction techniques were tested to optimize the extraction process. **RESULTS:** The results indicated that the selected biomass byproducts contain high amount of three valuable compounds: vanillin, apocynin, and phytol. **CONCLUSIONS:** Protobind-1000 contains high amount of interest compounds; Vanillin, apocynin & phytol are the three interest compounds; Ethanol is regarded as the optimum solvent because of its extraction efficiency and environmental friendly; Two times extraction by bead beating is considered as the best method.

Relevance of Research to State Related Topics

Large amounts of residues have been produced during bioprocessing progress. Those residues may be wasted or even become environmental problems if not being treated properly. After pretreatment and extraction procedures of the raw materials, many of them still can be used as raw materials to get value additions. Research is in progress to investigate the commercially viable isolation methods of these compounds, and to develop a mathematical model of the extraction process.

15

EVALUATING THE USE OF LONG-TERM CONDITIONING OR EXTRUSION TO EXTRACT NUTRIENTS FROM LOW ENERGY FEEDSTUFFS IN FINISHER PIGS

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BACKGROUND AND PURPOSE: A total of 270 finisher pigs starting at 115 lbs. were utilized in a 79-d experiment to determine the effects of long-term conditioned feed or extruded feed on pig growth performance. Four treatments with different manufacturing were evaluated; 1) control, mash 2) pelleted 45s conditioning time 3) pelleted 95s conditioning time 4) extrusion. Diets were low energy, high by-product and nutritionally similar. **METHOD:** There were 6-8 pigs per pen and 9 replications per treatment. Feed intake and pig weights were recorded regularly. Data were analyzed using the GLIMMIX procedure of SAS. **RESULTS/FINDINGS:** There was an overall effect of feed efficiency among pellet vs. control and control vs. thermal processing (P <.0001) while pellet vs. extruded had a tendency (P = 0.09). Both pelleted diets were similar while the extruded diet had the most efficient gain to feed (G:F) ratio. The control mash diet had the least overall efficiency stemming from low average daily gain (ADG) and was driven by higher average daily feed intake (ADFI) as compared to the other treatments. Pigs fed the extruded diet consistently had lower ADFI, although having similar feed efficacy values as the other two pelleted treatments (0.37 vs 0.36). **CONCLUSION:** This research suggests feed efficiency isn't affected by 45s vs 90s conditioning time, while extrusion outperformed pelleted and mash diets in G:F. Further research is needed assess the profitability and advantages producers could have with extruded swine diets compared to pelleted diets.

Relevance of Research to State-Related Topic(s)

Higher feed prices and production of ethanol for fuel has impacted the formulation of swine diets. Kansas produces approximately 500 million gallons of ethanol each year. Pork producers in Kansas have low cost feed by-products from ethanol manufacturing in Kansas and neighboring states available to them. As of recent years these ingredients have lost their value from refineries pulling higher levels of protein and crude fat out. This leaves swine producers with a feed ingredient high in fiber (cellulose and hemicellulose) and low in available energy. This research trial looks at methods of adding value back to high fiber ingredients through high temperature and extended processing of the grain. It was evident, that either pelleting or extruding a low energy diet improved feed efficiency from the non-processed feed. This result leads Kansas pork producers to purchasing lower cost feed ingredients that, through processing, can improve growth performance.

16

EXPLORATION OF NATURAL DYES FROM NATIVE KANSAS WALNUT, OSAGE ORANGE, AND CEDAR SAWDUST ON COTTON YARN FOR USE IN A HAND-WOVEN GARMENT

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BACKGROUND AND PURPOSE: Artisan weavers often use natural dyes to color their yarn; however, few have explored color derived from sawdust waste. In addition, weavers often translate hand-woven cloth into rectangle shaped garments with limited exploration of fitted garments. Thus, the purpose of this project was to (a) explore yarn dyeing using native Kansas Black Walnut (Jugalns nigra), Osage orange (Maclura pomifera), and Eastern Redcedar (Juniperus virginiana) sawdust and (b) create a fitted garment from the woven cloth. Inspiration was from photographs taken of local trees. **METHOD:** This study utilized research in design methodology and generated outcomes in both controlled and experiential settings. Methods included the sampling of dye color on aluminum acetate mordanted and nonmordanted cotton yarns, exploring color and weave patterns through physical and digital sampling, and experimenting with garment design through mock-ups. **RESULTS AND CONCLUSION:** Mordanted walnut and cedar yarns were light brown and dark beige with a yellow cast, providing subtle color variation when paired with the cool brown nonmordanted walnut dyed yarns. Osage orange dyed yarns were eliminated as the bright golden yellow clashed with the muted walnut and cedar browns. A herringbone twill weave structure in alternating stripes of dark and light was the selected pattern woven into fabric 22" x 72". A fitted jacket and shorts were constructed from the woven textile. The final ensemble resembled the tree inspiration through color and pattern. Recommendations for fitted garments are to use an underling to prevent the textile from stretching.

Relevance of Research to State-Related Topics

The Black Walnut, Osage orange, and Eastern Redcedar used for this study was grown and processed in Kansas and the resulting information may aid timber processors looking to add value to a sawmill byproduct. Two of the three trees selected, Eastern redcedar and Osage orange, are considered an invasive species and are harvested to maintain pastor and cropland in Kansas. Conversely, the cultivation and eventual harvest of Black Walnut trees is encouraged, as the resulting lumber is considered valuable. Whether the selected dyewoods are harvested due to the maintenance of Kansas's pastureland or because of its economic significance, sawmill waste from their timber could be a sustainable source of color for textiles. Thus, effectively adding value to a Kansas byproduct.

17

COMPARATIVE ANALYSIS OF WASTE MANAGEMENT AT KANSAS STATE UNIVERSITY AND THE UNIVERSITY OF GHANA, LEGON

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BACKGROUND AND PURPOSE: The proper disposal of waste is a significant issue plaguing many parts of the world. Traditional waste management systems are challenged by the increasing fraction of plastics, electronics, and hazardous waste in the waste stream. Growing populations and increasing consumption of 'disposable' items poses challenges for waste management companies whose landfills are quickly filling up. The common suggestions of waste reduction, reuse, recycling, and recovery have unique local obstacles preventing their adoption. A comparative study of waste management systems in two very different parts of the world could provide insights useful for reducing the hazards associated with improper waste disposal. **METHOD:** A year was spent studying abroad at the University of Ghana, Legon to understand more about the nature of waste issues confronting the university campus. A compost pile was started near a market on campus to demonstrate how valuable fertilizer can be produced from organic waste. At Kansas State University, projects have been undertaken to increase the amount food waste sent to the existing composting operation. **RESULTS/FINDINGS:** About 240 liters of food waste were diverted from the market every day for about 7 months to the compost pile where the food would break down to about 1/4 of its original weight. This finished fertilizer was used to start a bio-diverse rain garden near the night market as a demonstration. Student groups and other volunteers keep the composting going and spread knowledge. **CONCLUSION:** Overcoming the obstacles to sustainable waste management is critical to reduce the hazards and pollution often associated waste disposal.

Relevance of Research to State-Related Topic(s)

Reducing the waste sent to landfills is vital as landfills fill up and precious materials become more scarce. Significant value still remains in the materials commonly disposed in landfills. Many jobs can be created to extract the value from the waste stream. Plentiful valuable fertilizer can be produced from composting organic wastes, reducing the demand for energy intensive synthetic fertilizers. Returning the carbon from food waste back to the soil will increase the health of soil and sequester carbon from the atmosphere. The benefits of using materials to the fullest before proper disposal are enormous, but diverse social and economic issues often hinder progress. These issues must be better understood and overcome in order to solve the growing global waste problem. Economic security and social stability will be enhanced by tackling unique local waste challenges present in every community.

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EVALUATION OF SORGHUM AND ITS MUTANTS FOR EFFICIENT GRAIN AND BIOFUELS PRODUCTION

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BACKGROUND AND PURPOSE: Brown midrib (*bmr*) sorghum mutants are developed to improve both quality and quantity of biomass for second generation biofuel production without compromising grain yield. The purpose of this research is to evaluate different sorghum cultivars and their *bmr* mutants for agricultural productivity and efficient bioprocessing of lignocellulosic residues for 2,3-butanediol production. **METHOD:** Three sorghum cultivars (Early Hegari, Atlas, and Kansas Collier) and two *bmr* mutants of each cultivar (*bmr*6 and *bmr*12) were evaluated and compared for grain and biomass yields, biomass composition, and efficient production of 2,3-butanediol. **RESULTS AND DISCUSSION:** The *bmr* mutants of Kansas Collier had higher stover and lower grain yield than their parent cultivar, whereas opposite results were observed for Early Hegari. On the other hand, *bmr* mutants of Atlas had less stover and grain yields than their parent plant. The biomass composition analysis indicated that the *bmr* mutants had 10 to 23 % less lignin content than their parent cultivars. Consequently, the alkali pretreated *bmr*12 produced significantly higher amount of sugars by enzymatic hydrolysis than their parent cultivars; however, the reduced lignin content in *bmr*6 did not significantly improve the sugar yield. The production of the butandiol per gram of released sugar using the *Bacillus licheniformis* did not significantly differ among these biomass samples, indicating that *bmr* mutation did not affect the quality of released sugars. **CONCLUSION:** The low-lignin content lignocellulosic biomass do not necessarily improve biofuel production. Therefore, commercial viability of each bioenergy crops for biofuel without affecting grain yield must be evaluated individually.

Relevance of Research to State-Related Topic(s)

Biofuels are the sustainable alternatives of petroleum products; however, availability of feedstocks in the amount sufficient to meet huge energy demand in the near future without affecting food/feed supply is a denting challenge. Additionally, second generation biofuel production is still not viable because of the expensive pretreatment methods required to separate biopolymers of biomass. Therefore, the development of new bioenergy crops to improve both quality and quantity of biomass for biofuel production without compromising grain yield is vital. Sorghum is one of the most potential bioenergy crop because of its high photosynthetic efficiency, abiotic stress tolerance, and wide applications as food, feed, and fuels. The output of this research is an important finding for scientists, policy makers and entrepreneurs to shape their future strategy for bioenergy research for the development of alternative and sustainable energy sources.

GROUP 4

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CHARACTERIZING DIFFERENCES IN SHIGA TOXIN-PRODUCING *Escherichia coli* (STEC) ATTACHMENT TO PRE-RIGOR AND CHILLED BEEF CARCASS SURFACES

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BACKGROUND AND PURPOSE: The USDA has declared seven STEC serotypes to be adulterants in raw beef products due to their severe health implications. This study evaluted attachement efficiency of STEC to raw beef surfaces and the efficacy of lactic acid (LA) spray to reduce STEC populations under four different scenarios: (A) Pre-rigor beef surface STEC inoculated, 30 min attachment, antimicrobial spray; (B) Pre-rigor surface inoculated, 24 h chilled attachment, antimicrobial spray; (C) Beef surface chilled 24 h, inoculated, 30 min attachment, antimicrobial spray; and (D) Beef surface chilled 24 h, rewarmed to 37°C, inoculated, 30 min attachment, antimicrobial spray. **METHOD:** Lean and fat tissues were collected from two cattle immediately after harvest and assigned to the four scenarios for STEC inoculation, followed by a post-inoculation water (control) or LA spray. Samples were collected pre- and post-treatment, plated on *E. coli*/coliform Petrifilm, and incubated at 37°C for 24 h. **RESULTS/FINDINGS:** STEC attachment levels to lean and fat tissues were similar ($p>0.05$). LA reduced STEC levels more effectively than water across all scenarios ($p\leq0.05$). A significant treatment by scenario interaction was observed for STEC reductions, with LA being more effective in scenarios B and A (pre-rigor inoculation) than C and D (post-rigor inoculation). **CONCLUSION:** In commercial beef processing, applying LA sprays to pre-rigor carcasses is more effective that to chilled carcasses for reducing STEC. For laboratory studies, consideration must be given to when cultures are applied to meat tissue surfaces to accurately determine antimicrobial treatment effectiveness.

Relevance of Research to State-Related Topic(s)

Shiga toxin-producing *Escherichia coli* (STEC) carried by cattle can contaminate raw beef products during processing, posing a significant threat to consumers (health) and the beef industry (economics). Beef processors in Kansas and across the nation must scientifically validate their food safety systems to ensure that STEC risks are minimized. For this reason, antimicrobial intervention strategies have been broadly implemented across the beef industry to control these organisms. However, validation of these systems has not been done uniformly by companies or researchers with regards to how carcasses and/or sub-primals are inoculated with STEC, and thus, this research provides guidance on best practices for conducting these commercial and academic studies. Further, it demonstrates that lactic acid, a common beef intervention treatment, has little effect when applied to chilled beef products but is highly effective when used on freshly slaughtered pre-rigor carcass surfaces.

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EFFECTIVENESS OF VARIOUS CHEMICAL MITIGATION STRATEGIES ON POST-PROCESSING CONTAMINATION OF PEDV IN FEED AND FEED COMPONENTS

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BACKGROUND AND PURPOSE: Porcine Epidemic Diarrhea virus (PEDv) has become an economically and socially devastating issue facing the United States swine industry. It is directly responsible for the death of over 8 million pigs. While PEDv is not a new virus on the global scale, it was not present in the United States until 2013. The virus is transmitted by fecal-oral contamination, but epidemiological and controlled research evidence has confirmed swine feed or ingredients are another route of transmission. Therefore, strategies are needed to mitigate this virus in feed. The objective of this experiment was to evaluate various feed additives to mitigate PEDv. **METHODS:** Four additives (a commercial formaldehyde product, sodium bisulfate, sodium chlorate, and an organic acid blend) were applied to four different feed matrices (complete swine diet, blood meal, porcine meat and bone meal, and spray dried animal plasma). After treatment, the feed matrices were inoculated with PEDv. **RESULTS/FINDINGS**: Commercial formaldehyde was the most effective additive (Mean RT-PCR cycle time of 32.5, $P < 0.0001$). The organic acid treatment was also an effective mitigant, but less successful than the commercial formaldehyde treatment ($P < 0.0001$). However, it offers a more consumer-friendly alternative that is still effective at PEDv destruction. **CONCLUSIONS:** The commercially-available formaldehyde product appears to be a possible mitigation strategy in feed and feed ingredients for limiting PEDv transmission. Further studies are needed to determine the most appropriate dosage for mitigation and animal health.

Relevance of Research to State-Related Topic(s)

In Kansas, there have been over 250 farms afflicted with Porcine Epidemic Diarrhea virus (PEDv). The virus effects pigs of all stages, but is particulalry catastrophic to suckling pigs because of their less developed digestive tracts. The virus has a mortality rate of nearly 100% in sucking pigs as well as a reduction in health and performance in growing pigs. Some farms in Kansas have lost 8,000 pigs due to a single occurrence of PEDv. Fortunately, the disease is not transmissible to other species, and pork is safe to consume. However, poor animal health and performance has led to a low pork supply, which is the source of record U.S. pork prices for consumers. This research is a part of the National Pork Board's short term emergency program to keep animal feed safe. It is unique because it affects animal health, food safety, and is a farm to fork issue.

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PREVALENCE OF SHIGA-TOXIN PRODUCING *ESCHERICHIA COLI* (STEC) IN HOUSE FLIES FROM CATTLE FEEDLOTS

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BACKGROUND AND PURPOSE: Shiga-toxin producing *Escherichia coli* (STEC) are a major food-borne pathogen affecting ~265,000 people annually in the U.S. alone. Cattle are an asymptomatic reservoir of STEC and bacteria are released to the environment in feces. House fly larvae develop in cattle manure and adult flies commonly build up very large populations in cattle feedlots. It has been shown previously that house flies (HF) carried one of STEC serotype (O157:H7) and were able to transfer these bacteria to cattle and their feed and water. However, over the past decade, the number of human infections from other STEC has greatly increased and little is known about their ecology. The objective of this study was to assess the prevalence of seven non-O157 STEC serotypes (O104, O26, O45, O145, O103, O121, and O111) in HF from cattle feedlots. **METHODS:** HF were collected from ten feedlots in four states and individually tested for STEC by: 1) direct plating on MP agar and 2) enrichment in EC broth, both followed by multiplex PCR for genotyping and virulence screening. **RESULTS**: Out of 367 HF, 29.4% carried *E. coli* serotypes of interest (mainly O104, O103, O45) and 1.9% of HF were positive for STEC with the virulence genes *stx1*, *eae,* and *ehxA*. **CONCLUSION:** STEC prevalence in HF in cattle feedlots is relatively low; however, due to very large fly populations, this represents thousands of HF carrying STEC. HF likely play role in the dissemination of STEC within farms and possibly from farms to the surrounding environment.

Relevance of Research to State-Related Topic(s)

House flies are capable of transmitting several human and animal pathogens that cause cholera, dysentery, and food poisoning from pathogens such as *Salmonella* spp., *Yersinia spp.* and *Escherichia coli* O157. We screened house flies from feedlots from four Midwestern states for the emerging food-borne pathogen non-O157 Shiga-toxigenic *E. coli* (STEC). Our study revealed that house flies from cattle feedlots carry six STEC serotypes that are important foodborne pathogens. This is the first study reporting non-O157 STEC from house flies. Consequently, house flies due to their synanthropic nature and unrestricted movement are more than a nuisance factor and represent a food safety and public health risk.

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EVALUATING THE EFFICACY OF THREE USDA-APPROVED ANTIMICROBIAL SPRAYS FOR REDUCING SURROGATE SHIGA TOXIN-PRODUCING *Escherichia coli* (STEC) ON BOB VEAL CARCASSES

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BACKGROUND AND PURPOSE: STEC have recently been recognized as a food safety problem in the veal industry, signifying a need for effective antimicrobial intervention strategies throughout processing. This study evaluated the efficacy of USDA-approved foodgrade organic acids (lactic acid, Citrilow™, and Beefxide®) for reducing STEC surrogates on processed bob veal carcasses, and determined impact on chilled carcass color quality. **METHOD:** Veal calves were harvested using USDA approved practices and were inoculated with a 5-strain mixture of surrogate *E. coli* bacteria. The level of surrogate *E. coli* was determined post-inoculation, post-final water wash, post-antimicrobial spray, post-24-h chill, and post-2nd antimicrobial spray. Carcass color was measured using a Hunter MiniScan at each sampling point. **RESULTS/FINDINGS:** Water washing alone decreased ($p<0.05$) carcass *E. coli* levels by 0.88 log CFU/cm^2. There were no differences in the effectiveness of the antimicrobial treatments. Organic acid sprays applied to pre-rigor carcasses provided an additional 0.5 log cycle reduction compared to water alone. *E. coli* counts declined further (~0.4 log cycles) during the 24-hour chilling period. A second antimicrobial carcass spray to 24-h chilled carcasses provided no additional benefit. Chilled carcass color values (lightness, red/blue, yellow/green) were similar ($p>0.05$) among all antimicrobials applied and the water only control. **CONCLUSION:** Application of foodgrade organic acid antimicrobial sprays to pre-rigor (prior to chilling) veal carcasses can significantly reduce the public health risk associated with STEC contamination of fresh veal products, without negatively impacting color quality.

Relevance of Research to State-Related Topic(s)

Beef has always had a large economic impact within the United States. Kansas' cattle production, feeding and beef processing have been a large part of this impact, being the third largest beef producer in the country. A challenge that comes with beef and veal processing is the zero tolerance regulations against shiga toxin-producing *Escherichia coli* (STEC) in raw products. STEC cause more than 265,000 illnesses, 3,600 hospitalizations and 30 deaths annually in the U.S. Serotypes O157, O145, O121, O111, O103, O45, and O26 are regulated as adulterants in non-intact/ground raw beef and veal. The USDA has recently recognized veal as an important contributor to STEC positive regulatory samples, which leads to regulatory actions and costs for processors. Our research validates three USDA-approved chemical antimicrobials at the carcass level, providing the veal processing industry with practical tools to reduce their STEC positive rates and ultimately making veal products safer for consumption.

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LUMINEX BEAD-BASED MULTIPLEX ASSAY FOR SURVEILLANCE AND DIAGNOSIS OF RIFT VALLEY FEVER VIRUS IN CATTLE

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BACKGROUND AND PURPOSE: Rift Valley Fever Virus (RVFV) is an important concern in both livestock and human health due to the virus's zoonotic potential. In cattle and sheep herds RVFV infection causes abortion storms leading to devastating economic losses. Although the virus is not currently within the United States, if infected, the economic losses to cattle herds throughout the country would be damaging. The imminent threat to United States livestock herds could lead to a mandatory vaccination program. Currently, there are few assays that can differentiate between vaccinated and naturally infected cattle for viruses with the potential for economic losses. Furthermore, there are even fewer assays that are able to test for multiple viral infections within a single sample. **METHOD:** We are developing a Luminex bead-based assay that will test cattle samples against a panel of viral targets. Here, we focus on the RVFV portion of this multiplex assay. This assay will use the detection of host antibodies directed towards four RVFV proteins, nucleocapsid (N), glycoprotein (Gn), and two nonstructural proteins (NSs and NSm) for both recognition of infection and differentiation between vaccinated and naturally infected animals. **RESULTS/FINDINGS:** Naturally infected, vaccinated and unknown samples from both sheep and cattle were tested for comparison against serum neutralization (SNT) and ELISA results for determination of assay validity. Mean Fluorescent Intensity (MFI) values showed four-fold contrasts between positive and negative samples that compare to that of the SNT and ELISA results. **CONCLUSION:** These findings indicate that this assay will be effective for use in cattle herds across the United States.

Relevance of Research to State-Related Topic(s)

The development of a broad-spectrum cattle viral disease detection panel would align with the interests of the Kansas State legislature. The results of this assay will provide benefits for detection of multiple viral diseases in cattle, overall promoting animal health. Other legislative interests would be benefited as well such as educational opportunities in the field. Multiple graduate research theses geared towards assay development and refinement could be written. Additionally, educational and job opportunities for undergraduate students would be provided that would teach them the benefits and function of the assay.

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CHARACTERIZATION OF TWO *Aedes aegypti* caspases, CASPS20 and 21

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BACKGROUND: Caspases are a conserved family of cysteine proteases that play important roles in apoptosis and innate immunity. Eleven caspase genes have been annotated in *Aedes aegypti*. In this study we are characterizing two of these, CASPS20 and CASPS21. Caspases can be classified as either initiator or effector caspases. Although the length of the prodomain is often used to predict whether a caspase is an effector or initiator, this may not always be a reliable indicator. For example both CASPS20 and 21 group phylogenetically with effector caspases, but while CASPS20 has a short prodomain, CASPS21 is predicted to have a long prodomain. Thus it is not clear whether CASPS21 is an effector or initiator caspase. **METHOD:** To examine the potential roles of CASPS20 and 21 in apoptosis, their expression in Aag2 cells was knocked down using RNAi. After knockdown the cells were exposed to UV radiation as a stimulus for apoptosis. **RESULTS:**Following UV treatment, cells in which CASPS20 or CASPS21 had been knocked down had significantly lower caspase activity and higher cell viability than control cells. In ongoing experiments, the potential interaction of recombinant CASPS20 and CASP21 proteins with the caspase inhibitor AeIAP1 is being determined. The recombinant CASPS20 and 21 proteins are also being used to examine their substrate specificity, which will be a key factor in determining whether they are initiator or effector caspases. **CONCLUSION:** We have determined that CASPS20 and CASPS21 play a role in the apoptosis pathway of *Aedes aegypti.*

Relevance of Research to State Related Topic(s)

Vector borne diseases has been a major public health and veterinary problem because of the deaths they are causing among people and livestock. Apoptosis is one of the antiviral defenses in mammals and insects that is used to combat the viruses. *Aedes aegypti* is a vector for various arboviruses including those causing Dengue and Yellow fever. By understanding the molecular mechanism of apoptosis in *Aedes aegypti*, we can design potential targets for controlling the virus transmission from the vector to the host. This knowledge will be useful in controlling the morbidity and mortality in people as well as livestock that arise due to the diseases that are caused by arboviruses.

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EVALUATING THE EFFICACY OF LAURIC ARGINATE FOLLOWED BY A PEROXYACETIC ACID SPRAY FOR REDUCING SHIGA TOXIN-PRODUCING ESCHERICHIA COLI (STEC) ON BEEF SUBPRIMALS

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BACKGROUND AND PURPOSE: Seven STEC serotypes (O157, O111, O145, O121, O103, O45, and O26) are considered adulterants in non-intact/ground raw beef by the USDA. Regulatory mandates have led to the implementation of numerous antimicrobial intervention technologies throughout beef processing plants. This study was conducted to validate the efficacy of two lauric arginate (LAE) solutions, followed by a subsequent peroxyacetic acid (PAA) spray for reducing STEC populations on chilled, vacuum-packaged beef subprimals. **METHOD:** Four LAE treatment combinations (Mirenat-GA+tap water, Mirenat-GA+deionized water, CytoGuard LA20+tap water, and CytoGuard LA20+deionized water) were evaluated at seven concentrations (0, 50, 100, 150, 200, 250, and 500 ppm per kg of meat.) Treatments were applied to subprimals in-bag, immediately before vacuum packaging. All treatment combinations were stored for 24 and 72 h at 2°C to simulate wholesale distribution before being removed and treated with PAA. Subprimals were inoculated with STEC, a mixture of serotypes and viable populations were enumerated post-inoculation, post-chill period after LAE, and post-PAA secondary treatment. **RESULTS/FINDINGS:** The four treatments were performed similarly across all concentrations ($p>0.05$). Observations were combined across all treatments to compare the STEC reductions by different LAE concentrations. LAE applied at ≥200 ppm resulted in greater reductions ($p\leq0.05$) compared to water controls. No further reductions were seen following the secondary application of PAA to chilled subprimals. **CONCLUSION:** The application of LAE solutions at concentrations of at least 200 ppm to subprimals during vacuum packaging can significantly reduce the risk of STEC contamination in raw beef products.

Relevance of Research to State-Related Topic(s)

Meat packing and prepared meat manufacturing in Kansas employs over 18,700 people. We rank third in red meat production, with 5.3 billion pounds of beef produced in 2012. STEC are associated with beef products and are a focus of USDA regulatory efforts, putting extensive pressure on processors to implement the best possible control technologies. Processors invest large amounts of revenue to test their products, apply multiple intervention technologies, and train employees in best hygienic practices. Surface contamination of chilled beef subprimals can lead to severe consequences (recalls, disease outbreaks, loss of brand equity, and consumer compensations) for processors, as a large percentage of these cuts are processed into "non-intact" products including ground beef, mechanically tenderized whole muscle cuts, and injection marinated consumer goods. The validated in-bag intervention strategy from this project using lauric arginate can be applied to reduce the risk of STEC in popular raw non-intact beef products.

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RNA INTERFERENCE TO REVEAL THE ROLE OF THE NUCLEAR RECEPTOR HR96 IN UP-REGULATION OF CYTOCHROME P450 GENES IN AEDES AEGYPTI

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BACKGROUND AND PURPOSE: Cytochrome P450 monooxygenases (CYPs) have been known to contribute to insecticide detoxification and resistance in many insect species. However, little is known about the regulatory components responsible for their up-regulations. This study was to use RNA interference (RNAi) to reveal the role of the nuclear receptor *HR96* in the up-regulation of five CYP transcripts including three individual genes (*CYP6AA5*, *CYP6AL1*, *CYP9J32*) and two splicing variants (*CYP4J16A and CYP4J16B*) of *CYP4J16* when the mosquito (*Aedes aegypti*) adults were exposed to each of three pyrethroid insecticides including permethrin, cypermethrin and deltamethrin. **METHOD**: Double-stranded RNA (dsRNA) targeting *HR96* was synthesized and injected into mosquito adults. Control mosquitoes were injected with GFP dsRNA. After the suppression of the *HR96* transcript was confirmed by reverse transcription-quantitative PCR (RT-qPCR), mosquitoes were exposed to each insecticide. The mosquitoes were then transferred to clean cages and fed with 10% sucrose solution for 24 hours. The effect of *HR96* RNAi on the up-regulation of different P450 transcripts was evaluated by RT-qPCR. **RESULTS:** The up-regulation of *CYP4J16B* by cypermethrin was reduced by 10.1-fold after the expression of *HR96* was suppressed by RNAi. However, such an effect was not observed in other CYP transcripts or other insecticides. **CONCLUSION:** *HR96* plays an important role in the up-regulation of *CYP4J16B* but different regulatory mechanism(s) may be involved in the up-regulation of other CYP genes in response to different insecticides. Our results are expected to help researchers develop effective strategies for controlling mosquitoes.

Relevance of Research to State-Related Topic(s)

Metabolic detoxification is one of the main mechanism through which insects develop resistance to insecticides In most cases, up-regulation of detoxification enzymes such as CYPs has been reported in resistant insects but little is known about the regulatory components responsible for their up-regulation. Our study using RNAi shows that the nuclear receptor *HR96* plays an important role in the up-regulation of *CYP4J16B,* but not in that of other examined genes. This result indicate that functional analysis using RNAi is important to reveal the involvement of other regulatory genes responsible for the up-regulation of detoxification genes. This approach can be applied to reveal the role of other regulatory components in insects and other organisms.

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HUMAN UMBILICAL CORD MESENCHYMAL STEM CELL ISOLATION METHOD FOR INCRESASED CELL YIELD AND GMP COMPLIANCE

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BACKGROUND AND PURPOSE: Mesenchymal stromal cells (MSC) can be isolated from many tissues, have immunomodulatory abilities, and can differentiate into multiple stromal cell types such as bone, cartilage and fat. MSCs have been studied for their potential clinical application. Umbilical cord MSCs are derived via non-invasive methods that involve extensive manipulation of the cord and take a considerable time. These methods are less attractive for clinical expansion due to risks of infection and cost of working within the GMP facility. For these reasons we investigated new methods for UC-MSC isolation that involve less manipulation within a closed system for easy translation into a GMP facility. **METHOD:** This method was developed as a closed system, using tissue dissociator tubes (Militenyi) containing 1 cm sections of umbilical cord. Dissociation by the GentleMACs dissociator (program C and B) was combined with enzyme digestion to liberate the cells. Filtration was then used to remove tissue chunks, followed centrifugation to pellet cells and further enzyme exposure to lyse red blood cells. Live dead cell counts were performed after the isolation and the cells were cultured to ensure growth. **RESULTS/FINDINGS:** The new isolation method consistently produced > 100,000 live cells per cm. When compared to our previous method a >5x increase in cell yield per cm was found. **CONCLUSION:** We developed a closed system isolation protocol and increased cell yield. This method can be adjusted to GMP requirements with ease.

Relevance of Research to State-Related Topic(s)

In 2013 a bill to create the Midwest Stem cell Therapy Center was signed into law by the Governor of Kansas. The centers research is focused on adult stem cells and there clinical applications. Kansas has become a leader in adult stem cell therapy field with multiple ongoing clinical trials. UC-MSCs are adult stem cells that have great potential for cell therapy, but are held back by lack of compliant isolation protocols. My research demonstrates a new protocol that increases cell yield and can be applied to a GMP facility. This research relates to the states goal of being a leader in adult stem cell therapy.

GROUP 5

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EFFECT OF VERTICAL MINI-FINS ON EXTERNAL CONDENSATION HEAT TRANSFER

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BACKGROUND AND PURPOSE: The purpose of this research is to experimentally study how mini-fins affect the heat transfer coefficient on a vertical surface under external condensation conditions. Filmwise condensation is a major concern when designing steam condensers for thermoelectric power plants. These plants currently account for 40% of freshwater withdrawal and 3% of freshwater usage in the United States. Filmwise condensation averages ten times lower heat transfer coefficients than those present in dropwise condensation. Currently, filmwise condensation is the dominant condensation regime in thermoelectric power plants due to their prolonged usage. The film thickness is directly proportional to the condenser's overall thermal resistance. This investigation focuses on optimizing mini-fins to reduce film thickness and maximize filmwise condensation heat transfer. **METHOD:** The experimental setup allows us to control the cooling load, pressure, and steam quality in order to measure the steam-side surface temperature under steady state conditions. The heat transfer coefficient is determined by measuring surface temperature and steam temperature with relation to the conduction heat transfer across an aluminum test section. By comparing the heat transfer coefficients across a range of heat fluxes, we can find the optimal surface geometries. **RESULTS:** Results demonstrate an average improvement of 51.96% in heat transfer coefficients for heat fluxes above 75 kW/m^2K. **CONCLUSION:** In this research, heat transfer coefficients have been improved for vertical surfaces with mini-fin geometries. For future work, we will test micro-fin pitch widths and frequencies.

Relevance of Research to State-Related Topic(s)

This research is funded by the Electrical Power Affiliates Program of Kansas; it focuses on improving the food-water-energy nexus. The scope of this research is to improve thermoelectric power plant efficiency to reduce freshwater withdrawal and consumption in Kansas. The Environmental Protection Agency has regulations regarding maximum volume withdrawal, which affect the provision of energy in the United States. As a result, an improvement in thermoelectric power plant efficiency will allow for more power generation with the same freshwater withdrawal.

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INCREASING SUSTAINABILITY OF CIVIL INFRASTRUCTURE THROUGH USE OF HEAT EXCHANGER PILES

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BACKGROUND AND PURPOSE: Thermo-active foundation systems use geothermal energy resources for heating and cooling buildings, thus icreasing sustainability of the civil infrastucture. While piles are deep foundations that are necessary for load transfer they also have a direct access to the region in the ground where temperature essentially remains constant throughout the year. Consequently, embedding the small diameter pipes that contain cirulating fluid into piles enables harvesting the heat from the ground during winters and recharging the ground with the heat during summers. One of the principal reasons for a limited use of energy piles in U.S. is the lack of a proper understanding of the related soil-structure interaction. To this end, this research has been undertaken to identify the load transfer mechanisms and implications for design of energy piles. **METHOD:** In this study a computational model of an actual heat exchanger pile has been developed. Coupled pore pressure-displacement-temperature analyses were carried out for different soil-pile contact conditions. **RESULTS AND CONCLUSION:** The results of computational modeling were sucessfully verified and validated against the actual measurements collected from the instrumented pile in Switzerland. It was also found that thermal loading induced additional compressive stresses in the pile while increasing mobilized shear stresseses. More importantly, the thermal load induces a negative skin friction in the upper portion of the pile. This might cause a decrease in the overall bearing capacity of the pile, which is of a vital importance for design. Further analyses are currently performed to assess the effects of different soil layering.

Relevance of Research to State-Related Topic(s)

The consequences of global warming were perhaps the best described by the Intergovernmental Panel on Climate Change who stated: “Taken as a whole, the range of published evidence indicates that the net damage costs of climate change are likely to be significant and to increase over time”. The excessive combustion of the fossil fuels that serve as a primary energy supplier increases the CO_2 emissions, which is in turn linked to global warming. Thermo-active foundations decrease the use of fossil fuels by harvesting the renewable geothermal energy. They are a renewable, environmentally friendly and sustainable alternative energy source compared to current heating and cooling practices. This research aims to enable wider use of energy piles by advancing the knowledge necessary for their design. Additionally, it provides a sound basis for even broader future use of heat exchanger piles in transportation applications such as bridges and roads.

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TIME-CONTROLLED THERMAL EFFECTS ON THE SYTHESIS OF INDIUM PHOSPHIDE NANOCRYSTALS

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BACKGROUND AND PURPOSE: Indium phosphide (InP) is a popular material for solar cells, light emitting devices and detectors. Nanocrystals of InP have advantages over bulk InP semiconductors because of their solution processability and tunable optical properties. Controlling the number of atoms (size) in InP NCs has been difficult because of the high reactivity of indium and phosphorous precursor molecules. Although some procedures requiring rigorous steps and methods have been made to control the size, the obtained materials lack a glowing nature. Our work focuses on preparing different sized InP NCs in a microwave reactor, a procedure that has previously generated InP NCs that glow. **METHOD:** Indium acetate is treated with palmitic acid at 150 °C. After adding tris(trimethylsilyl)phosphine, the solution is heated to 50 °C. The obtained reaction mixture is reacted with an ionic liquid at 300 °C in a microwave reactor at powers ranging from 150 to 800W. **RESULTS:** From Ultraviolet-visible and photoluminescence spectroscopy, variation in the size of the NCs is observed. The NCs emit green, yellow and red color under ultraviolet radiation. Transmission Electron Microscope (TEM) images confirm the size of InP NCs is from 2-4 nm with spherical shape and narrow size distribution. **CONCLUSION:** The final size of the NCs changed with the power of microwave radiation applied. NCs prepared at the highest power have the smallest size. These emissive NCs can be used in LEDs and biomedical applications and this synthesis could be applied to other NC materials.

Relevance of Research to State-Related Topic(s)

Harnessing solar energy for increasing alternative energy resources to replace fossil fuels a promising area of research. The simple preparation of indium phosphide (InP) nanocrystals (NCs) and their light absorption in the visible region shows promise for solar cell applications. The less toxic nature of InP (vs currently used cadmium materials) and glowing properties make it an attractive material for light emitting devices (LEDs), and biology. For solar-water splitting, many efficient devices use group III (Al, Ga)-phosphide materials as photocathodes, so InP is a useful material for study in tandem cells for solar-water splitting.

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FIRST-ORDER NUMERICAL OPTIMIZATION OF FISSION-CHAMBER COATINGS USING NATURAL URANIUM AND THORIUM

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BACKGROUND AND PURPOSE: Current fission chamber technology utilizes neutron-sensitive coatings often composed of radioisotopes which are becoming increasingly difficult to obtain. Using only natural uranium and thorium, a maximized stable device lifetime in a constant neutron flux can be obtained by optimizing the regenerative fission chamber coating. **METHOD:** A system of coupled differential equations was developed by considering neutron-induced fission, neutron absorption, and radioactive decay of 17 radioisotopes spanning the product family tree from ^{232}Th to ^{241}Pu. By solving the system of coupled differential equations, the interaction rate of the regenerative fission chamber coating can be found as a function of time (or total fluence) in a constant neutron flux. The Kansas State University (KSU) TRIGA Mark II nuclear reactor was used as a basis to study the effectiveness of mixed fission chamber coatings over time. **RESULTS:** By varying the initial composition of the fission chamber coating, an optimal composition of ^{232}Th and natural uranium (23.6 atom percent ^{232}Th) is capable of maintaining stable device operation (<5% deviation from initial response) under a constant neutron flux of 2.2×10^{13} n•cm^{-2}•s^{-1} up to a total neutron fluence of 7.65×10^{22} n•cm^{-2}, corresponding to over 110 years of continuous, full-power operation. **CONCLUSION:** Development of in-core fission chamber technology is feasible with the use of naturally occurring elements. Further research will focus on the development of such devices, and an in-depth study of coating response for various nuclear reactor core configurations.

Relevance of Research to State-Related Topic(s)

Fission chamber technology is being investigated as a method to enhance nuclear reactor efficiency and safety. Micro-Pocket Fission Detectors (MPFDs) are being developed, which will be deployable into the core of a nuclear reactor, and provide real-time neutron flux measurements. Ultimately, this more compact, more accurate, and longer lifetime flux sensor for critical mock-ups, existing and advanced reactor designs, high performance MTRs, and transient test reactors has the potential to lead to higher accuracy and resolution data from irradiation testing, more detailed core flux measurements and enhanced fuel assembly processing. Prior evaluations by KSU indicate that these sensors could also be used to monitor burn-up of nuclear fuel. If integrated into nuclear fuel assemblies, MPFDs offer several advantages over current spent fuel management systems.

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CHARGE COLLECTION EFFICIENCY MAPPING OF A FRISCH-COLLARD BiI_3 GAMMA-RAY DETECTOR

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BACKGROUND AND PURPOSE: Gamma-ray radiation detection is critical to national security and this study was performed to demonstrate if BiI_3 crystals could meet that requirement. Thus, charge collection efficiency (*CCE*) mapping was studied theoretically by simulating a 5.0 x 5.0 x 10.0 mm^3 Frisch-collared BiI_3 device with an applied voltage of 4800V and comparing the results to those previously published for a 4.7 x 4.7 x 9.5 mm^3 Frisch-collared CdZnTe device with an applied voltage of 1200V. The BiI_3 mobility-lifetime products used for *CCE* mapping were $\mu_e\tau_e$ = 9.5 x 10^6 cm^2 V^{-1} and $\mu_h\tau_h$ = 9.5 x 10^6 cm^2 V^{-1} for electrons and holes, respectively. **METHOD:** The simulations were performed using the modified form of the Hecht equation and the necessary weighting potential and weighting field distributions were simulated using the commercially available software package COULOMB. Once the results were simulated and compared to CdZnTe, the applied voltage and mobility-lifetime products were adjusted separately until the Frisch-collared BiI_3 device approximately matched the *CCE* performance of the CdZnTe Frisch-collared device. **RESULTS AND CONCLUSION:** An applied voltage of approximately 2,100,000V is necessary to approximately match the *CCE* performance of CdZnTe at 1200V. However, since an applied voltage of 2,100,000V is impossible to supply to the device, an improvement of three orders of magnitude ($\mu_e\tau_e$ = 9.5 x 10^{-3} cm^2 V^{-1} and $\mu_h\tau_h$ = 1.0 x 10^{-4} cm^2 V^{-1}) to the BiI_3 mobility-lifetime products is required to operate the device at a reasonable applied voltage of 4800V and approximately match the *CCE* performance of CdZnTe at 1200V.

Relevance of Research to State-Related Topic(s)

National security is not only a state concern, but a national concern. These radiation detection devices are able to detect gamma-ray radiation, which is emitted by 'dirty bombs'. However, gamma-ray radiation is also emitted by naturally occuring radioactive materials (NORMs), which must be identified as to not cause any false alarms. This detector has the capability to identify the type of gamma-ray and if it is a security threat. It is critical that the state assist with protecting the citizens of Kansas. The new National Bio And Agro-Defense Facility (NBAF) would be a prime target for terrorists, which would impact our food supply and the health of people all over the state and nation.

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EFFECT OF CONCRETE RELEASE STRENGTH ON THE DEVELOPMENT LENGTH AND FLEXURAL CAPACITY OF MEMBERS MADE WITH DIFFERENT PRESTRESSING WIRES COMMONLY USED IN PRETENSIONED CONCRETE RAILROAD TIES

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BACKGROUND AND PURPOSE: Concrete railroad crossties have shown many desirable features over wood crossties, including long life expectancy, environmental friendliness, and better fuel economy of the trains. The length required to fully develop the prestressing force and flexural capicity is development length. In order to obtain full capacity for these prestressed concrete ties over their expected life, the prestress force and flexural capacity must be fully developed before the rail load is applied. A study was conducted to determine the effect of concrete release strengths on the development length and flexural capacity of members utilizing five different 5.32-mm-diameter prestressing wires. A consistent concrete mixture was used for the manufacture of all test specimens, and three different release strengths were obtained by allowing the specimens to cure for different amounts of time prior to de-tensioning. The prisms were identical except for the wire type and the compressive strength at the time of de-tensioning. **METHOD:** Two prisms in each category were loaded in 3-point-bending. These prisms were tested at both ends, with a different embedment length assessed at each end. Thus, for each wire type and concrete release strength evaluated, a total of 4 tests were conducted for a total of 60 tests (5 wire types x 3 release strengths x 4 tested embedment lengths). **RESULTS AND CONCLUSION:** Test results indicate that the concrete compressive strength at de-tensioning can have a direct impact on the ultimate flexural capacity of the members, and this has significant design implications for pretensioned concrete railroad ties.

Relevance of Research to State-Related Topic(s)

The use of prestressed concrete railroad ties is increasing in the United States as the railroad industry continues to become more efficient. Concrete railroad crossties have shown more desirable features over wood crossties, including environmental friendliness and better structural behavior. Using concrete crossties leads to longer service life of track which is more economical than using wood crossties. Concrete ties, being a part of railroad track, sought for better design to mitigate safety concerns. Development length is one of the important factors that should be taken into account in characterizing the prestressed concrete crosstie strength at end regions where the rail load applies. This study investigates the effect of concrete release strength on the development length and flexural capacity of members utilizing five different 5.32-mm-diameter prestressing wires that are commonly used in the manufacture of prestressed concrete railroad ties.

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AIR VOID CLUSTERING IN CONCRETE

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BACKGROUND AND PURPOSE: Incorporation of microscopic air voids into the material matrix is a very effective way to prevent deterioration of concrete due to repeated freeze-thaw action in cold climates. Clustering of these air voids around coarse aggregates has been recently identified as a potential source of low strengths in concrete mixes around the country. Experimental research study was carried out to (1) develop a quantitative measure of air void clustering around aggregates, (2) investigate whether air void clustering can be reproduced in a laboratory environment, (3) determine if air void clustering can blamed for lower compressive strengths. **METHOD:** Different types of coarse aggregate and air entraining agents (AEA) were included in the laboratory study. A total of 65 concrete mixes were made, implementing the frequently used technique of re-tempering that has been previously associated with air void clustering. Compressive strength was determined and the automated hardened void analysis (including a new method of clustering evaluation) was performed on all samples. **RESULTS AND CONCLUSIONS:** It was found that it is possible to reproduce air void clustering in laboratory conditions. However, the results have shown that re-tempering does not always cause air void clustering. In addition, it was observed that clustering is not responsible for a decrease in compressive strength of re-tempered concrete as neither aggregate type nor chemical composition of AEA had a significant impact on severity of clustering. It was also observed that not air void clustering but the total air content and an inhomogeneous microstructure and were responsible for lower strengths.

Relevance of Research to State-Related Topic(s)

Vast majority of roads and highways in state of Kansas are made of concrete. Therefore, the interest in durable, long-lasting, and cheap concrete is obvious. Conducted research and its results disproved some of the concerns related to air void clustering phenomena. It has been shown that synthetic AEAs (that are cheaper than traditionally used organic products) are safe to be used, as well as potential issues with widely-used local Kansas aggregate were pointed out. These two major conclusions, and other minor recommendations that are based on the experimental research study, can directly affect cost of roads and highways in our state, and subsequently every Kansas tax payer.

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RAPID METHOD FOR EXPLOSIVE DETECTIONS USING DENSE PLASMA FOCUS

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BACKGROUND AND PURPOSE: A fast and reliable method for explosive detections was introduced. Kansas State University Dense Plasma Focus (KSU-DPF) was used as an X-ray source for the process. The dense plasma focus (DPF) is a pulsed multi radiation source which produces X-ray, neutrons (When the working gas is Deuterium), ions and electrons in a very short time, tens of nanoseconds. **METHOD:** Signature-Based Radiation – Scanning technique (SBRS) was used by comparing multiple responses, called signatures, from a target, interrogated by the X-rays radiated from the DPF, to a template and calculating a figure-of-merit to decide if the target is an explosive or not. MCNP-5 simulation was done to confirm the experiment. **RESULTS/FINDINGS:** Experiment succeded to find all explsove-like samples used producing 100% sensetivity while the specificity ranged from 28.6 to 50 % depending on the sample volume. Simulation gave a reasonable agreement with the experiment. **CONCLUSION:** Dense plasma focus device can be used as an initial stage for explosive detection specially at shipping areas when large number of packages needed to be scanned in a short period of time.

Relevance of Research to State-Related Topic(s)

This research is very important for homeland security. Last few years many terrorist attacks happened by smuggling explosives to different parts of the country. Using this way an initial and rapid method can be used to scan packages in country boarders or any event that have large population. It's a vital issue not only for the state of Kansas but for the whole country.

GROUP 6

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SEXUAL EDUCATION DISPARITIES AMONG COLLEGE LGBTQ STUDENTS

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BACKGROUND AND PURPOSE: Sexually transmitted infections (STIs) are a prevalent health concern in the United States (Satterwhite, et al., 2013). In the United States, STIs disproportionally burden the lesbian, gay, bisexual, transgender, and questioning (LGBTQ) community compared to their heterosexual counterparts (U.S. Department of Health and Human Services, 2013). Additionally, approximately 20 percent of the 110 million prevalent STIs among women and men in the United States in 2008 were among 15 to 24 year olds (Satterwhite, et al., 2013), indicating that college students are at increased risk for STIs. A survey was sent out to college students at a large, Midwestern university to determine whether LGBTQ college students had different levels of self-efficacy and risk perception, as well as different message type preferences, from their heterosexual counterparts. **RESULTS AND CONCLUSIONS:** Results indicate that LGBTQ students had the same self-efficacy and higher risk perception than heterosexual college students and that heterosexual and LGBTQ college students prefer the same message types. These results indicate that, while LGBTQ college students are aware of their sexual health risks and their ability to manage these risks they may not have the knowledge to protect themselves. A comprehensive sexual health education campaign would be an appropriate step to lessen this apparent knowledge gap.

Relevance of Research to State-Related Topic(s)

Sexually transmitted infections are a prevalent health concern in the state of Kansas. According to the Kansas Department of Health and Environment Disease Control and Prevention, more than 11,000 instances of Chlamydia were reported in Kansas in 2013 (Kansas STD Case Count Report January-December 2013) and men who have sex with men (MSM) were the highest risk population among all of the risk categories in 2010 (Integrated Epidemiologic Profile 2010). In addition, the highest rates of new Chlamydia and Gonorrhea infections are in people aged 20-24 (Kansas STD Case Count Report January-December 2013), indicating that Kansas college students are at an increased risk for STIs. The purpose of this study is to inform a possible public health campaign to reduce the instances of STIs at Kansas colleges by discovering what messages are most effective in inspiring behavior change among the college student population.

ANALYSES OF THE BUILT ENVIRONMENTS AND THE PERCEPTIONS RELATED TO PHYSICAL ACTIVITY OF ADOLESCENTS IN RURAL LOW-INCOME ETHNIC COMMUNITIES IN KANSAS

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BACKGROUND: As part of a 5-year multi-state adolescent obesity prevention project, the resources and the perceived behaviors for physical activity (PA) were assessed in rural low-income ethnic communities in Kansas. **METHOD:** One control and one intervention communities in Southwest Kansas were randomly selected prior to program development. In-person audits of street segments (n_1=3 and n_2=5, respectively for the control and intervention communities) and parks (n_1=4 and n_2=2) were conducted by trained observers using validated Physical Activity Resource Assessment (PARA) and Active Neighborhood Checklist (ANC) to systematically document and describe current neighborhood conditions. Questionnaires, which were designed to identify primary factors for barriers, perceptions, and motivations of PA, were distributed to 6th to 8th graders (n_1=115 and n_2=142) in two middle schools in both communities. **RESULTS:** There were no statistical differences in the mean PARA and ANC scores between the control and intervention communities ($p>0.05$). The majority PA structures available were play sets (72.5%) and basketball courts (51.0%). Sidewalks (78.5%) and stop signs (69.0%) were present to promote neighborhood safety for walking and cycling. Demographic characteristics were similar ($p>0.05$), with Hispanic populations (n_1=60.9% and n_2=69.6%) as majority. More than 70% of adolescents reported to be physically active for at least 1hr/d for 5d/wk. **CONCLUSION:** The built environments and the perceptions of PA in both communities were similar. These findings suggest future interventions targeting PA improvement should integrate environmental and behavioral change, which can provide insights into the overall health and well-being of communities.

Relevance of Research to State-Related Topic(s)

Adolescent obesity has been highlighted as one of the most important public health issues in the United States. Obesity in children and adolescents is associated with adverse health outcomes, which poses risks to both contemporaneous and long-term physical and mental health. The World Health Organization recognizes PA as an essential factor in disease prevention and promotion of lifelong health. Thus, effective population-based intervention strategies target at promoting PA and minimizing adolescent obesity are in needs. Our study evaluated the resources and the perceived behaviors for PA of adolescents in rural low-income, ethnic communities in Kansas prior to intervention development, and our results may provide insight into effective intervention development that targets rural low-income and ethnic communities.

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BEYOND "STICKS AND STONES": PSYCHOLOGICAL TRAUMA PREDICTS POSTTRAUMATIC STRESS SYMPTOMS

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BACKGROUND/PURPOSE: Trauma research commonly focuses on the impact of physical trauma (e.g., hitting/slapping) on posttraumatic stress (PTS) symptom development (e.g., depression) for women. Empirical interest in psychological trauma (e.g., verbal assaults/threats, neglect) has recently progressed; however, few studies focus on solely psychological trauma. The current study addresses this limitation by examining psychological trauma and PTS symptoms using the Chronic Relational Trauma (CRT) Model as a theoretical guide. The CRT Model explains the progression of trauma across developmental stages (i.e., childhood, adolescence, and adulthood) and how trauma predicts PTS symptoms for women. Psychological trauma has yet to be tested within this model. Thus, the present study expands the applicability of the CRT Model to psychological trauma in an effort to better understand PTS symptom development. **METHOD:** Two hundred and thirty-two females completed questionnaires assessing trauma experiences and PTS symptoms. **RESULTS:** Structural equation modeling indicated that psychological trauma during childhood relates to peer psychological trauma, while peer trauma relates to intimate partner psychological trauma. Further, each type of psychological trauma predicts PTS symptoms. **CONCLUSION:** Findings highlight that early psychological trauma can persist across the lifespan and predict PTS symptoms. Importantly, childhood psychological trauma did not directly relate to intimate partner psychological trauma. This finding has implications for the prevention of psychological trauma perpetrated early in life. Preventing peer psychological trauma is critical for healthy development of later relationships; if early trauma cannot be prevented, then helping children and adolescents to develop healthy peer relationships is essential for decreasing the continuation of trauma and PTS symptoms.

Relevance of Research to State-Related Topic(s)

Exposure to traumatic events and subsequent health-related symptoms (e.g., PTSD) are a national concern. In 2012, over 24,000 cases of intimate partner trauma perpetrated against women were reported in Kansas. Research identifying factors contributing to this violence against women should be a priority. Our research focuses on psychological victimization, because this form of trauma is understudied despite occurring more frequently and potentially being just as, or more, damaging than physical victimization. Findings indicate that exposure to psychological trauma (especially psychological trauma perpetrated by peers) is a factor that predicts the development of health problems during adulthood and an increased vulnerability to experience intimate partner psychological violence. These findings have implications for teachers, counselors, and staff working with young girls. For example, after school programs or classes that teach children and youth ways to identify and prevent peer psychological trauma may be critical for the healthy development of later intimate relationships.

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BUILDING THE CHANNEL: IMPROVING COMMUNICATIONS WITH VETERANS

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BACKGROUND AND PURPOSE: Post-Traumatic Stress Disorder (PTSD) is among the major mental health problems that face the US. With a 12- month prevalence of 3.5% among adults, 36.6% of whom are considered severe cases, (Kessler, 2005; NMIH, 2014). Military veterans are disproportionately impacted but may not receive adequate care and treatment or be aware of these services as they transition from military into civilian life. While untreated, PTSD has precarious effects at individual, societal and national levels. This study examines perceptions of caregivers and veterans on current communication and outreach practices, and gather suggestions for improvements promoting awareness and access to health services among veterans who may suffer with PTSD or other war related illnesses. **METHOD:** A survey was conducted among veterans and caregivers (N=60) sampled through a snowball method and administered through the Department of Veteran Affairs healthcare system. Data were analyzed thematically based on McGuire's Information Processing Theory. **RESULTS AND CONCLUSIONS**: Results show a general lack of awareness of VA health-related programs, and current communications efforts do not adequately reach the veteran population. The lack of resources and training among caregivers and administration on communication issues including health literacy amongst their patient populations and doctor-patient communication is a barrier. There is a need for a comprehensive health communication program with a strong multi-media component focusing on benefits offered from the VA that support veteran mental and physical health. Proper research-based planning will heighten awareness and engagement between the veteran population, and the U.S. Department of Veteran Affairs.

Relevance of Research to State-Related Topic(s)

The health and welfare of the veterans residing in Kansas relies on the correct, and timely, information disseminated by the Department of Veteran Affairs and regional healthcare facilities. Kansas House action item HCR 5031 highlights the legislative concern with veterans and their benefits. With the close proximity of Fort Riley to Kansas State University there is an opportunity for leaders and scholars to collaborate in helping transitioning soldiers and improve their awareness of healthcare benefits. This cooperation would not be the first time such a program has been implemented. In fact the U.S. Army has directed units to collaborate with outside entities to help improve quality of life for soldiers and their families. Kansas State University could become a leader in community engagement with soldiers transitioning into the civilian population, and keep the support ongoing as veterans deal with long-term effects of war.

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THE NOT SO LINEAR PATHWAY: HOW TODAY'S STUDENTS CONSUME HIGHER EDUCATION

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BACKGROUND AND PURPOSE: Institutions of higher education need to address the growing number of students who swirl. In the College of Education at Kansas State University, the Center for Student and Professional Services noticed a significant number of students transferring hours from other institutions. Students enroll in other institutions during the summer and/or while taking 12-15 credit hours during the semester at KSU. Therefore, we started looking at the data to see if we could uncover different enrollment patterns to determine who is swirling and why. **METHOD:** We searched our database to find out which students had transferred credit to K-State by Fall 2013. We then tallied how many credits were transferred from which institutions and how many students took credits from which institutions. **RESULTS/FINDING:** 1,180 of 1,437 (82.1%) of College of Education students in Fall 2013 transferred a total of 32,176 credit hours from 204 different institutions. **CONCLUSIONS:** A large percentage of students are transferring credits in a variety of ways. Therefore, institutions need to create a 'culture of transfer' in order to improve both retention and completion rates. In the future, research needs to be conducted to determine who is swirling and how best to help them. We need accurate data to differentiate transfer students from swirling students and to determine what type of credits are they transferring in, at what level, and WHY?

Relevance of Research to State-Related Topic(s)

Foresight 2020 is the Kansas Board of Regents 10 year strategic agenda for public higher education. One of the goals within this plan is to increase student retention and graduation rates by ten percentage points. Academic advising is a crucial part of achieving that goal. Increasing our understanding of how students attend higher education and piece together their curriculum will allow academic advisors to work more effectively with their students in order to improve both retention and graduation rates.

UNSAFE BEHAVIORS OBSERVED IN CONSUMERS WHEN COOKING POULTRY AND EGGS

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BACKGROUND AND PURPOSE: Previous research has shown that many consumers do not follow recommended food safety practices for cooking poultry and eggs, which can lead to exposure to *Salmonella* and *Campylobacter*. Past research has been done through surveys and interviews, rather than observation. The objective of this project was to determine through observation if consumers follow food safety guidelines. **METHOD:** One hundred one consumers in three locations (Manhattan, KS; Olathe, KS; Nashville, TN) were observed as they prepared a baked whole chicken breast, a pan fried ground turkey patty, a fried egg, and scrambled eggs. Observers measured the end point temperature for the cooked products within 30 seconds after the consumers indicated they were finished cooking. **RESULTS AND CONCLUSION:** Thermometer use while cooking was low in all of the products; only 36% for the chicken breasts, and 22% for the turkey patties, with no thermometer usage for fried or scrambled eggs. Only 76% of the chicken and 68% of the turkey was cooked to a safe temperature (165°F), while 76% of scrambled and 49% of fried eggs reached a safe temperature (160°F). Safe hand-washing was noted in only 40% of respondents after handling the chicken breast and 44% after handling the ground turkey patty. This decreased to 15% after handling eggs for fried eggs, and 17% for scrambled eggs. These results show that there is a high prevalence of unsafe behaviors (undercooking and poor hand-washing technique) when cooking poultry and eggs, and a great need for improvement in consumer behavior with poultry and eggs.

Relevance of Research to State-Related Topic(s)

Food safety is an ongoing concern in the US and in Kansas with illness rates between 13 and 15 per 100,000 people for *Salmonella* and *Campylobacter*. *Campylobacter* infections, which are often associated with unsafe handling and cooking of poultry products, have risen by 13% since 2006-2008 according to the Center for Disease Control and Prevention (CDC). This has a tremendous impact on the cost of healthcare personally, in higher insurance costs, and to the state for medical treatment of persons with state subsidized healthcare. This research shows the prevalence of unsafe behaviors in the home when cooking poultry and eggs. A better understanding of what consumers actually are doing when cooking food helps us improve consumer food safety education, messages, and interventions, which in turn can help lower the risk of foodborne illnesses and lower healthcare costs.

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INTERGENERATIONAL INFLUENCES ON DIVORCE

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BACKGROUND AND PURPOSE: Divorce impacts individuals, families, and communities nationwide. Literature examining divorce has shown many risk factors for marital dissolution, including negative communication, low social support, income, education, and parents' divorce (Bramlett & Mosher, 2002; Lavner & Bradbury, 2012; Wolfinger, 2005). The present study was conducted to investigate the impact of quality of relationship with mother and father and experience of childhood trauma on the likelihood of divorce. **METHOD:** For this analysis, data were utilized from the 2010 wave of the Health and Retirement Study (HRS), a longitudinal biennial survey designed to be representative of Americans over the age of 50. Independent variables of interest included quality of relationship with mother and father, and experience of childhood trauma. Binary logistic regression was used to investigate the probability of having been divorced. **RESULTS/FINDINGS:** Preliminary results indicate support for the hypotheses that there are associations between the liklihood of having been divorced and both an invidiuals relationship with their mother and the experience of childhood trama.. First, respondents who indicated poorer relationship with mother in childhood were more likely to have been divorced, holding all else constant. Additionally, respondents who had experienced trauma before the age of 18, had a greater probability of experiencing divorce in later life. **CONCLUSION:** Using an attachment theory lens, poor relationship with parents or expereince of trauma may be conceptualized as attachment injuries. Results may suggest that experience of attachment injury in early life can increase the likelihood for divorce in subsequent romantic relationships.

Relevance of Research to State-Related Topic(s)

Over the past ten years, the divorce rate in the state of Kansas has been increasing. According to the most current United States Census report in 2011, Kansas has a higher divorce rate than the national average. Impacts of marital dissolution on individuals may include higher risk for suicide as well as mood, anxiety, and substance use disorders. Research has also shown that children of divorced parents may experience problems related to psychological adjustment, academic performance, and social relations as well as decreased involvement with noncustodial parent, exposure to continued parental discord, and a decline in economic and social resources. Implications of these risk factors following divorce may warrant a state response to take preventative measures beginning in early life. State-funded programs that foster healthy relationships with parents and prevent or intervene following traumatic experiences for children may greatly impact the next generation as they learn healthy relationship patterns.

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