

Research and the State

GRADUATE STUDENT POSTER SESSION

Program Booklet

Thursday, November 9, 2017
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

1:00 pm to 3:00 pm
Union Courtyard (ground floor)

Research posters will be presented by approximately 64 K-State graduate students representing five academic colleges and 25 graduate programs. The top 10 presenters will be selected by K-State faculty and post-doc judges to participate in the Capitol Graduate Research Summit (CGRS) being held in Topeka in February.

AWARDS CEREMONY

4:00 pm
Big 12 Room

The top 10 graduate student poster presenters selected to represent K-State by presenting their posters at the 15th annual Capitol Graduate Research Summit (CGRS) on February 20, 2018 will be announced at the awards ceremony. These 10 students will be presented with a monetary award to recognize their achievement.

About the GRS

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

Poster Titles and Presenters

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3. **EXAMINING INTIMATE PARTNER HOMICIDE: A META-SYNTHESIS**
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4. **EXAMINE TAXES ON BUSINESS BY THEORETICAL MODELS AND EMPIRICAL STUDY**
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5. **STUDENTS' USE OF MATHEMATICS WHILE WORKING ON ASSESSMENTS IN PHYSICS**
Amali Priyanka Jambuge
6. **INSPIRING FUTURE CONSERVATIONISTS THROUGH A JUNIOR ZOOKEEPER PROGRAM**
Ashley E. Kelly
7. **PERSONALITY TRAITS OF KANSAS: A COMPARISON BETWEEN FIRST AND REPEAT VISITORS**
Naiqing Lin
8. **PERPETRATOR RISK MARKERS FOR INTIMATE TERRORISM VERSUS SITUATIONAL COUPLE VIOLENCE**
Heather A. Love
9. **THE INFLUENCE OF PARENTAL EMOTIONAL SUPPORT ON INCOME AND WELL-BEING DURING THE TRANSITION TO ADULTHOOD: A LIFE-SPAN APPROACH COMPARING SEXUAL MINORITY AND HETEROSEXUAL INDIVIDUALS**
Barrett Scroggs
10. **STUDENTS'S USE OF MULTIPLE REPRESENTATIONS TO SOLVE COMPLEX UPPER-DIVISION PHYSICS PROBLEMS**
Nandana Weliweriya

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Elena Aronson

12. EXAMINING QUALITY, AFFORDABLE HOUSING IN RILEY, COUNTY, KANSAS

Brittany S. Hollerbach

13. SEXUALLY TRANSMITTED INFECTIONS- A MAJOR PUBLIC HEALTH ISSUE: SALINE COUNTY, KS

Dana Johnson

14. DEVELOPMENT OF EVIDENCE-BASED SCHOOL LUNCH BEST PRACTICES: A CRITICAL REVIEW

Jillian Joyce

15. AN EXAMINATION OF MOTIVATIONAL FACTORS AND E-HEALTH LITERACY AMONG COLLEGE STUDENTS IN HPV PREVENTION

Tazrin Khan

16. SOCIAL MEDIA USAGE AND HELP-SEEKING BEHAVIOR FOR MENTAL HEALTH AMONG COLLEGE STUDENTS

Ting Li

17. UNDERSTANDING BARRIERS TO PHYSICAL ACTIVITY AMONG AFRICAN AMERICAN WOMEN: A COMMUNICATIONS PERSPECTIVE

Quan Long

18. INFORMING ON COMMUNITY HEALTH THROUGH PODCASTING: AN EXPLORATORY STUDY

David Pluta

19. ENHANCE HEALTH WITH A NEW EVIDENCE-BASED TREATMENT FOR DEPRESSION

Tom Su

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Alyssa Toillion

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**60. INVESTIGATION OF CRACKING RESISTANCE OF RECYCLED SUPERPAVE
MIXTURES**

Ya Gao

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Shuvo Islam

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Rijesh Karmacharya

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Poster Abstracts

GROUP 1

1

MAKING TIME FOR YOUTH JUSTICE: PROCESS AND DELAY IN THE JUVENILE COURT

William A. Chernoff and W. Richard Goe

Department of Sociology, Anthropology, and Social Work, College of Arts and Sciences

BACKGROUND AND PURPOSE: Every year, hundreds if not thousands of hours are devoted in the United States to the process of youth justice. When these hours are wisely managed, the juvenile court is better primed to achieve its goals, whether they focus on crime-control, treatment, legal or restorative justice, or some combination thereof. The present study explores: 1) What prevents the juvenile court from efficiently managing its cases in a timely manner? And 2) What can the juvenile court do to improve the timely management of its cases? **METHOD:** Drawing a random sample of court cases (n=394) from a large Midwestern juvenile court filed between January 1st, 2012 and December 31st, 2015, the present study sought to better understand delay in the juvenile court. **RESULTS/FINDINGS:** Controlling for failure to appear, diagnostic evaluations, caseload, detention status and offense severity, statistically significant relationships were observed between the time-session rate, a measure of timely case processing, and factors measuring e-file status and the withdrawal of lawyers. **CONCLUSION:** There is much the juvenile court can do to reduce unnecessary delay. By automating more court procedures and withdrawing some court actors, the juvenile court can process cases more quickly.

Relevance of Research to State-Related Topic(s)

Managing scarce resources is not just about efficiency. In fact, the efficient use of resources is central to fulfilling the juvenile court's mission. Timely case processing is one way the juvenile court can protect and serve the community. Though benevolent in its mission, poor case management wastes valuable taxpayer dollars. One way to avoid such undue harm is through effective case management. By knowing what delays a case, what does not and why, the juvenile court can not only achieve its goals, but also provide sorely needed services to the community. It is in this way that the court can protect the community from the one thing it has the most control over: itself.

WHO UNDERSTANDS CONSENT?: A LATENT PROFILE ANALYSIS OF COLLEGE STUDENTS' BEHAVIORAL INTENTIONS REGARDING CONSENT

Eric Goodcase, Chelsea Spencer, and Michelle Toews

School of Family Studies Human Services, College of Human Ecology

BACKGROUND AND PURPOSE: Approximately 23% of female and 5% of male undergraduate students report being sexually assaulted while attending college. One of the factors that contribute to this is the ambiguity surrounding what consent is. Consent must be affirmative, ongoing, and explicit, but many college students report being uncertain about consent, despite the many educational programs that seek to educate college students about sexual assault and consent. **METHOD:** The current study uses a survey of 724 college students at a Midwestern university to determine if different people may have varying behavioral intentions regarding affirmative, ongoing, and explicit consent during different sexual situations. Latent Profile Analysis, a statistical approach that groups participants by similar traits, was used to find distinct profiles of how individuals intend to behave regarding consent. **RESULTS:** Results indicate that there are four distinct profiles of individuals: respecting affirmative, ongoing, explicit consent class (76.55% of sample); respecting explicit consent only class (9.89%); unsure about non-explicit consent class (9.04%), and consent not obtained in romantic relationships class (4.55%). **CONCLUSIONS:** Results indicate most individuals respect consent when it is explicitly stated, which is evidence to the effectiveness of current education programs. However, individuals in two of the profiles indicated they would potentially engage in sexual behavior that does not fully respect affirmative ongoing consent and would be considered sexual assault. Educating college students on the importance of how consent must be affirmative and ongoing can potentially decrease the number of sexual assaults occurring on college campuses.

Relevance of Research to State-Related Topic(s)

Sexual assault on college campuses has received a lot of attention from researchers, the media, and legislators due to its prevalence. Despite this attention, sexual assault is still common and college campuses struggle to adhere to Title IX guidelines (7 active Title IX complaints in Kansas alone as of June 2016). Potential effects of sexual assault to an individual include pregnancy, chronic pain or migraines, gastrointestinal issues, depression, anxiety, post-traumatic stress disorder, and other physical and mental health issues. This also affects larger systems as money is spent on healthcare and on legal fees. The current study highlights how college students understand consent and shows what aspects need to be emphasized or added to existing sexual assault education. These changes could lead to an increase in understanding consent for students, which could lead to a decrease in prevalence of sexual assault, and an increase college administrators' understanding of consent, would decrease potential Title IX complaints.

EXAMINING INTIMATE PARTNER HOMICIDE: A META-SYNTHESIS**Jacqueline Harden**, Jingshuai Du, Chelsea Spencer, and Sandra Stith.*School of Family Studies and Human Services, College of Human Ecology*

BACKGROUND AND PURPOSE: Intimate Partner Violence (IPV) is a serious health concern, and Intimate Partner Homicide (IPH) is one of the leading causes of death for women in the U.S. (CDC, 2017). Recent research has identified the strongest risk markers for IPV (Spencer, Cafferky & Stith, 2016), but little research has examined factors that increase risk of IPH, which is often much harder to predict than IPV. It is necessary to learn more about IPH risk factors in order for clinicians and law enforcement to be able to help victims before IPV escalates to IPH. **METHOD:** We conducted a meta-synthesis of qualitative research on IPH which included 30 studies. We examined studies related to IPH risk factors, themes, and motivations to create a meta-synthesis. **RESULTS/FINDINGS:** Preliminary results show that while victims themselves are the best source of prediction for IPV, they are rarely able to predict when abuse will turn lethal. In a majority of the studies that included victims who had survived homicide attempts, most victims said that they had not thought their partner or ex-partner was capable of murder. One of the risk factors that seemed prevalent throughout the literature was non-fatal strangulation. **CONCLUSION:** Based on our early findings, it is clear that there is a need for victims of IPV to be aware of the risk factors specific to IPH, and be provided with services and opportunities to extricate themselves from dangerous situations.

Relevance of Research to State-Related Topic(s)

This research is relevant for the state of Kansas because in 2013, there were 30 domestic violence homicides, which amounts to ¼ of all homicides in Kansas that year (NCADV). IPV and IPH costs the US billions of dollars each year in health care costs and also costs employer's billions each year (Centers for Disease Control and Injury Prevention). Because of the far-reaching impacts of IPH across health and economic services, it is crucial for us to understand what factors put an individual at risk for IPH. This research will aid communities, first responders, law enforcement officials, victim advocates, therapists, and hospital workers in identifying potential risk factors that may put individuals at risk for IPH, thus aiding in the prevention of IPH.

EXAMINE TAXES ON BUSINESS BY THEORETICAL MODELS AND EMPIRICAL STUDY

Kristen Huang

Department of Economics, College of Arts and Sciences

BACKGROUND AND PURPOSE: Voters are difficult to know the effectiveness of political policy, so this paper investigates taxes on business by comparing to without taxes on business. **METHOD:** In this paper, data is not needed, but the knowledge of macroeconomic theory is important for research. Models of analysis are one period, two period, and overlapping generations. Assumptions are that agents have different periods of life to maximize their utility and firms maximize profits under competitive markets. In addition, the amount of capitals and hired labors are fixed in different models. The purpose of analysis is to know change of endogenous variables after different kinds of taxes were imposed on business. **RESULTS/FINDINGS:** The price of wage and capital would decrease under taxes on production, the price of wage would decrease under taxes on labors holding the price of capitals the same, and the price of capitals would decrease under taxes on capitals holding the price of wage the same. Consumption would decrease in different theoretical models, but total consumption would decrease under taxes on production, would decrease/increase under taxes on labors, and would increase under taxes on capitals in empirical study. **CONCLUSION:** Due to different kinds of taxes, taxes on business would not be the way to boost the economy.

Relevance of Research to State-Related Topic(s)

Taxes on business could be taxes on production, taxes on labors and taxes on capitals. Taxes on business caused lower performance in stock markets, business and so on. From empirical study, results show that taxes on production could not be the effective policy to improve economic development. However, taxes on labors and taxes on capitals could increase consumption and economic activities. Thus, this study investigates the relationship between different kinds of taxes and economic outcomes. Results of this paper may give suggestions to government, lawmakers and business to make a policy and to improve the economy. During the election, voters may make the right choice for a country and choose a policy.

STUDENTS' USE OF MATHEMATICS WHILE WORKING ON ASSESSMENTS IN PHYSICS

Amali Priyanka Jambuge and James T. Laverty
Department of Physics, College of Arts and Sciences

BACKGROUND AND PURPOSE: The most common ways of assessing students' knowledge are through homework and exams. In the past, such assessments in physics were designed to assess concepts. With the introduction of the Next Generation Science Standards (NGSS), there is growing interest in assessing not just what students know, but what students can do with their knowledge. Therefore, we need new strategies for designing assessments that can provide evidence of what students are able to do with their knowledge. The NGSS is built around the idea that we should blend Scientific Practices, Core Ideas, and Crosscutting Concepts together into our curriculum, instruction, and assessment. The Three-Dimensional Learning Assessment Protocol (3D-LAP) was developed by researchers at Michigan State University to translate these ideas into the science exam and homework problems, primarily at the college level. The purpose of this study is to investigate how well such problems can assess students' use of their knowledge in mathematics. **METHOD:** I developed an exam with questions based on 3D-LAP and will record students taking the exam in an interview setting. These students will be asked to think aloud while working through the exam. **ANTICIPATED RESULTS/FINDINGS AND IMPLICATIONS:** The results of this study will be used to validate how effective the 3D-LAP is for assessing students' use of mathematics. The study will also inform potential modifications to the existing 3D-LAP.

Relevance of Research to State-Related Topic(s)

It is important to have a substantial portion of scientifically literate population in a country. The students should be educated such that they have the ability to think scientifically when they confront scientific inquiries. Assessments of scientific understanding should be developed to elicit evidence that students have the required knowledge needed for the grade level they are in as well as whether or not they can use that knowledge. Our study will expand the existing knowledge on assessing students on physics concepts by implementing 3D-LAP where students' knowledge will be assessed based on the scientific practices.

INSPIRING FUTURE CONSERVATIONISTS THROUGH A JUNIOR ZOOKEEPER PROGRAM

Ashley E. Kelly¹, Jeffrey C. Skibins¹, Susi Algrim¹, Jared Bixby², and Nicole Wade²
¹*Department of Horticulture and Natural Resources, College of Agriculture;* ²*Sunset Zoo, Manhattan, Kansas*

BACKGROUND AND PURPOSE: The recent decline in children’s engagement with nature due, in part, to our increasingly urbanized lifestyles, may produce future leaders less inclined to value and protect wildlife. Sunset Zoological Park in Manhattan, Kansas, has been a cultural and educational asset to the community for more than 80 years and is passionate about facilitating up-close explorations of wildlife as part of their mission to inspire conservation of the natural world. The Junior ZooKeeper program is a participatory summer career-shadowing opportunity for 10 - 13 year olds, which allows them to re-engage with nature and discover career opportunities in wildlife conservation. This qualitative study assessed the cognitive and affective impacts of the Junior ZooKeeper program on participants. **METHOD:** A total of seven group interviews (45 min each) of participants (n = 25) were conducted June – August 2016. Interviews were coded by three reviewers to identify themes expressed by participants. **RESULTS:** Emergent themes included a positive shift in thinking about wildlife, positive perceptions of science-based careers, and a greater understanding of the role of zoos. **CONCLUSION:** Results support the importance of immersive nature-based opportunities for education and exploration, and highlights the potential for similar career-shadowing opportunities to inspire today’s youth to become future conservation leaders.

Relevance of Research to State-Related Topic(s)

Sunset Zoo in Manhattan Kansas is investing significant resources into the development of community education programs related to wildlife conservation, animal care, career opportunity awareness and nature connectedness in an effort to improve both the quality of life for the children of Kansas and to perpetuate environmental stewardship. This evaluation will assist with the potential justification of this resource allocation and development directions for the program for future years.

PERSONALITY TRAITS OF KANSAS: A COMPARISON BETWEEN FIRST AND REPEAT VISITORS

Naiqing Lin and Kevin R. Roberts

Department of Hospitality Management, College of Human Ecology

BACKGROUND AND PURPOSE: The rapid growth of the tourism industry has resulted in increased segmentation, overall low-profit margins, and a plethora of brands and offerings within the tourism sector. According to Long Tail Theory, the American economy is shifting away from a small number of mainstream markets, and moving towards a large number of niche markets, which includes tourism markets in Kansas. A well-established brand personality that facilitates differentiation of Kansas from that of its competitors is vitally important to increase emotional loyalty and attract repeat visitors. Therefore, the purpose of this study was to develop a brand personality that can be applied to marketing the state to increase tourism. **METHOD:** A non-parametric Garrett ranking analysis with 209 domestic visitors was conducted to identify the most important attributes that describe Kansas. Descriptive and non-parametric statistics were performed. Post-hoc analysis using the Mann-Whitney-U-Test between first and repeat visitors were conducted on brand personality and travel satisfaction scales. **RESULTS/FINDINGS:** Hardworking, reliable, and down-to-earth were identified as top personality traits that describe Kansas. The results suggest that an emotional bond to Kansas is established when tourists were connected with a sense of hardworking, reliability, and down-to-earth atmosphere that Kansas is known for. Furthermore, sincere ($Z = -2.22, p < 0.05$), contemporary ($Z = -2.16, p < 0.05$), and outdoorsy ($Z = -1.98, p < 0.05$) has significantly decreased among repeat visitors, indicated areas of discrepancy for future improvements. **CONCLUSION:** Identifying and connecting tourists with strong personalized messages will help create emotional ties that will eventually lead to sustainable state revenue and future employment opportunities.

Relevance of Research to State-Related Topic(s)

In 2013, the state of California spent approximately \$50 million on tourism marketing, compared to \$4.8 million in Kansas. In 2017, the niche tourism market continues to grow and prosper. A well-established destination image and bond that facilitates emotional loyalty among visitors and the state is crucial to success. Results identified distinguish attributes that describe Kansas among visitors and areas of importance to create the strongest bond. Specifically, repeat visitors identified Kansas as less Sincere, Contemporary, and Outdoorsy than the first time visitor. Marketers should ensure that Kansas is consistent and authentic in its marketing to tourists. For local Convention & Visitors Bureaus and industry partitioners, a guided marketing campaign with a specific emphasis on the sincerity and contemporary developments of Kansas will most likely win over repeat visitors and create stable emotional loyalty among tourists that will eventually lead to sustainable state revenue and future employment opportunities.

PERPETRATOR RISK MARKERS FOR INTIMATE TERRORISM VERSUS SITUATIONAL COUPLE VIOLENCE

Heather A. Love, Chelsea Spencer, Marcos Mendez, Scott May, and Sandra Stith
School of Family Studies and Human Services, College of Human Ecology

BACKGROUND AND PURPOSE: In romantic relationships, intimate terrorism (violence that stems from the need to control one's partner) is more pathological but less prevalent than situational couple violence, a form of mutually escalating conflict between partners. In this study, we seek to determine whether or not the strength of risk markers identified from studies collected from clinical data sets (e.g., batterer intervention programs or shelters), which tend to represent participants experiencing intimate terrorism, differ from the strength of risk markers identified in general population studies, which tend to be more representative of situational couple violence. **METHOD:** To conduct this meta-analysis, we searched for studies that included behaviors and risk markers associated with intimate partner violence. This resulted in 202 relevant studies, from which we coded 312 effect sizes that were used in the final analysis. Risk markers for this study included communication, conflict resolution, demand/withdraw relationship patterns, relationship satisfaction, control, jealousy, patriarchal beliefs, power, antisocial personality disorder, and stalking behaviors. Male perpetrators with female victims overwhelmingly made up these studies; therefore, only male perpetrator risk markers were included in this analysis. **RESULTS/FINDINGS:** There were several significant differences between the risk markers for intimate terrorism versus situational couple violence. Control, jealousy, patriarchal beliefs, and power were all more significantly associated with clinical samples. **CONCLUSION:** This study indicates that control, jealousy, power, and patriarchal beliefs are more likely to be associated with high-risk samples indicative of intimate terrorism. This information has the potential to inform intervention programs and future studies of intimate partner violence.

Relevance of Research to State-Related Topic(s)

This research has the potential to influence policy regarding domestic violence offender intervention programs in the state of Kansas. Currently, the standard of care for batterer intervention programs include a strong focus on intimate terrorism characteristics, such as requiring batterer intervention programs which focus on power and controlling behaviors. However, there is a significant difference between violence that occurs as a result of intimate terrorism and violence that occurs as a result of situational couple violence. It is critical that careful screening is part of the determination for offender treatment in Kansas. For couples that experience situational couple violence, it may be necessary to implement couple's treatment, where communication and conflict management skills can be addressed instead of merely sending the male partner to a batterer program. Similarly, other risk factors are recommended to be included for batterer intervention programs for intimate terrorism, such as jealousy and patriarchal beliefs.

THE INFLUENCE OF PARENTAL EMOTIONAL SUPPORT ON INCOME AND WELL-BEING DURING THE TRANSITION TO ADULTHOOD: A LIFE-SPAN APPROACH COMPARING SEXUAL MINORITY AND HETEROSEXUAL INDIVIDUALS

Barrett Scroggs, Derek R. Lawson, and Amber Vennum
School of Family Studies and Human Services, College of Human Ecology

BACKGROUND AND PURPOSE: Financial stability is one of the primary tasks of the transition to adulthood (Arnett, 2000) and an important influence on well-being (Kahneman & Deaton, 2010). Additionally, it is important to explore the mechanisms by which parental support during adolescence may improve the ability of sexual minority youth to successfully tackle key developmental tasks. We were interested in how parental support during adolescence predicted income and well-being in adulthood, how optimistic financial expectations in emerging adulthood mediated this relationship, and how income was associated with well-being in adulthood. **METHOD:** Data were obtained from the National Longitudinal Study of Adolescent Health (Harris et al., 2009). We ran a multiple-group comparison model comparing the experiences of heterosexual and sexual minority (i.e. lesbian, gay, bisexual) individuals during the transition from adolescence to adulthood. **RESULTS/FINDINGS:** Parental support in adolescence was positively associated with financial optimism in emerging adulthood for both sexual minority and heterosexual individuals, although this relationship was not significantly different among groups. The positive relationship between adolescent parental support and well-being and income during adulthood was stronger for sexual minority individuals. Surprisingly, although income was positively associated with well-being for both groups, optimism for future financial success was only a significant predictor of income and well-being for heterosexuals. Similarly, future financial expectations significantly mediated the associations for heterosexuals only. **CONCLUSION:** Financial professionals working with sexual minority adolescents should understand that the well-being of sexual minorities is driven more by parental support and anticipate that a lack of family support may play a role in financial decisions.

Relevance of Research to State-Related Topic(s)

Recent analysis found that 3.1% of the Kansas adult population identifies as LGBT (Lesbian, Gay, Bisexual, and Transgender). Our research allows members of the Kansas legislature to see the ways negative experiences can influence the development of sexual minority Kansans. More specifically, our research allows Kansans to better understand the risks that are associated with this population's ability to thrive in Kansas. Kansas legislators have a desire to support the prosperous well-being of all Kansans and our research illustrates a population which needs support in order to be able to thrive in both income and well-being. This population has unique needs and are at risk for experiences which can have life-long effects. Research of this nature also brings adolescents to the forefront and recognizes the important influence that development during this stage has on later development. It is imperative for Kansans to better understand the experiences of this population.

STUDENTS' USE OF MULTIPLE REPRESENTATIONS TO SOLVE COMPLEX UPPER-DIVISION PHYSICS PROBLEMS

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BACKGROUND AND PURPOSE: Problem solving is an essential part of college physics courses, where students learn, improve their understanding of physics concepts and mathematical manipulation skills. Use of multiple representations play a major role in effective problem solving. Within the process of problem solving, students often use and translate between representations (gestures, diagrams, mathematics, words) for recording, sense-making and communicating purposes. **METHOD:** The data for this study is drawn from the Electromagnetism I course, where students engage in problem solving at individual oral exam settings. We do moment-by-moment analysis of student videos to investigate how students buildup representations and how students translate between those representations to solve the problems. **RESULTS/FINDINGS:** While analyzing students' problem solving videos, we found that students undergo different phases of problem solving. Where in some phases students develop representations while making translations among different classes of representations. And in other phases, students use those developed representations to solve the problems and answer the original questions. In this poster we present examples of students building compound representations and making translations among representation classes for effective problem solving. **CONCLUSION:** Our work shows that it is both possible and fruitful to model students' problem solving in terms of building and switching between representations, pushing theoretical and methodological developments in understanding students' problem solving in physics.

Relevance of Research to State-Related Topic(s)

STEM – Science, Technology, Engineering and Mathematics – education is vital to the future of Kansas. A well-educated population is the key to economic growth; STEM education has been particularly cited as the most important growth area in workforce development for the US as a whole. To best educate STEM students, we need to first understand the fundamental processes of learning STEM subjects, which is problem-solving. Problem-solving often involves decision-making, and decision-making is remarkably important for management and leadership. In order to teach students to solve problems correctly, first we must study their problem-solving behaviors in STEM classes.

WHY DO I NEED IT? A STUDY OF FLU VACCINATION PERCEPTIONS AND ATTITUDES AMONG HEALTHY WORKING ADULTS

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BACKGROUND: Each year the Centers for Disease Control and Prevention (CDC) launches a campaign to promote influenza immunization through promotional graphics for seasonal influenza that are used across the country. Local health agencies also collaborate with providers in providing free or affordable vaccines. However, these campaigns fail to raise vaccination rates to optimal levels partially due to misconceptions of the flu vaccine and lack of understanding about the seriousness of the influenza virus compared to other serious respiratory illnesses. **PURPOSE:** By implementing Health Belief Model, this study aims to understand the barriers to the adoption of the flu vaccine within the general population. Specifically, the study focuses on the perceptions and attitudes toward flu risks and safety of the vaccine among the general population, their level of self-efficacy and intention to get vaccinated. **METHOD:** Data are gathered through an online survey that is disseminated through various listservs. The sample (N=150) has an age range of 18-64 year. **RESULTS/FINDINGS:** Results will show that there are negative perceptions and attitudes toward vaccinations, both of which are correlated with the low knowledge about the virus. Similarly, efficacy is associated with knowledge and with the intention to get vaccinated. Gender and ethnic differences are observed in regards attitudes and perceptions. **CONCLUSION:** In order to increase the uptake of the flu vaccines, there is a need for evidence-based health campaigns that will target various population segments with relevant messages specifically to address the misconceptions while promoting the efficacy and motivation for vaccination.

Relevance of Research to State-Related Topic(s)

Despite the widely available preventative resources for seasonal influenza, including vaccinations at a variety of extended hours venues, influenza continues to claim the lives of Kansas residents every year. In 2014-2015, influenza was reported as the direct cause of death for 95 residents. Beyond these individuals, in the same flu season, 1153 were reported as having influenza or pneumonia as a contributing cause of death (KDHE, 2016). In order to avert the health impact of influenza within the state and related problems, there is a need for more research to understand the most effective communication strategies in order to address the misconceptions and motivate people to adopt vaccines.

EXAMINING QUALITY, AFFORDABLE HOUSING IN RILEY, COUNTY, KANSAS**Brittany S. Hollerbach, Brandon C. Irwin, and Katie M. Heinrich***Department of Kinesiology, College of Human Ecology*

BACKGROUND AND PURPOSE: Research suggests safe/affordable housing is a predictor of health and has been identified as a critical issue nationwide. There is little known regarding how this issue affects those in Riley County (RC). The purpose is to examine published data regarding quality, affordable housing affecting an underserved and socially disadvantaged population. **METHOD:** A document analysis of the health data available for RC was conducted to give voice and meaning to the issue of quality, affordable housing. This analysis included the 2015 Community Needs Assessment (CCNA), the Behavioral Risk Factor Surveillance System (BRFSS), RWJF County Health Rankings, and 2015 Community Health Improvement Plan (CHIP). These resources are a compilation of primary data including census data, community surveys, key informant interviews, and focus groups. **RESULTS/FINDINGS:** CHIP identified housing as a priority issue which CCNA echoed by ranking housing among the top three health priorities for RC. RC ranked 90/102 counties in Kansas in “Physical Environment” which included severe housing problems. Greater than 21% of RC residents lived below the federal poverty line. Furthermore, people living in RC felt there was a lack of affordable housing and that people couldn’t afford newly built options. The consequence was that people were living in trailers without running water or shared housing with more than one family which led to unsafe living conditions and overcrowding. **CONCLUSION:** These documents address quality, affordable housing as a priority issue in RC that needs to be addressed by community health organizations and policy makers.

Relevance of Research to State-Related Topic(s)

Quality, affordable housing is an important health issue nationwide that we can begin to address by evaluating the issue locally; the best way to evaluate a local issue is to involve community members in the planning/investigative process. The CCNA included 1,126 surveys from a broad sample of community members in RC and 25 key informant interviews. Additionally, focus groups were held with each of three underrepresented groups: young adults (18-24), low income individuals, and Hispanics/Latinos to broaden the sample. The CHIP involved over 200 stakeholders in reviewing data, discussing needs, and identifying community priorities. After an exhaustive review of local health data, housing remains a top priority. Priority health issues require documentation of the issue for policy change to occur. Consistent with national trends, RC has an affordable housing problem that disproportionately impacts low- and moderate-income, working families. Maintenance and creation of affordable housing options and living wages are needed.

**SEXUALLY TRANSMITTED INFECTIONS - A MAJOR PUBLIC HEALTH ISSUE:
SALINE COUNTY, KS**

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BACKGROUND AND PURPOSE: Sexually transmitted infections (STIs) have detrimental health consequences. In 2015, STIs cost the United States \$16 billion dollars annually. Gonorrhea, chlamydia, and syphilis cases are on the rise in the United States despite the implementation of STI prevention programs. In recent years, Kansas chlamydia, gonorrhea, and syphilis cases have increased. These increases may reflect increased awareness of and more routine testing for STIs. This research examines demographic factors associated with Kansas STI case counts. Saline County, Kansas is within the top 10 Kansas counties for STI cases. We partnered with the Saline County Health Department (SCHD) to investigate whether improvements in STI services could be made and to investigate risk factors for STIs within this county. **METHODS:** We tested for associations between demographic and chlamydia case count data using Pearson correlation coefficient analysis and Z hypothesis testing. We also collected data from SCHD clinic surveys to examine whether STIs associate with the attributes of the population. **RESULTS/FINDINGS:** Population density correlated significantly with the number of 2014 and 2015 Kansas chlamydia cases. In 2014, females represented a greater proportion of Kansas chlamydia cases than national cases. We used survey data to assess the Saline County population's perceptions of STI susceptibility, STI severity, and benefits and barriers of condom use, as well as its potential for self-efficacy. **CONCLUSION:** Data collected in partnership with the SCHD helped describe attributes of the population, which were used to identify potential opportunities for improvements in STI services using the Health Belief Model.

Relevance of Research to State-Related Topic(s)

STIs are a major concern in the United States and Kansas. Case counts of STIs are increasing and place economic burden on the state and federal government. The top ten counties in Kansas with the highest STI rates from highest to lowest in 2016 were: Wyandotte, Riley, Shawnee, Sedgwick, Douglas, Geary, Reno, Finney, Saline, and Seward. Minority groups, gender, age, and geographic discrepancies exist for STIs. We investigated gender discrepancies associated with Kansas chlamydia cases and potential opportunities for improvements in sex health education, awareness, and screening in Kansas that could help stabilize STI increasing trends.

DEVELOPMENT OF EVIDENCE-BASED SCHOOL LUNCH BEST PRACTICES: A CRITICAL REVIEW

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BACKGROUND AND PURPOSE: The National School Lunch Program (NSLP) was developed to provide healthy food to schoolchildren. Participating schools' lunches must meet NSLP nutrition standards. Research has shown that there may be significant variations in dietary quality (DQ) of school lunches while meeting standards. DQ is associated with child and adult weight status, chronic disease risk, and academic performance. Thus, the purpose of this study was to review previous research on child DQ recommendations and implementation of healthy school lunches, and to develop best practices for healthy school lunches based on the evidence.

METHOD: Relevant studies, published in the last ten years, were systematically identified using PubMed and Scopus. Keywords and search strategies were determined *a priori* with professional librarian assistance. Two independent reviewers assessed included studies for methodological quality, according to Academy of Nutrition and Dietetics Evidence Analysis Library criteria. Results were summarized and used to develop best practices for schools planning healthy lunches.

RESULTS: Twenty-one articles met inclusion criteria. Best practices to improve DQ of school lunches included increasing dairy, fruit, non-starchy vegetables, nuts and seeds, whole grains, lean meat/poultry, eggs, and fish, and decreasing/minimizing red/processed meat, total and saturated fats, salt, refined grains, and pre-fried/fried foods. Implementation techniques that improve selection and consumption of healthy foods included use of nudge strategies and Smarter Lunchrooms interventions; increasing normativeness, convenience, and attractiveness; including students in planning and implementation; and marketing healthy foods to schoolchildren.

CONCLUSION: The current study suggests that development of best practices, including implementation, for healthy school lunches may improve NSLP DQ.

Relevance of Research to State-related Topic(s)

National School Lunch Program (NSLP) nutrition standards, which schools' lunches must meet to receive reimbursement, have shifted focus from nutrient content to overall dietary quality (DQ), which measures how healthy a diet/meal is, compared to scientifically-/government-developed healthy diet standards. High DQ is associated with higher academic achievement, healthier weight status, and lower chronic disease risk in children. Overall DQ ratings of US children are 47-50/100, which is "poor." A recent study showed typical Kansas school lunches were rated at/below 72/100, which "needs improvement." This study also showed, with best practices implemented, school lunches could be rated "good" at 94/100 (30% increase). Given adult weight is associated with dietary behaviors, which establish in childhood, and that 1,700 Kansas schools serve 53+ million lunches annually, NSLP is a large-scale strategy to help Kansas combat childhood/adult obesity and improve academic performance. Best practices are feasible and could substantially improve Kansas school lunch DQ.

AN EXAMINATION OF MOTIVATIONAL FACTORS AND E-HEALTH LITERACY AMONG COLLEGE STUDENTS IN HPV PREVENTION

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BACKGROUND: Human Papilloma Virus (HPV) can cause various malignancies, including cervical, oral, anal, vulvar, and penile cancers. In the U.S. HPV is the common sexually transmitted disease affecting 6.2 million people annually. Though young people are most at risk of HPV, they lack motivation for adopting and maintaining self-preventive behavior. E-Health strategy has potential to motivate young adults to take preventive measures if accompanied by adequate skills to find, understand and implement the online information. **OBJECTIVES:** Using the lens of Protection-Motivation Theory, the study examines motivational factors for HPV prevention among young adults in relation to their e-Health literacy. **METHOD:** Data were gathered from an online survey among male and female college students, age range of 18-35 years. **RESULTS:** The significant motivational factors that influence HPV vaccine uptake include vulnerability to contracting HPV ($\beta = .19$, $t = 4.46$, $p < .001$), self-efficacy ($\beta = .12$, $t = 2.52$, $p < .01$), and response cost ($\beta = .48$, $t = 9.9$, $p < .001$). Online health information seeking behavior is positively correlated with motivation for prevention ($r = .11$, $p < .05$) whereas e-Health literacy is negatively correlated ($r = -.13$, $p = .05$). Additionally, people with higher knowledge of HPV showed lower motivation for prevention. **CONCLUSION:** As results indicate promoting knowledge alone will not necessarily lead to vaccine uptake. Rather, people need to be motivated to take preventive measures. Researchers need to emphasize the importance of e-health strategy and arrange education program to increase literacy level targeted at young adults so they can have the strong motivation to self-manage their health using cost-effective online health information.

Relevance of Research to State-related Topic

Young adults are most vulnerable to get infected by HPV because of lack of knowledge and lack of motivation to protect themselves. Increasing HPV vaccine rate is a national priority supported by the US Department of Health and Human Services. The number of receiving HPV vaccine rates remains extremely low within the United States, regardless of advanced vaccine development. Cancer communication about HPV vaccine has been emphasized as one of the preventive measures, however, the overall rejection accompanied by ineffective communication strategies, low knowledge, misconceptions about the vaccine, and lack of motivation all works as barriers in HPV prevention uptake. With only 38.3% of girls aged 13-17 vaccinated in 2014, Kansas has the lowest state-level HPV vaccine uptake rate. Based on the findings, researchers can make the strategic design using e-Health strategy to promote and motivate young people for vaccine and screen test as preventive measures of HPV and cancer.

SOCIAL MEDIA USAGE AND HELP-SEEKING BEHAVIOR FOR MENTAL HEALTH AMONG COLLEGE STUDENTS

Ting Li and Nancy Muturi

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BACKGROUND AND PURPOSE: Depression is the most prevalent and well-documented psychological disorders among young adults in the U.S. The 2008 National College Health Assessment sponsored by the American College Health Association report shows that more than one in three undergraduates reported “feeling so depressed it was difficult to function” at least once in the previous year. However, research show that the utilization of mental health services by college students is limited. This is partially due to inadequate health literacy, social stigma, and low self-efficacy. The purpose of the study is to investigate students’ utilization of mental health services and factors associated with their likelihood for online help-seeking. The study also examines their social media usage and how it is associated with their likelihood for online help-seeking for mental health purposes. **METHOD:** Based on Social Cognitive Theory, an online survey was conducted among college students (N=304). Key variables included knowledge about depression, self-efficacy, aculturation level, social stigma, social media usage and likelihood of online help-seeking for mental health. **RESULTS/FINDINGS:** The results show moderate knowledge of depression (Mean=5.96/10). Social stigma was negatively associated with likelihood for ($r=-.206^{**}$, $p=.001$). Furthermore, social media usage is significantly correlated with likelihood of online help-seeking ($r=.187^{**}$, $p=.002$). T-test results show significant differences in knowledge, likelihood for online-help seeking, stigma between domestic and international students ($p<.05$). **CONCLUSION:** The study recommends enhancing knowledge and utilizing social media to communicate about mental health especially among young and vulnerable populations.

Relevance of Research to State-Related Topic(s)

In 2011, the Bureau of Health Promotion (2013) reported that 15.9% of adults aged 18 years and older in Kansas had doctor diagnosed depressive disorder (including depression, major depression, dysthymia, or minor depression), while about 22.8% of adults in the state had mild to severe depression. Additionally, treatment can help 80% of those with depression and can enable people to return to satisfactory, functioning. Consequently, prevention among young and vulnerable population is more cost effective. For college student, treatment by school institution can be seen as a very convenient method for seeking mental health care. So it is important to communicate about the disease and the availability of the treatment services especially within educational institutions. The study recommends tailoring a communication strategy to include social media for educating college students the accessibility of the services and to enhance understanding of depression and other mental health disorders affecting young adults.

UNDERSTANDING BARRIERS TO PHYSICAL ACTIVITY AMONG AFRICAN AMERICAN WOMEN: A COMMUNICATIONS PERSPECTIVE

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BACKGROUND AND PURPOSE: Obesity is a serious public health problem affecting more than one-third of the U.S. Population. African American women are disproportionately impacted where four out of five women are either overweight or obese (Schiller, Lucas, & Pereogy, 2013). Some of the risk include inadequate physical activity due to behavioral, environmental and personal factors. Based on Social Cognitive Theory, this study mainly examined barriers for physical activity among African American women in personal, environmental and behavioral aspects. **METHOD:** Data were gathered anonymous among African American women Kansas through an online survey via Qualtrics (n=130). The target age group was 39 – 64 years. **RESULTS/FINDINGS:** Results show that self-efficacy is correlated with physical activity level ($r=.430$, $p=.000$), and social support was also correlated to physical activity ($r=.241$, $p=.010$). Additionally, there is a significant correlation between social support and self-efficacy ($r=.348$, $p=.000$). Some barriers to physical activity engagement that concern African American women included social perceptions ($M=3.19$, $SD=1.50$), body figure ($M=3.15$, $SD=1.26$) and affordability or physical activity services ($M=3.52$, $SD=1.42$). On a scale of 1 to 5, their strongest outcome expectation is reducing stress ($M=4.61$, $SD=0.78$), followed by building strength ($M=4.50$, $SD=0.72$), and improving flexibility ($M=4.45$, $SD=0.73$). **CONCLUSION:** Findings from this study indicate that to improve African American women's participation in physical activity, there is a need to improve their social support, knowledge, and self-efficacy while addressing the barriers. Further, this study recommends examining the most appropriate media and communication channels to reach this target group with culturally appropriate messages.

Relevance of Research to State-Related Topic(s)

Kansas has the 19th highest adult obesity rate in the U.S., specially among Black Americans. In 2005, the adult obesity rate for Blacks was 39.2% while the rate for Whites was 29.2% in Kansas (1). Accordingly, this study relates directly to physical activity engagement, which significantly impacts the health condition of American American women in Kansas, especially obesity and resultant chronic disease. This study also identifies barriers to physical activity and entry points to encourage African American women to break down those barriers. Results will help inform public health practitioners in Kansas the barriers and outcome expectations of African American women concerning physical activity, to let them help African American women increase knowledge, self-efficacy, and social support concerning physical activity, ultimately decreasing obesity rates in Black community in Kansas, and promoting the health condition and life quality of African American women in Kansas.

INFORMING ON COMMUNITY HEALTH THROUGH PODCASTING: AN EXPLORATORY STUDY

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BACKGROUND: Awareness of community health issues is necessary for networks to mobilize and take civic action. However, achieving awareness is challenged by the erosion of local journalism. Podcasting is a popular new medium for content delivery which could be utilized to fill this void. This study will explore public perceptions of utilizing podcasting to deliver hyperlocal community health information in Riley County, KS. **METHOD:** Using mixed-methods, we will survey a representative sample of local residents in Riley County, KS to assess information consumption habits, including use of new media. In focus groups, participants will react to a sample podcast and discuss civic engagement in the community. **RESULTS:** First, we expect that respondent's civic engagement on key community health issues will be directly related to awareness of those issues, lack of time, or knowledge of opportunities to be involved. Second, we expect that awareness will be moderated by the sources from where they get their community information. Third, we expect that use of new media as a source of community information will be correlated with age. **CONCLUSION:** This study will provide a framework to guide the development of a community health focused podcast in Riley County, KS. This podcast may ultimately contribute to a heightened sense of community and inspire civic engagement that results in more effective public health policies. It may also serve as a template for other communities seeking to address deficits in hyperlocal community health information delivery.

Relevance of Research to State-Related Topic(s)

This study will lay the groundwork for developing a community health focused podcast which seeks to address the problem of limited reporting on local health issues in legacy media. Hyperlocal news reporting is essential to mobilizing communities to address issues that may not be undeniably visible. The template that the study will provide can be utilized in communities around Kansas to inspire civic engagement that leads to more effective public health policies for all Kansans.

ENHANCE HEALTH WITH A NEW EVIDENCE-BASED TREATMENT FOR DEPRESSION

Tom Su and Chelsea Spencer

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BACKGROUND AND PURPOSE: Depression, a debilitating illness, is linked to major problems, such as, obesity and suicide. In the U.S., 18.8 million adults suffer from depression annually. Depression costs the U.S. more than \$34 billion a year in absenteeism, reduced productivity and treatment. There is a need for more effective treatments beyond the standard Cognitive Behavioral Therapy (CBT). A treatment that has shown promise but has not been evidence-based for depression is Eye Movement Desensitization and Reprocessing (EMDR) therapy. EMDR therapy, an evidence-based treatment for trauma, uses bilateral stimulation to decrease physiological arousal. This clinical trial compared the effectiveness of EMDR therapy to CBT to treat unipolar depression. Electroencephalogram (EEG) was used to measure changes in theta cordance of which early reduction predicted treatment response to antidepressants. **METHOD:** Fourteen participants with major depression were randomly assigned to receive 10 sessions of either EMDR therapy or CBT over 5 weeks. Participants were 18 years and older. Depression and QEEG were measured at 11 time points. **RESULTS:** 1. Both treatments were effective in treating depression. 2. The significant decrease in depression in the first three sessions of EMDR therapy produced sustained results. 3. EMDR therapy decreased prefrontal theta cordance, an effect similar to anti-depressants. 4. The statistical effect size of EMDR therapy was large (2.58). **CONCLUSION:** EMDR therapy can be used to effectively treat unipolar depression. Decrease in prefrontal theta cordance may reflect changes in anterior cingulate and prefrontal cortex linked to EMDR therapy. Research with a larger sample is needed.

Relevance of Research to State-Related Topic(s)

This study is not only directly relevant to the health, productivity and longevity of Kansas residents but has the potential to reduce the cost of healthcare in Kansas. The rising rates of depression if not curbed, promises to increase the loss of productivity from absenteeism and disability. Major depression contributes to poor sleep hygiene, poor eating habits, loss of interest and energy, and the inability to focus and be productive. These symptoms are linked to major and chronic conditions. Poor eating habits can lead to obesity and poor sleep hygiene can lead to cardiac problems. The most severe effect of untreated depression is suicide. Depression can cause sustained emotional and financial strain to families and communities. Results of this study that provides preliminary evidence for the use of EMDR therapy to treat depression has the potential to improve the health of Kansas residents and reduce the long-term cost of health.

MEDIA INFLUENCE ON THE PERCEPTIONS OF ANTIBIOTIC USE IN FOOD-PRODUCING ANIMALS

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BACKGROUND AND PURPOSE: Americans are becoming increasingly removed from the agricultural industry. The continually widening gap of unfamiliarity and biased media stories have led to misconceptions in the agriculture and food industries. False advertising and marketing ploys, such as organic, natural, non-GMO and antibiotic free products have been promoted in such a way to deceive consumers into paying more for a product and making them think they are choosing a healthier and safer option. Many people rely on social media as their primary source of information and previous studies have shown the media tends to be biased and can influence individuals' opinions about certain topics. The objective of this study was to utilize a survey to assess the influence media has on perceptions of antibiotic use in food-producing animals. **METHOD:** An online survey was developed (Qualtrics, K-State) and distributed via department list serves to currently enrolled students ages 18-40. Results were summarized to evaluate potential trends among respondents. **RESULTS/FINDINGS:** Results showed that students not receiving an education in agriculture and those not raised in a rural area were less knowledgeable about the use of antibiotics in food animals and made up the majority that were against the practice. Students raised in a rural area and/or receiving agricultural education were more knowledgeable and accepting of antibiotic use in food animals. **CONCLUSION:** Improving communication among these channels will provide individuals with the correct and accurate information needed in order to gain a better understanding of food-animal production practices.

Relevance of Research to State-Related Topic(s)

The lack of antibiotic use in sick animals not only threatens the safety of our food supply but is inhumane to the animal as well. The primary goal of antibiotic use in food producing animals is to alleviate disease progression and provide a safe wholesome product that is sustainable and accepted by consumers. The judicious use of antibiotics relieves sick animals from pain and suffering and ensures animals going to harvest are healthy and free from disease. The majority of Americans rely on social media or some type of media outlet as their primary source of information. The topic of antibiotic use in food-producing animals is complex and can be difficult to understand. Social media is a communication pathway that should be used to give consumers a basic knowledge of the industry and effectively communicate antimicrobial stewardship practices currently used in food-producing animals.

INFLUENCE OF INFORMATION-SEEKING BEHAVIOR ON SUGAR-SWEETENED BEVERAGE CONSUMPTION AMONG COLLEGE STUDENTS

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BACKGROUND AND OBJECTIVE: The prevalence of obesity has been associated with the overconsumption of high-calorie diets including sugar-sweetened beverages (SSBs). This has become a more serious problem among college students due to low self-efficacy and the SSB availability within their environments. College students use different channels to seek health and nutrition information which could influence their behavior. The goal of health communication is to increase awareness of risks of SSB consumption and to motivate behavior change. This study examined the effect of health and nutrition information-seeking from media and interpersonal communication channels on overall SSB consumption among college students. Such understanding is necessary in designing obesity prevention campaigns. **METHODS:** An online self-reported questionnaire was administered to college students (N=539). Key variables included socio-demographics, health and nutrition information seeking behavior, and SSB consumption. **RESULTS:** Results show that socio-demographics and health information seeking behavior had a significant influence on overall SSB consumption ($p < 0.05$). Of the socio-demographics, gender ($\beta = -0.143$, $t = -3.394$, $p < 0.05$) and education level ($\beta = -0.194$, $t = -2.550$, $p < 0.05$) were significant predictors for the overall consumption of SSB. An examination of information-seeking behavior showed that media (radio, internet, magazine, and television) sources had a significant effect on the overall SSB consumption ($\beta = 0.099$, $t = 2.148$, $p < 0.05$); however, no significant effect was found from interpersonal communication channels (public events, nutrition experts, hospital/clinic, friends/family, and church/community organization) ($p = 0.124$). **CONCLUSION:** Distributing nutrition and health information through media may be an effective way to increase awareness of risks associated with SSB consumption and reduce overall consumption of SSB compared to interpersonal communication channels.

Relevance of Research to State-Related Topic(s)

Kansas has the 22nd highest adult obesity rate in the nation (1). Prevention of obesity has become one of the most important public health issues in the past decade. The transition from high school to college is a critical period which is associated with many lifestyle changes, such as changes in eating and drinking habits. Because of the large amount of calories in SSBs and the relationship between consumption of these drinks and weight gain, reducing SSBs may be one of the effective opportunities to decrease the overall risk of developing certain chronic diseases, such as obesity. This research aims to find out the factors that impact SSB consumption among college students and makes recommendation for evidence-based communication strategies. Results will also inform nutrition educators with the development of educational materials to strengthen their self-efficacy and reduce their intention to drink SSBs, ultimately preventing the development of chronic diseases.

DEVELOPMENT AND VALIDATION OF MULTIPLEX PCR ASSAYS TO IDENTIFY SEROGROUPS OF NON TOP-7 SHIGA TOXIN-PRODUCING *ESCHERICHIA COLI* AND DETERMINATION OF THEIR PREVALENCE IN CATTLE FECES

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BACKGROUND AND PURPOSE: Shiga toxin-producing *Escherichia coli* (STEC) are major food borne pathogens that induce a range of responses from mild to bloody diarrhea, to kidney failure, and even death, particularly in children. Seven types of STEC that include O26, O45, O103, O111, O121, O145 and O157, often called ‘top-7’, cause most human infections. Cattle are a major reservoir of the top-7 STEC. The organisms reside in the hindgut and are shed in the feces, which is a major source of food and water contaminations. Cattle carry as many as 113 additional types of STEC, and some have been associated with human infections. Traditionally, *E. coli* typing is done by an immunological assay, performed by few reference laboratories. Therefore, our objective was to develop a molecular method (polymerase chain reaction; PCR), readily adaptable to any laboratory. **METHOD:** Eleven multiplex PCR (mPCR) assays were developed and validated to detect 113 types of ‘non-top-7’ STEC. We utilized the assays to identify the *E. coli* isolated from feedlot cattle feces (n=359) that did not belong to the top-7. **RESULTS/FINDINGS:** Out of the 113 types, we have determined that there are six dominant non top-7 STEC (O2, O74, O109, O131, O168, and O171). We developed a mPCR assay to detect the prevalence of the dominant non-top-7. The prevalence of the six serogroups in cattle feces were O109 (88.9%), O171 (82.0%), O168 (70.6%), O2 (51.5%), O74 (18.6%), and O131 (2.0%).

Relevance of Research to State-Related Topic(s)

With over twice as many cattle as there are humans in the state of Kansas, it is safe to say that beef safety is an important topic to address. Additionally, per Kansas Ag Statistics, cattle generated 7.8 billion in cash receipts in 2016, making cattle an economic priority in the state. Cattle carry and shed Shiga toxin-producing *Escherichia coli* (STEC) which is a source of food and water contaminations. According to the Centers for Disease Control and Prevention, seven types of STEC cause most human infections. We have shown that cattle carry 113 additional types of STEC. Although the 113 types are not commonly associated with human infections, they carry the genetic information to produce the toxin, like the top-7 STEC, making them a potential threat to human health. An example of how significant a non top-7 STEC outbreak can be was demonstrated in Germany in 2011 when *E. coli* O104:H4 killed 50, led to kidney failure in 908, and in total, infected over 4,000 persons. Development of our assay allows us to be prepared if, and when, non-top-7 STEC cause human infection.

ROLE OF THE GUT MICROBIOME IN RESPONSE TO VACCINATION AND VIRAL RESPIRATORY INFECTION IN GROWING PIGS

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BACKGROUND: Porcine reproductive and respiratory syndrome virus (PRRSV) and porcine circovirus type 2 (PCV2) are two of the most costly diseases affecting the swine industry, resulting in respiratory disease and reduced growth. PRRSV vaccines are used to reduce PRRS-associated losses; however, the currently available vaccines are considered inadequate for disease control. Previous work has shown that the gut microbiome, or collection of microorganisms in the gastrointestinal tract, is associated with weight gain following PRRSV/PCV2 co-infection in unvaccinated pigs. **OBJECTIVE:** To determine if the gut microbiome is associated with weight gain in pigs immunized with a PRRS vaccine followed by PRRSV/PCV2 co-infection. **METHODS:** Twenty-eight days post-vaccination and at the time of PRRSV/PCV2 challenge, fecal samples were collected from 50 pigs. At the conclusion of the study, 20 pigs were retrospectively identified as having high or low growth rates during the co-infection period and fecal microbiomes were characterized using a microbial detection array. **RESULTS:** Average daily weight gain was significantly higher in high growth rate pigs. At the level of the fecal microbiome, several bacteria were found at a higher rate in high growth rate pigs and may be beneficial for improving the growth response during vaccination and viral infection; specifically, increased species in the genera *Megasphaera*, *Spirochaeta* and *Prevotella* as well as increased Clostridiales species were detected in high growth rate pigs. **CONCLUSION:** Microbiome composition may improve PRRSV vaccine efficacy and disease response during PRRSV/PCV2 co-infection. Ultimately, modulating the piglet microbiome to have beneficial characteristics may be an alternative tool for disease control.

Relevance of Research to State-Related Topic(s)

In 2016, Kansas producers sold over 3.3 million pigs with a market value of approximately \$428 million. These hogs produced over 600 million pounds of pork which fed millions of people in Kansas, the U.S. and abroad. PRRS is the most costly disease to swine production, estimated to cost \$664 million annually to the U.S. industry. PRRSV and PCV2 infections increase antimicrobial usage in pigs due to reduced growth, compromised immunity, secondary bacterial infections, and respiratory disease. Alternative tools are needed to control PRRS due to the lack of effective vaccines and the need for reducing and/or eliminating antimicrobial administration in food-producing animals. The gut microbiome is a promising alternative tool for PRRS control, due to its important role in both immunity and weight gain. Our research provides evidence for the potential application of the microbiome as an alternative tool for improving response during PRRSV vaccination and infection.

THE 5'-POLY(A) LEADER OF POXVIRUS MRNA CONFERS A TRANSLATIONAL ADVANTAGE THAT CAN BE ACHIEVED IN A CAP-INDEPENDENT MANNER

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BACKGROUND AND PURPOSE: The 5'-poly(A) leader at the 5'-untranslated region (5'-UTR) is an unusually striking feature of all poxvirus mRNAs transcribed after viral DNA replication (post-replicative mRNAs). These poly(A) leaders are non-templated and of heterogeneous lengths; and their function during VACV infection remains a long-standing question. **RESULTS/FINDINGS:** Here, we discovered that a 5'-poly(A) leader conferred a selective translational advantage to mRNA in poxvirus-infected cells. A constitutive and uninterrupted 5'-poly(A) leader with 12 residues was optimal. The 5'-UTR A-tract also could increase protein production in the bacteriophage T7 promoter-based vaccinia virus expression system, the prototypic member of poxviruses. Interestingly, although vaccinia virus post-replicative mRNAs do have 5'-methylated guanosine caps and can use cap-dependent translation, in vaccinia virus-infected cells, the 5'-poly(A)-mediated translational advantage could be achieved through cap-independent translation. Moreover, the cap-independent translation was not mediated through an internal ribosome entry site (IRES). **CONCLUSION:** These results point to a fundamental mechanism poxvirus uses to efficiently translate its post-replicative mRNAs.

Relevance of Research to State-Related Topic(s)

Poxviruses continue to impact public health significantly, despite the eradication of smallpox, the deadliest disease in human history. The findings from the current study should facilitate targeting of poxvirus translation for the development of novel antiviral strategies. As a tool, poxviruses are being engineered to treat various infectious diseases and multiple cancers. The poly(A) leader can also be used to increase foreign gene expression when using the bacteriophage T7 promoter-based poxvirus expression systems. And, overexpression of foreign gene has many applications in cancer and vaccine field.

**IMMUNOGENICITY CHARACTERIZATION OF INTRADERMALLY IMMUNIZED
ENTEROTOXIGENIC *ESCHERICHIA COLI* (ETEC) SUBUNIT VACCINE
CANDIDATES**

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BACKGROUND AND PURPOSE: Enterotoxigenic *Escherichia coli* (ETEC) are the most common bacterial cause of diarrhea. ETEC bacterial adherence to the small intestine epithelial cells and delivery of enterotoxins cause diarrhea in humans and animals that leads to watery diarrhea and deaths. Currently, there are no vaccines available. It has been demonstrated that toxoid fusion 3xST_{aN12S}-dmLT, adhesin MEFA CFA/I/II/IV, and toxoid-adhesin MEFA CFA-3xST_{aN12S}-dmLT induced neutralizing antitoxin and/or anti-adhesin antibodies in intraperitoneally (IP) or subcutaneously (SC) immunized mice, or intramuscularly (IM) immunized pigs, suggesting these antigens potential candidacy for development of ETEC subunit vaccines. However, these antigens have not been examined in intradermal (ID) route, a route perhaps is more suitable for human vaccine administration. **METHOD:** In this study, we ID immunized mice with toxoid fusion 3xST_{aN12S}-dmLT, the CFA MEFA, alone or combined, toxoid-adhesin MEFA CFA-3xST_{aN12S}-dmLT, and characterized antigen-specific antibody responses. **RESULTS:** Data showed that mice ID immunized with the toxoid fusion antigen developed anti-LT and anti-ST_a antibodies, and mice immunized with the CFA MEFA developed antibody responses to all seven adhesins (CFA/I, CS1-CS6). In addition, mice co-administered with the toxoid fusion and the CFA MEFA, or with toxoid-adhesin MEFA CFA-3xST_{aN12S}-dmLT developed antibodies to both toxins and all seven adhesins. Antibody neutralization studies of the serum samples of the immunized mice showed induced antibodies neutralized enterotoxicity of LT and ST_a and/or inhibited adherence of ETEC or *E. coli* bacteria producing any of these seven adhesins. **CONCLUSION:** These data confirmed immunogenicity of these ETEC subunit vaccine target antigens and provide useful information for vaccine development against ETEC diarrhea.

Relevance of Research to State-Related Topic(s)

Enterotoxigenic *Escherichia coli* (ETEC) are the bacterial cause of diarrhea in humans and animals, the disease is prominent worldwide. In underdeveloped countries they are facing deaths in children and adult travelers, due to lack of sanitation or consumption of contaminated food. Meanwhile, developed countries are facing a more economical problem such as swine dying from post weaning diarrhea. Currently, there is no vaccine available. Therefore, my research aims to find a new administration route and compare with previously used routes (intraperitoneal and subcutaneous) to see which one will induce the best immune response, while using the least amount of antigen. My research investigates the immune response of previously used subunit vaccines: toxoid fusion 3xST_{aN12S}-dmLT, adhesin MEFA CFA/I/II/IV, and toxoid-adhesin MEFA CFA-3xST_{aN12S}-dmLT using intradermal (ID) route.

MUSCLE MEETS IMMUNITY: USING THE FRUIT FLY MODEL TO UNDERSTAND BIOLOGICAL INTERSECTIONS

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BACKGROUND AND PURPOSE: In humans, muscle tissue damage elicits immune responses that cause immune cells to invade tissue and induce inflammation. Short periods of immune activation can restore tissue health, but long-term stimulation of immune responses can cause tissue damage and aid in the progression of muscular dystrophies and other muscle diseases. We are harnessing the genetic toolkit of the fruit fly model, *Drosophila melanogaster*, to understand the connection between muscle function and immune signaling. Our initial research into these processes found a specific set of secreted proteins normally involved in clotting could also be incorporated into the attachment sites of larval muscles. At muscle attachment sites (MASs), proteins organize into complex structures known as the extracellular matrix (ECM) to form dynamic, yet stable connections that can persist withstand muscle contraction over time. **RESULTS/FINDINGS:** Loss of one of these proteins called Fondue (Fon) results in catastrophic deficits to ECM integrity, causing muscles to detach from one another during development. During the course of these studies, we observed that loss of the *fon* gene overactivates the conserved Toll pathway resulting in phenotypes such as spontaneous melanization at MASs and continual expression of the antimicrobial peptide *drosomycin*. Genetic studies revealed that *fon* interacts with several members of the Toll pathway including, Spatzle-processing enzyme (*SPE*), the NFκB inhibitor *cactus*, and NFκB (*dorsal*). **CONCLUSION:** We propose that tissue stresses caused by altered mechanical forces of weakened and damaged MASs leads to overactivation of Toll signaling and the progression of muscle disease.

Relevance of Research to State-Related Topic(s)

While we have made many advances in muscle-related treatments, scientists and clinicians lack a comprehensive understanding about what leads to various muscle diseases. However, a trend can be seen between prolonged immune activity and muscle diseases in human muscular dystrophies (MDs) and MD mouse models. The fruit fly is an advantageous model for uncovering and dissecting shared genetic pathways important for overall muscle health in *Drosophila* and humans. By studying the overlap between immune processes and healthy muscle maintenance in this model, we can elucidate important biological targets to be pursued in novel therapies. Working in concert with the broader research community, our contributions to basic biomedical knowledge will begin to improve the care and outlook of Kansans with muscle-related injuries and disease.

INVESTIGATION OF PHYSICOCHEMICAL PROPERTIES OF MOLECULES IN GRAM- NEGATIVE BACTERIAL PENETRATION

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BACKGROUND AND PURPOSE: The development of drug resistance among gram-negative bacteria (GNbac) has precipitated a looming global health crisis and the threat of a world without effective treatment for infections. GNbac has a highly regulated cellular structure, a dual membrane with an impermeable lipopolysaccharide layer. This structural barrier makes it difficult for antibiotics to cross but also accumulate, and thereby greatly reducing their antibacterial properties.. Most antibiotics cross the cell envelope through transmembrane channel porin and drug resistance occurs mainly due to the selectivity of porin channel transport. Traditional antibacterials are rendered ineffective under these circumstances; however, investigating physicochemical properties of molecules which aid in penetration of GNbac may yield novel therapeutics to combat resistant infections. **METHOD:** Brocazine G is a thiodiketopiperazine natural product which has a potent MIC value of 0.25 $\mu\text{g}/\text{mL}$ against the GNbac *Staphylococcus aureus*. Our laboratory devised a total synthesis route to access brocazine G, due to its potency and intriguing polycyclic core structure. We expect to access a unique set of small molecules with varying physicochemical properties with the aim of understanding how transport via porin-channels occurs. **RESULTS/FINDINGS:** Total synthesis of brocazine G is underway and a new class of screening libraries has been accessed to investigate how GNbac penetration is governed by specific physicochemical properties. **CONCLUSION:** Physicochemical properties such as $\text{cLogD}_{7.4}$ and MW are important for GNbac penetration, however, they cannot solely explain the penetration process. The three-dimensional orientation of each molecule as well as how other physicochemical properties effect GNbac penetration will be investigated.

Relevance of Research to State-Related Topic(s)

Drug resistant gram-negative bacterial (GNbac) infections represent a critical human health issue in Kansas primarily due to misused antibiotics. Methicillin-resistant *Staphylococcus aureus* (MRSA) and *Clostridium difficile* related deaths greatly increased in recent decades throughout Kansas, incurring costs upwards of \$3500 per patient according to the Centers for Disease Control and Prevention. These trends have also disrupted major economic activity within Kansas Agriculture, of which, ~60% is comprised of livestock such as cattle and calves. Many farmers depend on antibiotics to prevent and cure GNbac infections in their livestock. Unfortunately, the continuous decrease in antibiotics capable of crossing the GNbac cell membranes due to antibiotic resistance has made our efforts in increasing the effective penetration of antibiotics a critical health mission.

RELIABILITY OF PORTABLE ULTRASONOGRAPHY IN EXAMINING PENNATION ANGLE OF THE BICEPS FEMORIS AT DIFFERENT JOINT POSITIONS

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PURPOSE: Portable ultrasonography (US) is a useful tool for assessing changes associated with aging, immobilization, and neuromuscular diseases. Pennation angle (PA) is the orientation of the muscle fascicle to the tendinous axis. The current study investigated the reliability of US measurements of PA of the biceps femoris (BF) at different knee joint positions [i.e., 90°, mid-(Mid_{ROM}), and end-range of motion (End_{ROM})]. **METHODS:** Seventeen females (mean±SD: age=21.12±0.78) volunteered on 2 non-consecutive days. Participants were placed in a supine position, with the right hip and knee joints at 90°. Full ROM was established from 90° hip/knee joint angles and passively extending the leg to the point of self-reported End_{ROM}. US measurements of the right BF were obtained at 90°, Mid_{ROM}, and End_{ROM} joint positions. US settings included: gain (50dB), depth (8cm), and frequency (12MHz). Longitudinal US images were captured between the greater trochanter and the lateral joint line of the knee. Reliability for PA was determined using intraclass correlation coefficient (ICC, model 2,1) and standard error of measurement as a percentage (SEM%). Systematic variability was examined using separate one-way repeated measures analyses of variance (ANOVAs). **RESULTS:** The ANOVAs indicated no systematic variability in any of the dependent variables (P>0.05). The ICCs (90°=0.735, Mid_{ROM}=0.664, End_{ROM}=0.311) and SEM% values (90°=17.38%, Mid_{ROM}=11.75%, End_{ROM}=26.41%) ranged from 0.311-0.735 and 11.75-26.41% for PA measurements of the BF. **CONCLUSION:** Portable US may be consistent and a moderately reliable technique for measuring PA in practical joint positions (90°) but not as the muscle fascicles become lengthened (Mid_{ROM} and End_{ROM}).

Relevance of Research to State-Related Topic(s)

Assessments of muscle architecture may provide information directly related to musculoskeletal pathology and function. Changes in muscle architecture as a result of disuse, injury, or neuromuscular disease can affect a variety of populations across the age-span. Undiagnosed architectural-related pathology may predispose individuals for further injury and decrease the overall quality of life. This research provides support for a reliable, cost-effective method of assessing muscle structure and diagnosis of musculoskeletal injuries. Portable ultrasonography may be utilized in rural communities across Kansas, where the expense of travel to large municipal clinics and associated costs may not be financially feasible. This would ultimately improve the access to quality care for Kansans statewide. Central to the legislative system, this research could be utilized at the house level by the Health and Human Services Standing Committee, as well as at the Senate level within the Public Health and Welfare Standing Committee.

EXTRACELLULAR VESICLES FROM FETAL BOVINE SERUM AND HUMAN PLATELET LYSATE MODIFY MESENCHYMAL STROMAL CELL GROWTH

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BACKGROUND: Mesenchymal Stem Cells isolated from Human Umbilical Cords (HUC-MSCs) secrete extracellular vesicles (EVs) that are being investigated for their potential local and remote signaling capabilities. EVs are suspected to be an important form of communication between individual cells within the body, and may regulate the growth rate and differentiation of other cells. Our lab isolates and grows HUC-MSCs which are usually cultured in media containing either Fetal Bovine Serum (FBS) or Human Plasma Lysate (HPL). FBS and HPL provide important growth factors, but their use creates a potential safety concern for applications in future human cell therapy. Here we investigate whether EVs have the potential to support MSC growth and viability without introducing safety concerns. **METHOD:** Cell growth and viability were tracked using two different media, with and without EVs, and were characterized for their size and zeta-potential. **RESULTS:** Our study shows a biologic effect of EVs from FBS and HPL on MSCs in cell culture using different culture media. **CONCLUSIONS:** The type of medium supplementation affects MSC's response to EVs.

Relevance of Research to State-Related Topic(s)

Adult stem cell research and clinical trials are ongoing areas of interest in the State of Kansas and especially at Kansas State University College of Veterinary Medicine. Research by Drs. Weiss, Troyer and Davis, has resulted in patents on the isolation, characterization, culture and clinical trials of MSCs. This discovery has tremendous potential for stem cell research and human clinical application. The Weiss lab collaborates with other researchers within the State and beyond to promote and advance adult stem cell research. Our study furthers development of safe, effective, and scalable culture methods necessary to produce the numbers and quality of cells necessary for effective treatment of many difficult and refractory diseases encountered in both human and veterinary medicine.

EVALUATION OF COMPETITIVE ELISA FOR DETECTION OF ANTIBODIES TO RIFT VALLEY FEVER VIRUS IN CATTLE AND SHEEP SERA

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BACKGROUND AND PURPOSE: Rift Valley fever virus (RVFV), a mosquito-borne zoonotic pathogen of genus *Phlebovirus* (order: *Bunyavirales*; family *Phenuiviridae*) is endemic to sub-Saharan Africa that has spread beyond the continent to the Arabian Peninsula. RVFV is a negative-sense RNA virus that causes mass abortions in ruminants and febrile illness to hemorrhagic fever that can lead to death in humans. The high likelihood of RVFV's spread to non-endemic countries spurs the need for rapid diagnostics and surveillance tests. In this study, we assessed the efficacy of the Veterinary Medical Research & Development's (VMRD) recombinant RVFV nucleoprotein based competitive ELISA (cELISA) assay to detect RVFV antibodies in cattle and sheep sera. **METHOD:** We used heat inactivated serum samples (cattle=66, sheep=99) that were experimentally infected with a candidate RVF vaccine or virulent RVFV strains and known RVFV negative sera (cattle=330, sheep=77). We compared the cELISA results using the recommended cut-off value of 60% to results from a plaque reduction neutralization test (PRNT₈₀), the gold standard method for the detection of anti-RVFV neutralizing antibodies. **RESULTS:** Antibodies to RVFV were first detected at 5 days post inoculation (dpi) in both sheep and cattle. Using the cut-off of $\geq 1:40$ for PRNT₈₀, the c-ELISA test has a sensitivity of 95.0% and a specificity of 99.2%. Interestingly, the cELISA detected antibodies in 2/5 samples from 5 dpi RVFV inoculated animals in comparison to 1/5 by PRNT₈₀. **CONCLUSION:** We found the VMRD cELISA to be an easy, cost effective, and safe test for the detection of antibodies to RVFV in cattle and sheep.

Relevance of Research to State-related Topic(s)

Kansas is the third largest cattle producer state in the USA. Livestock accounts for about 60% of agricultural revenue generated in Kansas. Rift Valley Fever, a disease that is causing losses of thousands of livestock and millions of dollars annually in endemic areas has spread out of its endemic zone. Not only has it the possibility to spread to Europe and the United States but it could also be misused as a biological weapon. Introduction of such a disease in Kansas would have devastating societal impact, affecting animal and human health and causing significant economic losses. Given the urgent need to develop efficient and time-saving RVFV diagnostic tools, this cELISA is an excellent diagnostic and surveillance assay for RVFV due to its simplicity, cost, reliability, sensitivity, and specificity.

6-THIOPURINE: UNDERSTANDING THE MODE OF TOXICITY THROUGH EXPLORING BILIRUBIN EXCRETION PATHWAY

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BACKGROUND AND PURPOSE: 6-thiopurine (6TP) is a potent therapeutic agent in the treatment of acute lymphoblastic leukemia. While 6TP has shown great treatment towards this deadly disease, it also has toxicity that prevents its continual administration. The major side effect associated with 6TP treatment is jaundice and hepatotoxicity, both of which comes from increased concentration of bilirubin within the blood. As a result of this deadly toxicity, 6TP needs to be administered in an on and off treatment regimen to allow recovery from the toxicity. Said regimen greatly reduces 6TP effectiveness in the remission of leukemia. Noting that 6TP administration results in the onset of jaundice, we hypothesize that this is from the direct inhibition of the enzyme UDP-glucose dehydrogenase, biological enzyme responsible for formation of UDP glucuronic acid (substrate for bilirubin glucuronides) and thereby decreasing the conjugation of bilirubin to its water-soluble glucuronide form for excretion. **METHOD:** To date we have investigated the 6TP and its biological metabolites associated toxicities on bilirubin excretion pathway both in vitro and in vivo. **RESULTS/FINDINGS:** It has been found that UDP-glucose dehydrogenase is inhibited by 6TP and its metabolites while UDP-glucuronosyl transferase enzyme is unaffected both in vitro and in vivo. **CONCLUSION:** Through understanding how 6TP and its biological metabolites cause jaundice, structure-activity relationship studies within 6TP can be undertaken that will allow the construction of a new class of 6TP compounds with lower, if not eliminated toxicities to be used against leukemia and other cancer through our newly developed delivery vehicles.

Relevance of Research to State-Related Topic(s)

According to the Kansas Cancer Registry, over 200,000 invasive cancer cases have been reported between 1999 to 2014. While new innovative forms of cancer treatment are being discovered each day, Kansas is currently not leading the charge in these efforts. Limited financial resources greatly restrict research being done to combat cancer in our great state. Our group aims at developing new cancer therapies with the resources given to us in the aims of increasing our federal funding, cancer research productivity, and most importantly the health and lives of Kansans. In our current work, we have not only identified the key enzymatic step preventing the use of 6-thiopurine as a general anti-cancer therapy, but have developed new means at delivering this safe saving drug. Through our efforts, we not only aim at increasing Kansas's role in the fight against cancer, but also increase public understanding through education and outreach.

DETECTING SUGARCANE APHID (*MELANAPHIS SACCHARI*) INFESTATION IN GRAIN SORGHUM (*SORGHUM BICOLOR*) USING LEAF SPECTRAL RESPONSE

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ACKGROUND AND PURPOSE: Sugarcane aphids (*Melanaphis sacchari*) have recently become a serious pest to sorghum in the United States. This is especially problematic in Kansas as alates, winged aphids, migrate in during the summer and reproduce exponentially on susceptible sorghum. Fields that are not regularly monitored and treated with insecticide, when densities reach damaging levels, cause growers to lose up to 70% yield. Current monitoring practices for sugarcane aphids (SCA) require large amounts of field sampling twice a week to obtain an accurate estimate of aphid densities. This process is time consuming and not practical for high acreage fields. Our objective is to develop more efficient monitoring techniques for SCA by using hand-held leaf reflectance sensors to determine infestation levels. We propose that changes in SCA density cause detectable changes in spectral response by sorghum that can be measured locally, near the feeding site, and systemically, plant-induced response. **METHOD:** Sugarcane aphids were placed in leaf cages at high, low, and zero densities. A leaf spectrometer, 350-1044 nm range, was used to detect plant spectral response to aphid feeding at the site and distant to infestation. **RESULTS AND CONCLUSION:** It was determined that SCA feeding at varying infestation levels on sorghum plants can be detected using a leaf spectrometer. This project is an important first step in developing larger field level monitoring techniques as it can be applied to unmanned aircraft systems. The goal is to improve sampling efficiency and overall decision making for this invasive species, and reduce potential yield losses for growers through timely decisions

Relevance of Research to State-Related Topic(s)

Agricultural pest management is a critical field of study for controlling detrimental pest species. The sugarcane aphid (*Melanaphis sacchari*) feeds on sorghum and has become a wide-spread and economically damaging pest. Populations can grow exponentially and completely devastate crops if not treated with insecticides before densities reaches damaging levels. For this reason, my research is focused on developing more efficient monitoring techniques for this pest that will allow growers to make informed decisions on when to treat their fields. This project is aimed at using hand-held leaf spectrometers to detect levels of aphid densities and whether aphids can be detected at the site of feeding and distally. This is a first step in efficient monitoring techniques that can be applied to other devices such as unmanned aircraft systems. It is important research that aims to decrease yield loss and thereby economic loss to growers due to this devastating pest.

SOIL MICROBIAL COMMUNITY SHIFTS DUE TO DIFFERENT FIRE SEVERITIES

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BACKGROUND AND PURPOSE: Wildfires burn large areas of forested land annually, and the frequency of these fires is projected to increase. This study compares fires of differing severities and their impacts on soil microbes. This study aims to gain deeper insight on the dynamics of soil microbial communities following an extreme high severity fire event. **METHOD:** Ten pairs of plots were established in the Pringle Falls Experimental Forest in Oregon. For each pair, one plot served as a background control (low severity burn), whereas another mimicked a whole log combustion and included logs piled in 1.5m x 8m x 1m structure for added fuel (high severity burn). The soils were sampled from 0-10cm in depth at each plot before the burn, one week after the burn and 2 and 4 years after the burn. DNA was extracted from these soil samples, and DNA-barcode regions (ITS2 for fungi; 16S for bacteria) were PCR-amplified. Amplicons were sequenced on MiSeq Illumina platform and microbial communities compared using R. **RESULTS/FINDINGS:** Fungal communities shifted dramatically in high severity burn treatment, remained distinct from the pre-fire conditions after 2 years and we expect also after 4 years. The bacterial data analyses remain to be completed, but we expect similar responses in the high severity fires following the fire event, but with a faster recovery as a result of their faster generation time. **CONCLUSION:** Wildfires can have a lasting impact on organisms above ground; our research shows that high intensity disturbances cause a long-term impact on microbial communities.

Relevance of Research to State-Related Topic(s)

Wildfires cause huge economic and ecological losses. Understanding the microbial dynamics in the soil could lead to restoration of wildfire areas. In 2017, hundreds of thousands of acres were impacted by wildfire in Kansas. As of September 2017, there is a projected statistic of the fire season in the West being 105 days longer than usual due to increasingly dry conditions. Understanding the soil microbial communities could aid in forest management practices and restoration of burned sites.

DECADAL TRENDS OF NITROGEN CONCENTRATIONS IN PRAIRIE STREAMS

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PURPOSE: Excessive inputs of biologically-important nutrients such as nitrogen (N) may impair water quality in streams and lakes. The effects of this process, known as eutrophication, can negatively impact fisheries, recreational use of water bodies, and ecosystem services provided by freshwater systems. Our goals are to summarize long-term trends of nitrogen concentrations in a prairie stream network and highlight potential drivers of observed trends. **METHODS:** Long-term water quality data (1993-2015) were collected from Konza Prairie Long-Term Ecological Research (LTER) station. Scatterplots are used to display trends of ammonium (NH_4^+) and nitrate (NO_3^-) concentrations. Potential drivers of observed trends are identified with regression analysis. **RESULTS:** Data from multiple sampling locations on Konza Prairie show that NH_4^+ concentration has increased by approximately one order of magnitude over the past three decades, which is similar to observed trends in precipitation chemistry. In contrast, NO_3^- concentration has decreased at an agriculturally-impacted sampling location. This pattern is concurrent with increasing prairie restoration at Konza Prairie LTER. **CONCLUSION:** The increasing trend of NH_4^+ concentration at numerous locations in the Kings Creek watershed suggests this is a large-scale phenomenon with potential to affect freshwater ecosystems in the broader region. The relationship with precipitation chemistry provides evidence that this trend is related to nonpoint source inputs of N in rainfall. On the other hand, the decreasing trend of NO_3^- concentration in association with increasing prairie restoration indicates that habitat restoration could be a valuable strategy for reduction of nutrient loads in streams and lakes.

Relevance of Research to State-Related Topic(s)

Nonpoint source nutrient inputs to freshwater ecosystems are a significant threat to sustainable water supply in Kansas. The state of Kansas has a unique opportunity to benefit from water quality monitoring programs organized by Konza Prairie LTER. These programs allow examination of how land management impacts water quality, and evaluation of long-term trends in water quality that could be missed without continuous monitoring efforts. Our research shows that atmospheric deposition of N likely contributes to a long-term increase of NH_4^+ concentration in surface waters, while prairie restoration may be reducing NO_3^- concentration near agricultural areas. These decadal trends highlight separate issues that will be important influences on water quality in Kansas in the future. Effective stewardship of our freshwater resources will require action by land managers to protect riparian areas bordering streams and lakes, and public policy decisions that minimize harmful effects of atmospheric pollution at regional scales.

**EFFECT OF WESTERN FLOWER THRIPS, *FRANKLINIELLA OCCIDENTALIS*
PUPAL STAGES, PREDATOR-PREY RATIOS, AND PREDATOR-PREY NUMBERS
ON ADULT ROVE BEETLE, *DALOTIA CORIARIA* PREDATION**

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BACKGROUND AND PURPOSE: The rove beetle (RB), *Dalotia coriaria*, a commercially available soil-dwelling predator, has been reported to feed on western flower thrips (WFT), *Frankliniella occidentalis*. However, minimal information is available on RB adult predation associated with WFT. A study was conducted to assess the effect of WFT pupal stages, predator-prey ratios, and predator-prey numbers on predation efficacy (percent emergence of WFT adults) of RB adults. **METHOD:** The study was set-up as a randomized complete block design, with day as a blocking factor. Predation efficacy of RB adults was evaluated using two WFT pupal stages (prepupae and pupae), three predator-prey ratios (RB adults: WFT pupal stages—1:5, 1:10 and 1:15), and three predator-prey numbers based on 2x, 3x and 4x the above predator-prey ratios. The number of WFT adults captured on yellow sticky cards was assessed 17 days after the study was initiated. **RESULTS:** Both predator-prey ratios and predator-prey numbers significantly affected predation efficacy of RB adults. The percent emergence of WFT adults at the 1:5 predator-prey ratio (61.1%) was significantly higher than 1:10 (39.0%) and 1:15 (34.7%). Percent emergence of WFT adults at the predator-prey number associated with the 2x predator-prey ratios was significantly higher (57.0%) than 3x (37.2%) and 4x (40.6%). **CONCLUSION:** The results of our study indicate that RB is a viable biological control agent of WFT in greenhouse production systems.

Relevance of Research to State-Related Topic(s)

In my research, the target pest is western flower thrips (WFT). It is an important insect pest of horticultural crops worldwide. WFT causes direct damage to greenhouse-grown horticultural crops by feeding on leaves and flowers, as well as indirect damage by vectoring the tospoviruses. In 2006, damage to ornamental in Georgia by WFT, resulted in over \$15 million in economic losses. So WFT may be a big threat to greenhouse-grown horticultural plants' health. Therefore, greenhouse producers apply insecticides to suppress WFT populations. However, the intensive insecticides application leads to the development of insecticide resistance in WFT populations. Thus, we use one WFT predator rove beetle to manage WFT populations instead of insecticides application. So greenhouse growers may produce healthy, quality, safe and marketable horticultural crops and customers won't have safety concerns on horticultural crops in the market.

DEFINING SUSTAINABILITY: A FIELDPRINT CALCULATOR APPROACH

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BACKGROUND AND PURPOSE: Producers and consumers exhibit strong interest in sustainable crop production; however, sustainability is an ambiguous term. Field to Market a consortium of public and private entities representing the spectrum of field-to-fork developed Fieldprint Calculator, a model, to quantify sustainability for row-crop commodities. Fieldprint Calculator's responsiveness to a gradient of cropping systems needed to be evaluated. **METHOD:** Two Kansas State University dryland wheat studies were selected to act as surrogate fields to examine the model. The scope of research treatments included fertility, pesticides, plant growth regulators and management practices. Fieldprint Calculator, version 2.5, produced an extensive set of metrics for each field which were qualitatively compared. **RESULTS:** Fertility was very responsive as the model accounted for source, rate, time, and place. Secondary macronutrients and micronutrients were unaccounted for in the model. Pesticide applications were broadly defined, such as herbicide or insecticide. Pesticide composition dictates environmental impact; generic categories can skew data. Management practices relevant to Kansas dryland wheat production were subject to rigid frameworks or nonexistent. Tillage regimes were very specific and could not be tailored to capture a producer's system. Kansas producers were at a disadvantage due to terraces not being available as a conservation measure in the model, which inflated the environmental footprint and misrepresented the sustainability of Kansas dryland wheat production. The model constrained producers to one cash crop per year, which excluded double-crop systems, thereby lowering calculated sustainability. **CONCLUSION:** Fieldprint Calculator provides a reasonable characterization of producer sustainability, but still warrants further development to fully evaluate winter wheat production.

Relevance of Research to State-Related Topic

Global food security is contingent on sustainable agriculture systems. Producers and consumers want to ensure that sustainable food is produced and purchased, respectively. Sustainability remains a cryptic term and causes confusion for agriculturists and consumers. Fieldprint Calculator affords the ability to consistently and objectively assess the sustainability of row-crop production. Metrics generated by Fieldprint Calculator enable producers to determine relative efficiency compared to state and national averages. Furthermore, producers are able to distinguish specific production facets where improvement opportunities exist. In addition to empowering producers, Fieldprint Calculator allows consumers to select products that have been sustainably produced. In summary, Fieldprint Calculator's contribution to sustainability is two-fold: it allows producers to identify areas of improvement and provides transparency to sustainability. Due to the broad scope of sustainability this study has relevance to House and Senate agriculture, economic, energy, environment and natural resources committees.

OPTIMIZING THE DESIGN OF THE KANSAS MESONET ENVIRONMENTAL MONITORING NETWORK

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BACKGROUND: The Kansas Mesonet is a state-wide network of 56 environmental monitoring stations broadly used for weather and flash flood forecasting, assessment of agricultural droughts, daily farming decisions, and wildfire preparedness. Long-term, accurate, and spatially unbiased observations are critical to better understand mesoscale (~few hundred miles) environmental processes and forecast potentially hazardous events. However, the Kansas Mesonet lacks an objective method to site new stations. **OBJECTIVE:** The objective of this study is to develop an unbiased method to determine the optimal locations of new Kansas Mesonet stations. **METHODS:** The method consisted of the following steps: i) delineate all unmonitored areas across the entire Kansas Mesonet network using all possible subsets of current stations; ii) identify the largest unmonitored area; iii) find a tentative location for the new station by calculating the centroid of the largest unmonitored area. To account for hazardous environmental events potentially concentrated in specific areas of the state, we also included long-term geo-referenced records of severe thunderstorms and wildfires in our analysis. **FINDINGS:** Next station should be deployed ten miles West of Madison, KS (Greenwood county). We discovered the current largest unmonitored area matches the portion of the state with the highest wildfire frequency and is adjacent to the portion of the state with highest frequency of severe thunderstorms. **CONCLUSION:** The proposed method allowed us to objectively identify the location of the next Kansas Mesonet station. Deployment of new monitoring stations in South-East Kansas will significantly improve our ability to understand environmental processes and forecast potentially hazardous events and increase public safety.

Relevance of Research to State-Related Topic(s)

The Kansas Mesonet is the most important resource of environmental information in Kansas. The network monitors multiple soil (soil temperature, soil moisture) and weather (rainfall, wind speed and direction, solar radiation, air temperature, barometric pressure, etc.) variables used in many disciplines and by private and public institutions across the state. Applications span the agricultural sector, the energy sector, and constitutes a cornerstone of public safety by providing the underlying data for environmental research and weather forecasting. The Kansas Mesonet is an unparalleled data hub that sits at the base of and propels many of the current topics of interest by state legislators.

**FERTILIZER APPLICATION AND WOODY ENCROACHMENT ENHANCE
NITROUS OXIDE EMISSIONS FROM SOIL; ANNUAL BURNING REDUCES IT**

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BACKGROUND AND PURPOSE: Nitrous oxide, a greenhouse gas with about 300 times more warming potential than carbon dioxide, is primarily produced by the soil microbial processes of nitrification and denitrification. Frequent fire as well as fertilizer application are two common land management practices with the potential to greatly affect nitrification and denitrification, and therefore nitrous oxide production. In this study, we were interested in determining nitrification and denitrification rates in soils with a history of annual burning, annual fertilization, both, and neither. **METHOD:** The Konza Prairie Long-Term Ecological Research program has maintained a plot-level manipulation in which plots have been burned annually, fertilized annually, both, or neither for the past 30 years. We sampled each of these plots every five weeks from April to late September and determined both the nitrification and denitrification potentials of these soils using phosphate buffer extraction and acetylene inhibition technique, respectively. **RESULTS/FINDINGS:** We found both nitrification and denitrification potentials to be highest in unburned, annually fertilized plots, and lowest in annually burned, unfertilized plots. Denitrification potential was highest in June and lowest in April. **CONCLUSION:** The suppression of fire and addition of nitrogen fertilizer enhances soil nutrient content, increasing potential microbial nitrous oxide production. In contrast, annual burning removes nitrogen and promotes plant and microbial retention of nutrients over gaseous losses. This information can be used by land managers interested in reducing greenhouse gas emissions.

Relevance of Research to State-Related Topic(s)

Our research indicates that fertilizer application can increase nitrous oxide production, and significantly more so in land that has experienced decades of fire suppression and woody encroachment. According to the Kansas Department of Agriculture, 88.1% of all Kansas land is devoted farmland; therefore, the status of land management and vegetation cover on these lands may reflect a significant unrecognized source of greenhouse gas emission. Better awareness and accounting of how land management affects Kansas rangeland soil fertility and microbial activity are needed to help minimize the impact of agricultural activities on greenhouse gas production.

QUANTIFYING NITROGEN LOSSES DUE TO AMMONIA VOLATILIZATION ON WHEAT PRODUCTION

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BACKGROUND AND PURPOSE: Wheat farmers profitability can be substantially improved by reducing losses of nutrients under typical field conditions. Urea is a widely used fertilizer by wheat farmers in Kansas. Depending on the local weather and soil conditions urea is lost to the atmosphere in a process known as ammonia (NH_3) volatilization. Cold weather is widely accepted to be a less favorable for volatilization to occur, but recent studies have shown that ammonia volatilization can still be important under cold weather conditions. Therefore, this research project has the objective to evaluate nitrogen losses through ammonia volatilization and investigate its impact on wheat yields under different soil and weather conditions. **METHOD:** We carried out two field trials simultaneously: one to quantify nitrogen losses due to ammonia volatilization and other to investigate the effect of volatilization losses on wheat yields for different rates of N fertilizer in Manhattan and Solomon, KS. Two different nitrogen fertilizers were used: urea and urea treated with a urease inhibitor that reduces nitrogen fertilizer losses due to volatilization. Continuous measurements of NH_3 volatilization were taken using passive ammonia samplers and a micrometeorological approach. **RESULTS/FINDINGS:** Our results show that the ammonia volatilization losses vary over time. The volatilization losses were lower in Manhattan, but much higher at the Solomon site. The reasons for the differences among sites are probably related to soil characteristics. There was no significant difference on wheat yield. **CONCLUSION:** Losses on cold weather environments can be substantial, although further research is necessary to analyze the real impact on wheat production.

Relevance of Research to State-Related Topic(s)

Kansas the largest producer of wheat in US, and agriculture is the largest economy sector representing over 45% of the state's total economy. The vast majority of farmers applies nitrogen fertilizer on their crops. Understanding how the processes leading to nitrogen losses through ammonia volatilization and its impacts on wheat production is crucial to improve the efficiency of farms. Reducing nitrogen could lead to higher wheat yields and grain quality, expressed by high protein content, and consequently increase agriculture profitability. In addition, reducing NH_3 volatilization also has positive environmental and health impacts on Kansas communities.

EVALUATING EPHEMERAL GULLIES WITH PHOTOGRAMMETRY AND COMPUTER MODELING

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BACKGROUND AND PURPOSE: Sedimentation is a significant threat to water reservoirs and streams in Kansas. Soil erosion from upland areas and ephemeral gullies (EG) on agricultural fields contributes a substantial fraction of annual upland sediment, and does so disproportionately (relative to other sources) during higher-flow events. EGs are localized areas of soil erosion that form from concentrated water flow. There are few documented field experiments that monitor EG development. In this study, the main objectives were: (1) to assess EG-driven soil erosion by monitoring elevation changes within EGs, and (2) to evaluate factors that mainly contribute to soil loss along concentrated flow paths with a physically-based spatially distributed predictive model. **METHOD:** In this work, photogrammetry technique was used to produce high resolution 3-D images of landscape evolution and degradation within three gullies on a no-till field near Manhattan, Kansas. A high resolution full frame camera with 50mm fixed focal length lens was used to take 80 to 300 images for each 4 to 20 meter long gully. A set of 53 pins were placed as benchmarks along EGs to maintain a 60% overlap between two consecutive photographs. At the beginning of each weather season, positions of the pins were geographically surveyed with a Total Station. From summer 2016 to fall 2017, twelve photogrammetry surveys were conducted for each of the three EGs, and 3D models and point clouds were created. **RESULTS:** Based on the 3-D models, areas of soil losses and sediment accumulation, advancement of headcuts, gully widening, and channel meandering were identified and analyzed.

Relevance of Research to State-Related Topic(s)

This study will support to improve understanding of EG erosion and complement a decision-support system implemented in watershed restoration and protection strategies to enable watershed stakeholders to more effectively target and implement watershed protection and improvement plans according to in-field EG erosion. This study was supported by Kansas Water Resources Institute through USGS, 104(b) Program.

IDENTIFYING THE CLIMATE ASSOCIATED ALLELES IN WILD EMMER AND AEGILOPS TAUSHCHII

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BACKGROUND AND PURPOSE: In the face of global climate change, breeding for varieties that are better adapted to the extreme climate has become a primary components of germplasm improvement. Wild relatives of wheat are valuable source of genetic diversity, of which only a small fraction has been used in improving wheat's adaption to extreme climate like heat and drought. **METHOD:** We performed genome scan on 475 georeferenced *Triticum dicoccoides*, "AABB" genome donor, and 115 *Aegilops tauschii*, "DD" genome donor of bread wheat to identify the accessions carrying genes for adaption to extreme climate. For this we associated the patterns of genomic variation with historical climatic data from the accessions' collection sites. And used multiple genotyping platforms and bioinformatics tool to analyze the data. **RESULTS/FINDINGS:** The analyses of population structure revealed genetically distinct groups of wild emmer and *tauschii* accessions coinciding with their geographic distribution which supports the fact that these wild relatives are rich in allelic diversity. Genomic variance partitioning and environmental association scans showed that climate plays a major role in SNP variation. We identified highly significant climate-associated SNPs that are linked with the genes known to be involved in plant growth, defense and adaptation to extreme climate. We crossed the wild relatives carrying adaptive genes with hexaploid wheat to and made synthetic lines. These lines will be tested in field for drought and heat traits using high throughput phenotyping platform. **CONCLUSION:** Wild relatives of wheat provide a great reservoir for improving existing germplasm for drought and heat tolerance.

Relevance of Research to State-Related Topic(s)

Kansas is known a bread basket of the world. Kansas wheat is known for it's great quality. However, from past few years crop failure due to drought and high temperature at grain filling stage reduced the quality and quantity of Kansas Wheat. This is a collaborative effort form wheat genetisicist and wheat breeder at Kansas State University to develop a high yielding, drought and heat tolerant wheat variety for Kansas Wheat farmers.

DO WINTER CANOLA HYBRIDS AND OPEN-POLLINATED REQUIRE DIFFERENT SEEDING RATES?

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BACKGROUND AND PURPOSE: Some Great Plains winter canola producers have turned to planting in 30-in. rows as a strategy to take advantage of residue management options that facilitate planting canola in high-residue cropping systems. The objective of this study was to determine the effect of seeding rate on performance of hybrid and open-pollinated winter canola cultivars in 30-in. and 9-in. rows. **METHOD:** Experiments were conducted in 2013 to 2017 at two K-State Research and Extension facilities. Treatments were four cultivars (two hybrids and two open-pollinated cultivars) and three or five seeding rates. Fall and spring stand counts were collected to determine winter survival. Bloom notes were recorded in the spring to track crop development. **RESULTS:** Winter survival tended to increase as the number of plants present in the fall decreased. Bloom was occasionally delayed, and harvested seed moisture was greater when fewer plants were present in the spring. In 30-in. rows, seeding rate had no impact on yields when they were less than 2,000 lb acre⁻¹, but yields were reduced at extremely low or high seeding rates when yields were greater than 2,000 lb acre⁻¹. In 9-in. rows, seeding rate did not affect yields in 2014, but in 2016 and 2017, both kinds of cultivars maximized yield at 225,000 to 375,000 seeds acre⁻¹ with reduced yields at 150,000 seeds acre⁻¹. **CONCLUSION:** Although hybrids maintained greater yields than open-pollinated cultivars at sub-optimal seeding rates in 9-in. rows in 2016, yield responses to seeding rate were similar for hybrids and open-pollinated cultivars in most experiments.

Relevance of Research to State-Related Topic(s)

Agriculture plays a significant role in Kansas's economy and workforce. A large portion of land in the state is dedicated to agriculture by growing crops or animals. Farmers are the stewards of that land, therefore they try to use the best management practices to increase conservation and productivity of their land. Diversity in cropping systems is encouraged and there is currently little diversity in many Kansas crop rotations. Winter canola is an oilseed crop that can be included in a rotation with grain crops. It provides a chance to control weeds that are problematic in winter wheat and can sometimes improve wheat yields. However, winter canola can be an unpredictable crop in Kansas. This research attempts to determine some of the best management practices Kansas farmers can use to grow a more stable winter canola crop. Land stewardship would be improved along with overall Kansas agriculture.

UNRAVELING MECHANISMS INDUCING HEAT STRESS RESILIENCE IN SORGHUM DURING FLOWERING

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BACKGROUND AND PURPOSE: Sorghum is one of the most heat tolerant grain crop. However, it is also sensitive to the high temperature stress in its reproductive stage especially during flowering. This study was conducted to understand the mechanism sorghum follows for its resilience/susceptibility to heat stress during flowering. **METHOD:** Twenty-four geographically and genetically diverse sorghum genotypes and 3 popular hybrids (Pioneer, Dekalb and Maturity Check) flowering pattern was recorded at half an hour interval starting from 6 AM over multiple flowering days in greenhouse and field. Two relatively heat stress resilient sorghum genotypes (Macia and P898012), one elite US cultivar (RTx 430) and 1 hybrid (Dekalb) were tested for flowering pattern and heat stress resilience under control (32°C/22°C day/night temperature), high temperature treatment during early morning (40°C/22°C; 6 to 11AM) and high temperature treatment during day (40°C/22°C; 9AM to 4PM) for 12 days using the growth chamber facility. In another experiment, same 4 contrasting sorghum genotypes were provided two more intermediate daytime heat stress treatments (OT 32/22°C, HT 35/22°C, 38/22°C and 40/22°C day/night temperature; 9AM to 4PM) and impact of heat stress on yield loss and the degree of tolerance were assessed. **RESULTS AND CONCLUSION:** Flowering peak was completed within two hours of dawn in all genotypes in all the studied conditions, triggering the hypothesis that sorghum primarily follows heat escape mechanism to avoid heat stress during flowering. Heat stress during flowering mainly affected pollen development processes and viability which lead to reduced pollen germination, seed set that resulted decreased grain yield.

Relevance of Research to State-related Topic(s)

Global temperature is expected to increase by 3.7 °C by the end of this century with increased intensity and frequency of high temperature episodes in future. Sorghum is mostly widely grown in the arid and semi-arid regions of the world and is considered as one of the most heat tolerant grain crop. However, it is also sensitive to the high temperature stress during its reproductive stage and flowering is the most critical stage in sorghum to heat stress. This study aims to unravel the mechanism of heat stress resilience in sorghum during flowering which may be useful in developing heat tolerant sorghum and other grain crops to tackle the possible threat of global warming on food security.

WITHDREW**WHEAT BLAST: HOW CAN WE STOP THIS CEREAL KILLER?**

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BACKGROUND: Wheat blast, caused by the fungus *Magnaporthe oryzae Triticum*, can completely devastate affected fields and fungicide control has proven inconsistent. Therefore, genetic resistance is the most promising sustainable alternative for disease suppression. **OBJECTIVE AND METHOD:** The objective of this study was to identify specific regions in the wheat genome that are associated with wheat blast resistance, known as quantitative trait loci (QTL), using a population with 187 lines from a cross between ‘Sossego’ x ‘Alvorada’, widely grown spring wheat cultivars in Brazil. While ‘Sossego’ has shown moderate levels of wheat blast resistance, the cultivar ‘Alvorada’ was chosen as the susceptible parent. The population was evaluated under field conditions in one meter-row plots established in a randomized complete block design with three replications during the 2016-2017 season in Quirusillas (Bolivia). Disease incidence and severity were measured at approximately two-day intervals during the wheat grain development. Standard, composite, and multiple QTL mapping were performed using Haley–Knott regression. **RESULTS:** Despite the low disease pressure due to the dry and cool season, two QTLs associated with incidence and severity were identified on chromosomes 2AS and 5AL. The QTL on 2AS explained 30.4% of the phenotypic variation for wheat blast severity. The QTL identified on 5AL is likely a novel wheat blast resistance gene and it explained 5.7% for severity. Resistant alleles for both QTLs came from the cultivar ‘Sossego’. **CONCLUSION:** Despite promising preliminary data, the low disease pressure in this season compromises drawing definitive conclusions. Thus, the experiment will be repeated under controlled conditions.

Relevance of Research to State-Related Topic(s)

Wheat is one of the most important cereals cultivated in the world. Approximately 50 million acres are sown to wheat in the United States every year, from which about 8-9 million acres are sown in Kansas, making the state the leader producer. Wheat blast is a devastating emerging disease caused by the fungus *Magnaporthe oryzae Triticum* (MoT). It was first identified in 1985 in Brazil and for over 30 years had not been officially reported outside South America. In February of 2016, MoT was identified in Bangladesh and more recently it spread to India. The risk of introduction of wheat blast is considered high because it is a seed-borne disease and also there is a constant trade and travel between the U.S. and the countries where the disease is present. Thus, the identification and the deployment of novel sources of blast resistance are crucial and a matter of food security.

WATER SOLUBLE CARBOHYDRATES ACCUMULATION IN WHEAT STEMS USING NIR SPECTROSCOPY

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BACKGROUND AND PURPOSE: The capacity for storage and utilization of water soluble carbohydrates in the stem (WSC) is an important trait to support grain filling, particularly under water deficit. WSC has been found to be an important contributor to yield, biomass, and harvest index under stress. However, it's very challenging to measure WSC in several genotypes in the breeding program using conventional method. So, the main objective of this study is to dissect genotypic difference in water soluble carbohydrates using a near-infrared spectroscopy (NIRS) model. **METHODOLOGY:** A set of 400 diverse breeding lines and 30 varieties were planted in western Kansas, to evaluate their performance under two treatments: irrigated and limited irrigation. The breeding lines were planted in type II modified augmented design and the 30 varieties were planted in a randomized complete block design (RCBD) with 6 replicates in each treatment. The NIRS and WSC were measured in finely ground 20-wheat-stems fifteen days after flowering. **RESULTS AND CONCLUSIONS:** The calibration and cross-validation of NIRS data with measured WSC concentration resulted in R^2 of 0.83 and SECV (Standard Error of Cross Validation) of 4% using partial least square regression in 105 diverse set of samples. Accumulation of WSC was significantly higher below top node compared to the stem part above top node. There were significant differences between the varieties with a mean value ranging from 132 mg/g to 340mg/g. This genotypic diversity can be utilized in breeding for high WSC in wheat. NIRS techniques are effective in monitoring plant physiological process rapidly and nondestructively.

Relevance of Research to State-Related Topic(s)

Kansas is the number one wheat producing state in the United States. In 2016, Kansas state produced 4.67 million bushels of wheat that worth \$1.5 billion in production or sales. More than one-third of the farmers in the state are involved in the wheat production, so, wheat yield highly impacts the livelihood of a large number of rural farmers in the Kansas. Water deficit stress in wheat is one of the major factor decreasing wheat yield. The water soluble carbohydrates (WSC) reserves in the wheat is a major contributor to maintain yield under limited water availability or water deficit. My current research focuses on identifying wheat genotypes with the higher level of WSC in the stems. This is particularly important in developing high-yielding varieties under water deficit, addressing the needs of Kansas farmers and also helping in water conservation.

EFFECT OF POTASSIUM CHLORIDE ON DOUGH RHEOLOGICAL PROPERTIES, GLUTEN MICROSTRUCTURES, AND BREAD CHARACTERISTICS

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BACKGROUND AND PURPOSE: According to 2015-2020 Dietary Guidelines for Americans, average intake of sodium is higher than limit across the U.S population, while potassium intake is much lower than recommended level. Substitution of sodium chloride with potassium chloride in bakeries will be a potential way for sodium reduction. Although there have been studies on this subject, it still lacks a fundamental and molecular-level understanding of the functions of potassium chloride in bread doughs and bakeries. This study focused on the effect of different levels of potassium chloride (0-2%) on the gluten microstructures, physical and rheological properties of doughs, and bread characteristics. **METHOD:** Gluten microstructures were characterized using HPLC, ATR-FTIR, and Spectrophotometer. Dough physical and rheological properties were measured by Mixograph, Farionograph, TA XT2 Texture analyzer, and Malvern Bohlin CVOR 150 rheometer. Bread was baked according to AACC standard method, and bread quality was evaluated by texture, cells and sensory characteristics. **RESULTS:** Dough water absorption and mixing time gradually increased with more potassium chloride. Dough strength increased while extensibility first increased then decreased with more potassium chloride, but stickiness was significantly decreased. Free sulfhydryl content of gluten decreased, and extractable gliadin to glutenin ratio also decreased with more potassium chloride. Bread volume increased and better crust color were achieved with more potassium chloride. **CONCLUSION:** Overall, potassium chloride led to similar changes as sodium chloride in dough properties, gluten microstructures, and bread characteristics, except that when potassium chloride was higher than 1%, some metallic and slightly bitter taste could be recognized.

Relevance of Research to State-related Topic(s)

Since sodium chloride plays an important role in most foods, including bakery products, directly removing of sodium chloride is not a good way. There are several approaches for sodium reduction, such as using other flavors and ingredients, or using saltiness enhancement (amino acids, peptides, MSG). Salt replacement, like magnesium soleplate or potassium chloride can also be used. Our results may help understanding fundamental and molecular-level functions of potassium chloride. It proved a potential and easy way for sodium reduction in breads.

ARE MODERN WHEAT VARIETIES MORE RESPONSIVE TO IN-FURROW PHOSPHORUS FERTILIZER THAN HISTORICAL ONES?

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BACKGROUND AND PURPOSE: Wheat varieties released during different historical eras have shown increased genetic yield gain as a result of advances in breeding, which consequently increases their nutrient requirement. However, current university recommendations have been developed in past decades and limited information exists on the differential responses of modern and historical varieties to fertilizers. Our objective was to determine the agronomic responses of historical and modern winter wheat varieties to two different fertilization programs. **METHOD:** Field experiments in Ashland Bottoms and Belleville, KS, with seven winter wheat varieties released between 1920 and 2016 and two fertilizer practices (no phosphorus fertilizer versus 100 lbs/ac of phosphorus fertilizer) were established to determine the plant height, stem diameter, canopy cover, canopy uniformity, and grain yield. **RESULTS/FINDINGS:** Historical varieties were taller and had thinner stems than modern ones regardless of fertilizer practice. Phosphorus fertilizer increased the maximum canopy cover, led to a quicker achievement of maximum rate of canopy cover, and improved canopy uniformity, irrespective of era of variety release. Modern varieties increased the grain yield due to phosphorus fertilizer whereas historical ones showed neutral to negative responses and the genetic yield gain was greater with phosphorus fertilizer. **CONCLUSION:** The agronomic responses of modern wheat varieties were notable when compared with historical varieties. Our findings indicate that current fertility recommendations should be re-evaluated for modern wheat varieties to better explore the yield potential and increase on-farm productivity.

Relevance of Research to State-Related Topic(s)

Winter wheat is one of the most important crops in Kansas, during the last ten years, approximately 8.6 million acres were cultivated annually, producing around 9 million tons of grains. In 2016, the value of wheat production at Kansas State was US\$ 1,495,680,000. A large amount of information exists on the yield gain resulting from genetic improvement of wheat varieties, however, limited information was pursued to understand how these increases in yield may have shifted nutrient requirements, as well as response to fertilizer rates. Understanding how varieties released at different decades differ to different fertilization programs can lead to better agronomic and nutrient management recommendations, improve wheat productivity and profitability.

A NOVEL DRONE BASED LODGING ASSESSMENT APPROACH FOR WHEAT BREEDING

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BACKGROUND AND RATIONALE: Lodging, the permanent displacement of plant stem from its upright position, causes yield and quality losses in wheat. It is a complex genetic trait, and is conventionally assessed through visual assessment methods in field, which are time-consuming, subjective, and non-scalable. **METHOD:** To study lodging rapidly and accurately, we have developed a drone-based digital lodging assessment method that is scalable to large wheat experiments. **RESULTS:** Using the drone-derived images of lodging affected wheat fields, we have identified two areas of the wheat genome that are associated with lodging resilience. Our research provides a novel application of drones to not only measure lodging damage in the field, but also to identify genetic determinants of lodging in wheat. **CONCLUSION:** The research would pave the path of developing lodging resistant wheat varieties and has potential applications across other crops and disciplines.

Relevance of Research to State-Related Topic(s)

Kansas is the leading wheat producer in the USA. Lodging, a complex trait, can cause up to 40 percent of losses in wheat yield. The novelty of our research work lies in its rapid and accurate lodging assessment of wheat fields through drone based imagery as against the conventional field based methods. When fully implemented, the proposed methodology would help accelerate the development of lodging resistant wheat varieties for Kansas and globally.

EXPRESSION OF ATGRXS17 IN MAIZE INCREASES YIELD UNDER HEAT STRESS

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BACKGROUND AND PURPOSE: The human population is currently estimated to rise by a staggering 83 million people per year and reach a global total of almost 10 billion by 2050. This represents an increase of almost 29% from our current population of 7.6 billion people. Maize (*Zea mays* L.) is the largest crop in the world, as well as Kansas, as measured by yield and value. Heat stress has been identified as a serious constraint on grain production, especially if it coincides with flowering and grain filling. Previously, our group has identified the Arabidopsis glutaredoxin S17, *AtGRXS17*, as a key regulator of redox status and heat stress response. Despite this, it is unknown if expression of this gene can influence yield when plants are challenged with heat stress specifically during flowering under field conditions. **METHOD:** Yield of three transgenic lines and one wild type control was assessed under a high temperature treatment during flowering (n=4). At VT growth stage, thermostat controlled heat tents were placed over plots designated for heat treatments. These tents remained in place from tasselling through grain filling. **RESULTS/FINDINGS:** Maize plants expressing *AtGRXS17* displayed significantly higher grain yield than their non-transgenic control plants when challenged with heat stress at tasselling through grain filling. **CONCLUSION:** These data indicate a possible new approach to engineering heat tolerant inbred lines to be used for hybrid development.

Relevance of Research to State-Related Topic(s)

Kansas corn production is important for industrial uses, food production, feed for animal production, and most importantly jobs for Kansans. In the future, irrigation may not be a viable option as our Ogallala aquifer slowly becomes depleted. Even now, many farmers who are not able to utilize irrigation practices grow dryland corn and could benefit greatly from new traits such as heat and/or drought stress tolerance. Both traits are important as they commonly occur together and their effects are compounded. This theory is proved by the drought and heat wave in 2012. Dryland farmers yielded 49.5 Bu/Acre, less than one third the yield of their irrigated neighbor at 172 Bu/Acre. Our objectives are to continue working on heat and drought stress tolerant inbred lines for hybrid development to help alleviate the strain put on Kansas farmers bottom line during heat and/or drought waves.

INFLUENCE OF PLANTER DOWNFORCE SETTING AND GROUND SPEED ON SEEDING DEPTH AND PLANT SPACING UNIFORMITY OF CORN

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BACKGROUND AND PURPOSE: Two key planter performance parameters that can influence corn stand establishment and grain yield are weight on the planter and planting speed. However, controlling seed placement can be difficult when the planter are operated at faster speed. Therefore, the objectives of this study was to assess the effect of planting speed and downforce setting on seeding depth and plant spacing and to evaluate the relationship of planting speed and row unit bounce on gauge wheel load and its impact on seed placement consistency. **METHOD:** A 12-row planter was used to plant a variable seeding rate of 30,000 to 32,000 seeds/acre at a target seeding depths of 2 and 2.5 inches. Two levels of downforce control (fixed and active) were implemented in combination with four planting speeds (4.5, 6, 7.5 and 10 mph). A 17.5 ft long strips were randomly selected along the treatment plots where plant spacing and seeding depths were measured. **RESULTS AND CONCLUSION:** Results suggests that planting speed and downforce setting influenced consistency in seed placement. Slower planting speed, medium setting for fixed downforce control and high setting for the active downforce control resulted in a more uniform seed placement. Seeding depth was maintained within the range of the target by the medium and high setting for the fixed downforce control. Both settings for the active downforce control exhibited an average seeding depth of within the range except at high speed for the low setting. Row unit bounce increases with speed for both fixed and active downforce control.

Relevance of Research to State-Related Topic(s)

Planting is one of the most important stage in crop production. Placing the seeds in an ideal environment will result in a uniform germination and emergence. However, seed placement uniformity can be affected when planting at faster speed as the applied weight on the planter may not be sufficient to keep it in contact with the ground all the time. These could result in a shallower seeding depth and wider plant spacing as a result of too much bounce on the planter due to varying field conditions. Literatures have shown that non uniform plant spacing and seeding depth influences final stand establishment which can negatively impact the grain yield. Thus it is important to identify proper planter settings to be able to optimize planter utilization and improve planting productivity of farmers.

EVAPORATION OF SESSILE WATER DROPLETS FROM HYDROPHILIC AND HYDROPHOBIC PORES

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BACKGROUND AND PURPOSE: Access to water is one of the most critical issues in the food-water-energy nexus of the future. For irrigation in areas without sufficient rainfalls, agriculture accounts for two-thirds of water withdrawals. The Ogallala Aquifer is the primary water source for food production in the Great Plains and is responsible for providing water for over 20% of corn, wheat, sorghum, and cattle produced in the U.S. Reduction of water evaporation from soil decreases the need for irrigation and provides an excellent opportunity for water conservation in the state of Kansas. **METHOD:** In this study, evaporation fundamentals were studied through sessile, 4- μ L water droplets evaporating from single pores created using three hydrophilic glass or hydrophobic polytetrafluoroethylene (PTFE or Teflon) beads. Experiments were conducted at the same temperature, RH, and various lighting conditions. The time to fully evaporate the droplets was recorded and the transport phenomenon was captured using a high-speed camera **RESULTS AND CONCLUSIONS:** Due to the higher wettability of glass surface, the droplets were more stretched on the glass beads, more droplet-air areas were created and therefore, the evaporation times were lower (i.e., approximately 30 minutes). The PTFE surface is hydrophobic, for which the water droplets were more pronounced, air-water contact areas were lower, thus the evaporation was delayed (i.e., approximately 40 minutes). Further investigation into evaporation dynamics could inform agricultural standards to reduce soil evaporation.

Relevance of Research to State-Related Topic(s)

The production of food requires sufficient supply of fresh water and sustainable production of food is a challenge of the food-water-energy nexus. Water sources like ponds, rivers, canals can mitigate the need of irrigation but that can cause drought. The annual average rainfall in western Kansas is only 12-14 inches which is inadequate for crop growth. As a result, there are 1.5 million acres irrigated farmland in the southwestern Kansas and the Ogallala Aquifer provides 90% of the water for irrigation. Reduction in the rate of evaporation from soil will diminish irrigation demands and overall water consumption for crops production, therefore, the water in Ogallala Aquifer will be conserved. The main aim of this study is to find a suitable pore combination and evaporation mechanism that can help reducing evaporation from soil and thus conserving the soil water level.

A SIMULATION-BASED APPROACH FOR OPTIMIZATION OF A SMALL-ANIMAL MICROWAVE APPLICATOR FOR PRE-CLINICAL HYPERTHERMIA RESEARCH

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BACKGROUND AND PURPOSE: Integration of hyperthermia with radiation and chemotherapy is an effective combinatory cancer treatment protocol. During hyperthermia, the tumor is heated up to temperature in the range 40-45 °C for 60 to 90 minutes, while limiting heating in adjacent healthy tissue. Magnetic resonance imaging (MRI) provides a non-invasive technique for spatial monitoring of temperature profiles during hyperthermia, which can be used to adjust applied power in order to achieve the desired thermal dose. We have designed an experimental platform for hyperthermia investigations in small animals, incorporating a microwave applicator integrated with 14.1 T ultra-high field MRI. Our objective was to adapt the applicator design, to focus heating within 0.0141-0.113 cm³ tumor volume located at 1-3 mm from the skin surface, with minimal heating of the surrounding tissue. **METHOD:** A 3D numerical method is employed to optimize the design of the water-cooled microwave applicator, which consists of a hemi-cylindrical reflector to restrict energy deposition. We assessed the effects of: reflector geometry; monopole shape; cooling water temperature; and flow rate on spatial-temperature profiles. The quality of heating was quantified by determining the fraction of tumor volume heated to the desired temperature, and the extent of heating in non-targeted tissue. **FINDINGS:** Heating of tumors in range 41-43 °C was optimally achieved with a 240 ° reflector, monopole displacement from center of 0.8 mm, and coolant temperature of 15 ° C. **CONCLUSION:** We have adapted a small-animal microwave hyperthermia applicator to heat 0.0141-0.0335 cm³ tumor volumes at depths of 1-2 mm.

Relevance of Research to State-Related Topic(s)

Hyperthermia, controlled heating of the targeted tumor, is a minimally invasive cancer treatment. We employed a simulation-based approach to optimize the design of a microwave hyperthermia applicator and assessed heat delivery to the tumor site. This research may lead to the development of a minimally invasive technique for treating cancer, which may benefit patients in Kansas and other regions.

STABILIZING EXPLOSIVES AND ENERGETIC MATERIALS BY CO-CRYSTALLIZATION TECHNOLOGY

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BACKGROUND AND PURPOSE: Explosives and energetic materials are capable of delivering large amounts of energy very rapidly. Unfortunately, these substances are often very sensitive to environmental conditions, such as heat, impact or friction which in turn, leads to considerable challenges when it comes to handling, storage and transportation. Rather than making completely new safe explosive materials (which is very costly and time consuming), it is essential that we develop new technologies that are cost effective, scalable, easily implemented, and fast. We are currently exploring a new approach for improving the stability of a family of explosives that are inherently acidic (corrosive) and impact sensitive. **METHOD:** The hydrogen bond is a specific example of a chemical bond that may be used as a way of combining the energetic molecule with a stabilizing molecule in a new solid form in such a way that acidity and sensitivity are reduced. With this in mind, we have prepared several new “co-crystals” containing an energetic molecule combined with a stabilizing molecule. This co-crystallization technology has produced numerous new solids of energetic materials and we have compared their thermal/impact sensitivity and chemical stability with the properties of the parent explosive. **RESULTS/FINDINGS:** We have found that the new co-crystals display favorable impact and thermal sensitivity as compared to the original explosives, and the corrosiveness has been reduced. **CONCLUSION:** Co-crystallizations provide the basis for a new technology that can be employed as a way of altering and improving many of the unfavorable properties that are associated with the behavior of current energetic materials.

Relevance of Research to State-Related Topic(s)

Explosives and energetic materials are used in various applications such as fireworks, mining, fuels and in armaments. The excessive sensitivity of these materials can cause serious accidents and we need to improve our ability to safely handle and store such materials. This is of particular concern to the state of Kansas as we have several military installations and bases located throughout the region. In addition, transportation of dangerous explosives between different locations on public roads can also put the civilian population at risk. Therefore, our focus here is to make energetic materials safer without loss of performance in order to facilitate their storage and transportation at lower costs and with lower risks.

SUSTAINABLE RESOURCE RECOVERY FROM MUNICIPAL WASTEWATER IN A PILOT-SCALE ANAEROBIC MEMBRANE BIOREACTOR (ANMBR) AT FT. RILEY, KS

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BACKGROUND AND PURPOSE: Municipal/agricultural wastewater treatment consumes energy and resources, while there is great opportunity to sustainably recover these resources (water, energy, and nutrients). Anaerobic membrane bioreactor (AnMBR) technology is a promising alternative to aerobic wastewater treatment, including activated sludge and oxidation ponds. The Department of Defense's Environmental Security Technology Certification Program (ESTCP) has funded a demonstration project at Ft. Riley, Kansas from 2016 till present, to evaluate a pilot scale gas sparged AnMBR for sustainable municipal wastewater treatment. This pilot system is one of the world's largest, treating upto 1000 gallons of wastewater/day, under ambient temperatures. **METHOD:** Reactor was started up with anaerobic digested sludge from Topeka,KS in July 2016, followed by treatment and energy optimization. Weekly samples were collected for chemical analyses throughout the startup (3 months) and continuous demonstration phases (12 months). **RESULTS/FINDINGS:** The pilot scale AnMBR demonstrated that we achieved effluent Biochemical Oxygen Demand₅ (BOD₅) close to 10 mg/L, meeting the ANSI reuse standards, while reaching Chemical Oxygen Demand (COD) values below 60 mg/L, and superior capture of Ammonia-N and Phosphorus from the wastewater as valuable products, at 99% and 90% efficiencies, respectively. This high effluent quality was achieved at a 12-hour Hydraulic Retention Time (HRT), with a net flux of 7 Liters per Square Meter per Hour (LMH) consistently, suggesting its viability for implementation. **CONCLUSION:** Overall, the performance of the AnMBR suggests its potential as a sustainable wastewater treatment technology, with an even greater viability when applied to agricultural wastewaters, since it works better at higher loading rates.

Relevance of Research to State-Related Topic(s)

Successful operation of the AnMBR pilot for more than one year demonstrates a viable platform for decentralized municipal and agricultural wastewater treatment in Kansas, producing indirect potable water supply and protecting sensitive watersheds from the runoff of the algal bloom triggers - N and P - that will now be sequestered. The research also generates tailored nutrient products for agriculture, namely ammonia-N and Phosphate fertilizers, which can be blended in farmlands at pre-requisite ratios, supporting a wide variety of crops and vegetables. The project will spawn new innovations within all public utilities in Kansas to consider AnMBRs as a means to achieve energy positive operation, while still meeting stringent nutrient discharge goals. Finally, AnMBRs will create a greener workforce in the rural Kansas communities, pivoted around nutrient product marketing, water and renewable energy (biogas) management, as well as reused water reallocation budgeting, without compromising the cropland and food safety.

EFFECT OF SURFACE PASSIVATION ON PHOTOTHERMAL EFFECT OF GOLD NANOROD

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BACKGROUND AND PURPOSE: The unique photothermal (PT) properties of gold nanorod (AuNR), due to its strong plasmonic effect at near-infrared (NIR), have been explored widely as an alternative to chemotherapy or in combination to treat cancer. However, its stability in biological media greatly hinders its application. Therefore, studies were focused on improving its stability by introducing biocompatible surface functionalization such as polyethylene glycol (PEG) coatings. But, PEG hinders the NIR light to reach the surface of the AuNR, thereby altering PT effects. Herein, we investigated the influence of PEG passivation on PT efficacy of AuNR. **METHOD:** NIR-responsive AuNR was synthesized using seed-mediated growth and further surface modified with various molecular weighted PEGs (2, 5, and 10 kDa). The modified AuNRs were evaluated for NIR-mediated hyperthermia, biocompatibility, cellular uptake efficiency, and cytotoxicity against cancer. **RESULTS:** When AuNR suspension irradiated with NIR laser ($\lambda=808\text{nm}$ at $10\text{W}/\text{cm}^2$), the temperature reaches to 90°C . It has been observed that the increase and distribution of temperature throughout the suspension was greatly influenced by PEG length. Our observation shows following trend of temperature distribution, i.e., $2\text{kDa} > 5\text{kDa} > 10\text{kDa}$, which is presumably due to the different chain length that passivate of NIR light and jacket the heat. Furthermore, AuNR-PEG was found to be biocompatible and internalized into the cells as depicted by hyperspectral imaging. However, under NIR irradiation cell death was observed thereby showing PT efficiency of AuNR. **CONCLUSION:** This study demonstrates a fundamental strategy for surface modification of AuNR to enhance PT effect, which could be an effective alternative to chemotherapy in arresting cancer.

Relevance of Research to State-Related Topic(s)

Cancer is one of the most devastating diseases that affect thousands of lives in the United States as well as Kansas every year. According to American Cancer Society, in 2017 there is an estimate of 87,000 new cases of melanoma will be diagnosed in the USA. Among the Kansas residents, the average melanoma incidence rate is 24.3 and the mortality rate of 3.1 per 100,000 respectively. As a consequence, the costs of cancer to the state of Kansas are approximate \$2 billion annually and make it become a substantial financial burden on state resources. With the solid fundament development of effective treatment modality, the huge cost of cancer and mortality rate can be reduced significantly. Therefore, this study provides the useful insight for skin cancer treatment by using non-invasive laser light using gold nanorod.

LMS ADAPTIVE FILTERING BASED P300 COMPONENT ESTIMATION

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BACKGROUND AND PURPOSE: Various assistive technologies are available for people with amyotrophic lateral sclerosis (ALS), neuromuscular disease (NMD), and numerous other diseases that impair the neural pathways which control muscles or impair the muscles themselves. Brain-computer interfaces (BCIs) are a possible solution for people with these conditions, and the P300 Speller is one of the most popular types of BCI. The P300 Speller uses event-related potentials (ERPs) embedded in electroencephalography (EEG) signals to determine the character users intend to spell, called the target character. In a classical speller, a grid matrix of 6×6 or more characters and commands are presented to the user. Rows and columns are flashed in a random order. The probability of the flashed row/column containing the target character is 1/6, which creates a rare event that will elicit a P300 response. It is difficult to recover from single observations as the ERPs are buried under the background EEG signals which have much larger amplitudes than ERPs. In this work we have presented a method to estimate P300 ERPs from single observations as well as the P300's latencies and amplitudes. The proposed method has shown potential to estimate latency jitters. **METHOD:** Least square classification has been used for detection of P300 and least mean squares (LMS) filter has been used for estimating P300 components from individual responses. **RESULTS:** P300 signals have been estimated and plotted. **CONCLUSION:** The goal was to investigate the efficacy of the LMS adaptive filtering method to estimate P300 ERPs. The LMS filter worked as expected and LMS was able to help extract the P300-related components.

Relevance of Research to State-Related Topic(s)

This research is related to health conditions impacting the health of Kansas citizens. Specifically, the communication devices used in this research can alleviate some of the burden of paralysis associated with conditions such as Amyotrophic lateral sclerosis (ALS), neuromuscular disease (NMD), brainstem stroke, cerebral palsy, spinal cord injury, and numerous other diseases that impair the neural pathways which control muscles or impair the muscles themselves. While the number of citizens affected by these diseases is small, the disease can progress to the point where they have no other option for communication. ALS is estimated to affect around 113 Kansans, based on census population and disease prevalence which is 3.9 per 100,000. This research fit with the interest of Kansas House: Health and Human Services and Senate: Public Health and Welfare standing committees.

DEVELOPMENT OF LIGNIN-PROTEIN BASED ADHESIVE

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BACKGROUND AND PURPOSE: About 1.96 million tons of adhesive supplies to wood-based industries annually. Approximately 70% of the adhesives are formaldehyde-based adhesives. Formaldehyde-based adhesives have high adhesion strength and water resistance property. However, it is toxic to human and causes environmental pollution. Nowadays, depletion of petroleum fossil feedstock along with significant concern about health and environment lead to an interest in seeking alternative sources for green products. Soy protein-based adhesive is an interesting option to replace formaldehyde-based adhesive. It has used in foundry sand, children glue, packaging and labeling and wood adhesive. However, the water resistance property needs to be improved to be more successful and useful in wood-based industries. One way to improve this property is to mix modified lignin in the protein adhesive. Therefore, this research aims to develop lignin-protein based adhesive, improve the water resistance property, and utilize and add value to lignin. **METHOD:** Kraft lignin was modified at 260 and 290 °C by hydrothermal degradation process and used to make lignin-protein adhesive. **RESULTS AND CONCLUSION:** Lignin was broken down by hydrothermal processes to smaller fragments with more porosity. The results showed that the water resistance property of 20% blending of 260°C solid lignin, 260°C liquid lignin, and 290°C solid and liquid lignin with soy protein adhesive is higher than that of pure soy protein adhesive.

Relevance of Research to State-related Topic(s)

Nowadays, people pay more attention to have a healthy life in a safe environment. In addition, petroleum demand is increasing while petroleum shortage has been a topic of concern. Therefore, there are strong demands for safe, environmentally friendly, and sustainable wood adhesives. Soybean is one of the major crops in Kansas. Soybean protein, the main component in the adhesive, is extracted from soy meal, a by-product from soybean oil industries. In addition, lignin, another main component, can be obtained from the abundant agricultural waste in Kansas. Therefore, the purpose of this research is to develop lignin-soy bean based adhesives in order to replace petroleum-based adhesives for wood products. This research is not only utilized Kansas agricultural products but also lower the risk of cancer and provide better life quality to Kansas resident and world population.

MOLECULAR RECOGNITION: FROM FUNDAMENTAL TO APPLICATIONS

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BACKGROUND AND PURPOSE: The backbone of animals, plants and humans who all have the ability to recognize each other is molecules. We want to know does molecules at an angstrom level also recognize each other? We designed four novel target molecules and introduced 20 guest molecules of different shape and size to study the molecular recognition phenomenon. The approach applied in this study was further used to tackle real world problem associated with urea, an inexpensive and most commonly used fertilizer. The high solubility of urea in water is often susceptible to mobility and/or runoff from treated areas. The high moisture content of urea at relative humidity of 40-50% causes stickiness, leading to storage and stability issues. It would be highly advantageous if it was possible to alter/control the aqueous solubility, storage and stability in a predetermined manner. **METHOD:** A carefully designed easy, scalable, cost-effective strategy was used to study molecular recognition in the target molecules. **RESULTS/FINDINGS:** The results suggested that we can make molecules recognize each other and make urea less soluble and more stable towards high moisture content by systematic design approach. **CONCLUSION:** This approach may offer unique opportunities for developing new solid forms of a compound in which a variety of desired physical properties can be tuned in a predictable and desired manner to optimize the performance and benefits of compounds of interest.

Relevance of Research to State-Related Topic(s)

Kansas is an agriculture state and Urea is the most common fertilizer used in the state. Kansas is also susceptible to unexpected heavy rain every year which leads to runoff of urea from treated areas into lakes, and reservoirs where it causes environmental damage by killing aquatic organisms and plants. Kansas is also very humid state, and in areas such as Kansas City, Topeka and Wichita; humidity levels can go as high as 80% in summer. This causes problems with storage of urea because urea turns into liquid form at this high humid conditions. Our simple approach shows that we can make urea less soluble and more stable towards moisture content thereby reducing the environment damage and stability issues.

WITHDREW**ROLE OF DRIVER BEHAVIORS AND ENVIRONMENTAL CHARACTERISTICS IN EVALUATING SAFETY EFFECTIVENESS OF ROADWAY COUNTERMEASURES: A NOVEL APPROACH OF ESTIMATING CRASH MODIFICATION FACTORS**Uditha Galgamuwa¹, Christopher I. Vahl², and Sunanda Dissanayake¹¹Department of Civil Engineering, College of Engineering; ²Department of Statistics, College of Arts and Sciences

BACKGROUND AND PURPOSE: Kansas has experienced higher number of motor vehicle fatalities due to lane departure crashes, hence evaluating the safety effectiveness of the countermeasure to reduce such crashes are important. Since in most cases, the date of implementation of the countermeasure is not known, cross-sectional studies have been employed to evaluate the safety effectiveness of the roadway countermeasures. There, the regression models are developed using crash counts in each road segments as a response variable and the road geometric, traffic-related characteristics and the countermeasures as an explanatory variables. Estimated regression parameters respective to countermeasure variables are then use to predict safety effectiveness. The major limitation of these cross-sectional models is that those do not incorporate environmental and human behaviors into modeling which may lead to erroneous models, hence the estimated safety effectiveness will be flawed. This research proposes a new method of estimating safety effectiveness of the roadway countermeasure by incorporating the environmental and human behaviors into cross-sectional modeling hence to estimate accurate and representative safety effectiveness. **METHOD:** New models were developed using generalized linear regression models assuming Poisson distribution. Generalized linear regression models assuming negative binomial distribution was used to develop conventional cross-sectional models to compare the results with the new models. **RESULTS/FINDINGS:** Conventional cross sectional models overestimate the safety effectiveness of the roadway countermeasures. **CONCLUSION:** This research suggests that incorporating more contributory factors result in accurate estimation of the safety effectiveness.

Relevance of Research to State-Related Topic(s)

Overestimate the safety effectiveness of roadway countermeasure may result in implementing inefficient countermeasures hence it costs both money and valuable human lives. Since, majority of the motor vehicle fatalities are due to lane departure crashes in Kansas, this study identifies the effectiveness of two lane departure countermeasures namely paved shoulders and rumble strips. Furthermore, the new models proved an insight of how other variables are related with crashes, hence authorities can focus on those factors and implement countermeasures to reduce such crashes. Finally, the results can be used as a decision making tool when implementing the similar countermeasures on similar road segments.

INVESTIGATION OF CRACKING RESISTANCE OF RECYCLED SUPERPAVE MIXTURES

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BACKGROUND AND PURPOSE: The use of recycled asphalt materials, reclaimed asphalt pavement (RAP) and recycled asphalt shingles (RAS), has become increasingly popular for asphalt pavement mixtures. Although these mixtures are acceptable under current specifications, issues with the durability of these mixtures have surfaced, since the aged binder from RAP and RAS changes the mixture performance. Some studies found that as higher amounts of reclaimed materials are being used, the potential for premature pavement distresses, especially cracking, is increasing. This research evaluated the cracking resistance of four recycled Superpave mixtures with different RAP and RAS contents from Kansas Department of Transportation (KDOT) projects. **METHOD:** In this research, two of the mixtures contained 10% RAP and 5% RAS, while the other two mixtures contained 25% RAP but no RAS. Illinois semicircular bending (SCB) and Florida indirect tension (FL-IDT) tests were performed to assess mixture cracking and fracture properties. The SCB test evaluated fracture resistance parameters of an asphalt mixture. FL-IDT test, including resilient modulus test, creep compliance test, and the IDT strength test, was used to obtain the fatigue and fracture properties of asphalt mixtures. **RESULTS/FINDINGS:** SCB test results indicated that mixtures with 10% RAP and 5% RAS had lower fracture energy and flexibility index. Based on FL-IDT test results, mixtures containing 10% RAP and 5% RAS had a relatively higher resilient modulus but lower creep compliance, dissipated creep strain energy at failure, and energy ratio. **CONCLUSION:** All tests results indicated that mixtures containing 10% RAP and 5% RAS were stiffer and more prone to cracking.

Relevance of Research to State-Related Topic(s)

The KDOT now allows asphalt pavement mixtures with high percentages of recycled asphalt materials. Recycled asphalt materials are economical and environmentally friendly. The use of recycled asphalt materials reduces material costs because virgin materials are replaced by asphalt and aggregates in recycled asphalt materials. Considering material and construction costs, use of 20%–50% of RAP provides savings of 14%–34%. At the meantime, use of recycled materials reduces the demand for non-renewable natural resources such as virgin aggregate and asphalt binder and eliminates the need for landfilling. It is to be noted that the performance of asphalt pavements should not be compromised by the use of recycled materials. The KDOT aims to determine an optimum mixture which containing higher percentage of recycled asphalt materials exhibits equal or improved performance compared to conventional mixture.

ROAD FRICTION ASSESMENT IN KANSAS**Shuvo Islam** and Mustaque Hossain*Department of Civil Engineering, College of Engineering*

BACKGROUND AND PURPOSE: Friction assessment of in-service roads is an integral part of ensuring safe highway network. Road surface friction helps minimize skidding and reduces the number of crashes. Since this surface friction is a function of surface texture, assessment of roadway texture characteristics is essential. In this study, variations in textures on different roadway projects in Kansas were assessed. In addition, the relationship between this texture depth and the skid number from a traditional test were investigated. **METHOD:** The Kansas Department of Transportation (KDOT) traditionally had been using a skid trailer to assess skid number on the road network. Recently KDOT has been collecting texture data using a state-of-the art 3-dimensional laser scanning system (known as LCMS). **RESULTS AND CONCLUSION:** Results show that there are significant differences in average texture depth across projects. Significant differences in average texture depth were found on horizontal curves compared to the adjacent tangent/straight sections. At the network level, skid number did not correlate well with surface texture depths, irrespective of surface type. However, the correlation between these parameters at the project level is promising. This indicates that surface friction can be monitored using LCMS data.

Relevance of Research to State-Related Topic(s)

There were approximately 6,000 wet surface crashes in Kansas in 2016. The Federal Highway Administration estimates 70% of wet pavement crashes can be prevented or minimized by improving surface friction on roadways. This study aims to characterize surface texture properties for monitoring and managing surface friction properties on Kansas roadways. The results of this study will assist highway engineers in selecting pavement preservation treatments as well as new surface policies related to friction for both asphalt and concrete roadways in Kansas.

CALIBRATION OF HIGHWAY SAFETY MANUAL FOR 4-LEGGED SIGNALIZED INTERSECTIONS AT URBAN AND SUBURBAN AREAS IN KANSAS

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BACKGROUND AND PURPOSE: The Highway Safety Manual (HSM) provides various Safety Performance Functions (SPFs) and Crash Modification Factors (CMFs) for different types of facilities at urban locations in order to predict the expected crash frequency at these facilities depending upon the Average Annual Daily Traffic (AADT), traffic control features and geometric characteristics. The main objective of this study was to calibrate the HSM SPFs for 4-leg signalized intersections (4SG) at urban and suburban areas and develop a calibration factor for the state of Kansas. **METHOD:** A sample size of 203 was determined from 55 urban cities from the state of Kansas. Based on the availability of recent data, the study period was determined to be a three year period, from 2013 to 2015. The data elements required for the calibration process mentioned in the HSM Part C, Chapter 12, were obtained from various sources and the calibration procedure provided in the HSM Appendix A was followed. **RESULTS/FINDINGS:** At this time, 129 intersections have been taken as a sample resulting in a calibration factor of 1.153. **CONCLUSION:** The calibration factor greater than 1 implies that the actual number of observed crashes were higher than the predicted number of crashes. The calibration factor developed can be used to predict the total number of crashes in the future at 4-legged signalized intersections in the state of Kansas and suitable countermeasures can be used. However, this calibration factor needs to be recalibrated in the future to accommodate the change in traffic features.

Relevance of Research to State-Related Topic(s)

Every year, thousands of crashes occur in the transportation network along with loss of human life. In 2015, 11.85% of the total crashes in the state of Kansas occurred at 4-legged signalized intersections with 8 fatal crashes. In order to reduce the number of crashes at these locations, suitable countermeasures need to be applied. Since all intersections cannot be focused at once, a prioritized list of intersections is required based on the number of crashes. My research focuses on calculating the calibration factor for the predictive methods in the HSM which can be used to predict the crashes at different locations in the future more accurately. Critical locations can be identified based on the prediction of crashes and suitable works can be done at these locations in order to decrease the number of crashes and fatalities.

ALIBRATION OF THE HIGHWAY SAFETY MANUAL FOR BASIC FREEWAY SEGMENTS IN KANSAS

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BACKGROUND AND PURPOSE: Motor vehicle crashes are one of the top ten causes of death in the United States. Highway Safety Manual provides prediction models to quantify the potential safety impacts for various types of highways. HSM predictive models have their limitations due to the diversity in jurisdictions. Therefore HSM recommends to calibrate the predictive models to enhance the accuracy of the predicted crash frequency. This study estimated crash prediction model calibration factors (CFs) for Kansas basic freeway segments. **METHOD:** Most of the data required gathered from two main databases maintained by Kansas Department of Transportation (KDOT). Crash data and geometric data of segments were integrated in ArcGIS for the analysis. A minimum sample of 446 segments were drawn based on 95% confidence level was considered. The CF is equal to the total number of observed crashes divided by the total number of predicted crashes. Four CFs were computed according to crash type (Multiple vehicle [MV], Single vehicle [SV]) and crash severity (Fatal and Injury [FI] and Property Damage Only [PDO]). **RESULTS/FINDINGS:** Results indicate that HSM methodology under predicts (CF >1.0) crashes for MV FI, MV PDO, & SV PDO models and over predicts (CF <1.0) crashes for SVFI model for Kansas basic freeway segments during the study period. **CONCLUSION:** The CF greater than 1.0 implies that crashes on basic Kansas freeway segments are higher than the national average. These CFs could be used to predict the crash frequency for future years.

Relevance of Research to State-Related Topic(s)

In 2013, crash related death cost in Kansas was \$449 million. One fatal crash approximately costs \$4.6 million. This research estimates four calibration factors which assist to predict crashes for future years on Kansas basic freeway segments. These results are really supportive to Kansas Department of Transportation (KDOT) to identify and make adjustments to the problematic freeway segments in Kansas in order to reduce the crash occurrence as well as the crash severity. Further, this research could save several million dollars to the Kansas state by reducing the number fatal crashes as well as the total crashes on basic freeway segments. On the other hand, these calibration factors also act as an indicator for further development of Kansas-specific crash prediction models.

EFFECTS OF COVER, COMPRESSIVE STRENGTH, AND WIRE TYPE ON BOND

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The bond between wire and concrete is crucial for transferring the stresses between the two materials in a prestressed concrete member. Bond can be affected by such variables as thickness of concrete cover, type of prestressing wire used, compressive strength of the concrete, and concrete mix. This work presents current progress toward the development of a testing procedure to get a clear picture of how all these parameters can ruin the bond and result in splitting. **BACKGROUND AND PURPOSE:** This research is crucial in the concrete railroad crosstie industry, where incompatible conditions can result in cracking and even tie failure. The purpose is to develop the capability to readily identify compatible wire/concrete designs “in-plant” before the ties are manufactured, thereby eliminating the likelihood that defectively manufactured ties will lead to in-track tie failures due to splitting. The tests presented here were conducted on pre-tensioned concrete prisms cast in metal frames. **METHOD:** Three beams with different cross sections were cast simultaneously in series. Four prestressing wires (denoted by WE) with 5.32mm diameter were symmetrically embedded into each concrete prism, resulting in a common wire spacing of 2.0 inches. The wires were initially tensioned to 7000 pounds and gradually detensioned when the compressive strength reached 3500 psi, 4500psi and 6000 psi (41.37 Mpa). **RESULTS:** According to this investigation WE wire showed very bad bond performance. **CONCLUSION:** The objective is to develop a qualification test procedure to proof-test new or existing combinations of prestressing wire and concrete mix to ensure a reliable result.

Relevance of Research to State-Related Topic(s)

The growth of economy and society leads to increase the use of transportation system almost in every country around the world. The railway system provides the safest and the best solution for transportation passenger or freight. Railway prestressed concrete tie is one of the most important parts of railroad truck system. Study supported by Railway Tie Association said that average of damaged prestressed concrete ties since 1970's is 7.9-9.2% of 29 million concrete ties. The influence of concrete cover and release strength are clearly indicated from these initial tests. The influence of indented wire type (indent geometry) will also be discussed in this paper, along with a presentation of some preliminary test results This work represents a successful first step in the development of a qualification test for validating a given combination of wire type, concrete cover, and release strength to improve the reliability of concrete railroad crosstie manufacturing.

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