

Louisiana (Louisiana State University and A&M College, Southern University and A&M College Combined) Annual Report - FY2021

Report Status: Approved as of 07/08/2022

Contributing Organizations

Louisiana State University and A&M College
Southern University and A&M College

Executive Summary

Overview

FY 2021 the Coronavirus (a.k.a., COVID-19) pandemic, which disrupted research and extension activities for over a year, gave us a little bit of relief to perform limited in-person activities. During the year, we continued to provide virtual activities especially since some of the clientele were not comfortable with in-person meetings. Our faculty and staff under the leadership of Dr. Fatemeh Malakian collaborated with North Carolina A&T University, Tuskegee University, and the 1890 Universities Foundation applied and were awarded the Center for Excellence grant". A project developed garden program and therapeutic horticulture experience for adjudicated and incarcerated youth within the correctional facility and school campus; helped to promote healthy lifestyles through nutrition education to adjudicated and incarcerated youth; and provided adjudicated and incarcerated youth with interpersonal and professional work skills for career opportunities and family strengthening techniques. An average of 25% of the students that have gone through the horticulture program some graduating and obtaining agricultural-related jobs in plant nursery and landscape helper. To build viticulture research at Southern University AG Center and evaluate the new and existing popular grape varieties for Louisiana and the Southern region, the grapes planted on the campus have enabled teaching students to manage fruit crops, pruning, and provided samples for undergraduate and graduate students' research. Graduate students have also presented their work in workshops and conferences. The research plot was also used to teach high school students during the summer about growing grapes, soil nutrient management, weed, and water management.

In FY21, the LSU AgCenter welcomed an interim Vice President of Agriculture and Dean of the College of Agriculture. Dr. Luke Laborde accepted the role in early August 2021. The LSU AgCenter also continued to conduct meetings through a variety of delivery modes because of the effects of the pandemic. Virtual delivery modes was a very prominent tool in our youth development and nutrition programs while our agriculture programs made good use of field demonstrations and the greater flexibility afforded by the open air environment to transition to more in-person meetings.

Critical Issue: Family and Community Development

Low levels of financial literacy and high levels of financial stress among college students can result in serious health problems, absenteeism, and withdrawal from college, among others. Financially literate individuals have the ability to make informed decisions regarding the current and future use and management of their money. Implementing a project revealed low levels of financial literacy among the participants and high levels of financial stress. A large majority of the participants did not use a budget to track monthly income and expenses and did not grasp concepts related to the time value of money or to investing. Participants were taught how to make a household budget and to compute interest rates, the basics of market investing, and how to record stock prices and compute quarterly portfolio balances for hypothetical investments in a publicly traded company and in mutual funds.

When consumers make clothing purchase decisions, they always face problems such as garment fit issues in ready-to wear (RTW) clothing unless they are willing to get custom made clothing at extra expense and time. One study used the 3D body scanner to identify the body mass location within body volume index (BVI). The results of this project may be used as a step to develop an expert system to correlate body measurement and fit problems for each generation. Fashion designers will pay attention to target consumers' body shapes and ready-to-wear (RTW) clothing fit preferences when they design the clothing. And, fashion marketers can create different shopping applications for their potential customers to search for clothing items.

Critical Issue: Food Security and Systems

Two plant projects are ongoing; the objective of one project is to build viticulture research at Southern University AG center and evaluate the new and existing popular grape varieties for Louisiana and the Southern region. Pierce's disease tolerant American hybrids and French American hybrid bunch grapes were planted in a randomized complete block design. The grapes planted on the campus have enabled teaching students to manage fruit crops, pruning, and provided samples for undergraduate and graduate students' research. Graduate students have also presented their work in workshops and conferences. The research plot was also used to teach high school students during the summer about growing grapes, soil nutrient management, weed, and water management. On another project, the general public became aware of the roselle hibiscus crop, its uses, and its health benefits in the daily diet. The project will encourage small farmers to grow roselle hibiscus as a home garden crop for health maintenance to the family as well as an economic crop for field production.

Two animal science projects; one is to determine the prevalence of foodborne pathogens in small ruminants, as unique food vehicles, at both pre-harvest and processing levels. And the second project is to help goat producers to increase the amounts of kiddings per year.

The LSU AgCenter maintains several research projects which address the continued productivity and security of food production systems. Two projects to highlight ongoing research in basic agricultural commodity productivity include research in sugarcane variety development and cattle breeding. Sugarcane production is a major row crop enterprise in Louisiana and the state's industry is solely dependent on sugarcane varieties developed to produce well in Louisiana's climate. Research in a current project has the objectives to develop sugarcane varieties with improved sugar yield, cold tolerance, ratooning ability, pest and disease resistance and general adaptability to Louisiana's temperate environment. Results of this project provide the state's sugarcane producers with superior varieties for production with enhanced agronomic traits. Another research project seeks to enhance the process of in vitro fertilization and maturation in beef cattle production to provide cattle producers with additional tools in the practice of cattle breeding.

Several ongoing research projects seek new and improved practices in the area of pest management in agronomic crop production. One project is using host induced gene silencing (HIGS) as a means of achieving disease control in corn production instead of the traditional use of chemicals to control disease. Consistent suppression of aflatoxin production in selected corn variety lines was observed. Research continues to work in the introduction of disease suppression genes into commercial corn varieties. Another project focuses on the epidemiology and management of soybean diseases in the state. Cercospora leaf blight (CLB) has been a persistent problem in soybean production in the state for many years. Management of this disease has far-reaching impacts to the economies of the state and region. Current research is directed towards developing tools to more quickly and easily screen soybean varieties and to identify new sources of disease resistance. Other research projects ongoing at the LSU AgCenter investigate aspects of the food system beyond the farm gate. One project is conducting research to develop industrial technologies in raw sugar factories which can reduce undesirable effects of fructan polysaccharides on factory performance. Another project is evaluating the operation of domestic U.S. sugar policy and its impact on the high fructose corn syrup market.

The LSU and Southern AgCenter extension agents have actively and cooperatively worked to showcase the results of these projects to Louisiana producers. Educational programs like the Morehouse Black Farmers and Landowners Association Field Day; regional and statewide field days held at our rice, row crop, and sugarcane research stations; regional on-farm beef cattle and forage field days; and intensive animal production workshops have all provided places for agents from both AgCenters to work cooperatively in meeting the needs of the public. Additionally, the on-farm component of many of these programs has increased producer interest in, advocacy for, and adoption of the practices that are demonstrated.

Critical Issue: Natural Resources & Environmental Sustainability

The study to quantify biomass potential availability for bio-oil and bio-char production and utilization. The research extended to the biomass from agricultural crops in southern states such as Mississippi. Relative measures, time series graphs and descriptive statistics coupled with geographic information systems (GIS) mapping using ArcMap were employed to generate the outcome of this research. Two new research trainings have been initiated for students: "Quantifying forest waste potential availability for bio-oil and biochar production and utilization in urban and rural interface" and "Relationship among woody biomass, forest fire, biochar and bioenergy".

One project is evaluating the diversification of Louisiana pastures for multiple uses and enhanced sustainability. Identification and evaluation of reduced-input pasture species options, as alternatives to traditional bermudagrass and bahia grass production, could decrease vulnerability to volatile input costs and increase benefits from provision of multiple ecosystem services by pasture landscapes increasing sustainability of pasture-based enterprises. On-going evaluations of field plot and small pasture experiments continue to provide insights for use of new grass and legume varieties with potential to contribute diversity to Louisiana pastures.

Another project is evaluating multi-functional substrates for use in the horticultural industry. Nursery production relies upon soilless substrates as a rooting media for containerized production. These substrates can be modified to create more efficient use of resources (water and fertilizer). The goal of this research is to identify new techniques and engineer new substrates to help increase economic and environmental sustainability of the nursery production industry. In 2021, three individual research projects were developed and completed which focused on water efficiency through pairing irrigation schedules with stratified substrates. Further, pragmatic stratification practices identification was also completed, focusing on grower-oriented engineering of substrates. Nursery growers have begun to implement stratified substrate trials on farm. With the implementation of more efficient production practices, the industry may be able to reduce use of fertilizer and water.

Collectively, the research across both the Southern and LSU AgCenters are communicated to the people of Louisiana by the extension agents working across the 64 parishes. One key extension effort in the natural resources and environmental sustainability area for the past year included on-farm demonstration trials in Tensas and Assumption parishes that are aimed at showing agricultural producers how to implement environmentally sustainable farming practices on a large scale across several thousand acres. Additionally, a wildlife field day, statewide forestry forums, local burn management trainings, and ongoing Master Farmer programming have all served to emphasize the importance of using the natural resource and environmental sustainability best management practices.

Critical Issue: Obesity, Health and wellness

The *Combating Obesity and Related Diseases through Innovative Food, Nutrition and Wellness Programs* is focused on development of healthy food products utilizing agricultural commodities such as whey protein, resistant starch, sweet potatoes, hibiscus etc. in the areas that have been identified as a food desert. The goal of this project is to develop healthy foods using whey protein/resistant starch and other agricultural products such as sweet potatoes, after assessing the nutritional needs of the communities surrounding Southern University campus. The expected outcome/impact of this project are as follows: community needs are identified, new food products are developed based on the community member's needs, community leaders are being identified, the students, faculty and staff have been involved with community members and the health and wellbeing improvement of these venerable neighborhoods. The participants have learned and changed behaviors that will lead to reduced visits to the physicians and less prescription drugs. In addition, Our faculty and staff under the leadership of Dr. Fatemeh Malakian collaborated with North Carolina A&T University, Tuskegee University, and the 1890 Universities Foundation applied and were awarded \$1,780,000 for the Center for Excellence grant.

LSU AgCenter research projects have focused on issues of food safety, health and wellness. Southern and LSU AgCenter agents and educators have increased their focus on healthy communities and the sustainable changes that can occur when environmental and policy level changes provide healthier options for community and individual change. The Grow a Row program is one example of a project initiated by a state senator and supported by the collaborative efforts of the faith-based community, LSU and Southern agents and many other community partners to grow and provide vegetables to families across the Northeast region. LSU Agents across the state have been actively involved in changing the food system by implementing healthy retail changes, increasing the refrigeration and storage capacity of food pantries, facilitating the adoption of policies to improve the healthfulness of foods offered through the pantries, establishing farmers' markets, supporting the acceptance of SNAP at farmers' markets, and connecting producers to local market. From a physical activity standpoint, these agents have focused on environmental changes that provide more and safer destinations for walking, biking, and engaging in multiple other physical activities. Furthermore the joint -use agreements have been negotiated to provide the public access to school facilities for after hours activity options. In some parishes Southern and LSU AgCenter agents have worked together to hold community forums and facilitate engagement of parish citizens in taking a more active role in community change.

Direct education programs like Dining with Diabetes, Break Up with Salt, Build a Healthy Meal (video series) and Let's Eat for the Health of It have been signature LSU AgCenter programs offered during the past year. Story Walks have emerged as a signature interactive program that engages families with young children in physical activity. The LSU AgCenter Healthy Communities program focuses on making policy, systems, and environmental (PSE) changes that will result in long-term, sustainable solutions to health challenges that our communities face. We work on improving both nutrition and physical activity environments through projects like: Farmers markets; healthy food retail programs; healthy nutrition standards in schools, food pantries, and churches; community and school gardens; exercise stencils and fitness signage in public spaces like parks, playgrounds, and libraries; local Complete Streets plans; youth coalitions focused on community health; and walkability and bikeability improvements along routes to everyday destinations like grocery stores and schools.

Critical Issue: Youth Development

A project developed garden program and therapeutic horticulture experience for adjudicated and incarcerated youth within the correctional facility and school campus; helped to promote healthy lifestyles through nutrition education to adjudicated and incarcerated youth; and provided adjudicated and incarcerated youth with interpersonal and professional work skills for career opportunities and

family strengthening techniques. Changes in action include trying new fruits and vegetables, being open to trying new things and enjoying fruits and vegetables directly from out of the garden. Condition changes include an increased amount of youth with interest in agricultural related careers.

Through social media and face-to-face interactions, the public has benefited from our youth project, *Eliminating the Effects of Food Insecurities in Food Desert Areas through Youth Gardening project*. Sessions included mental health and the therapeutic benefits of gardening. Issues associated with food insecurities may adversely impact one's mental health. In collaboration with community groups and schools within proximity of the university, we train youth about starting/sowing seeds, additionally, the project has increased volunteer engagement from college students to assist with building youth school gardens in the local community. Church groups have joined the efforts with local partner, ExxonMobil YMCA, which encourages the intergenerational connection between youth and seniors. With partnership with Louisiana Public Broadcasting (LPB), the SU Ag Center increased the audience size as many viewers were made aware of our activities using USDA/NIFA funding towards eradicating food deserts and expanding the public's knowledge on food insecurities.

Two important and overarching achievements of the Louisiana 4-H Program in the past year was the adoption of the THRIVE Model as the foundational theory undergirding the program experiences that are offered to Louisiana youth and adoption of the 4-H Online system as member enrollment and program management system for the state. Louisiana 4-H continues to participate in the nationwide retention study, a study that has provided excellent opportunity for the state program to better understand youth experiences in the program, their intention to re-enroll, and ultimately provide data for making program decisions that help to retain youth in the program. Louisiana 4-H also continues to implement the Lesson Study program as a way to provide quality professional development and youth educational programming. The Louisiana 4-H Food Challenge provides youth in 4th through 12th grades a way to learn about healthful foods while practicing proper food safety, food preparation and communication skills in a competitive environment. In light of the destruction at Camp Grant Walker and ongoing COVID concerns, the traditional, residential 4-H Camp experience in summer 2021 was replaced with a series of Traveling Road Show Day Camps. The camps reached 777 youth from 31 different parishes and delivered an educational, enjoyable alternative to the youth. Camps in a Box ----. The Louisiana 4-H program continues to make a strong investment in ag awareness programming. AgMagic At the State Fair, AgMagic CENLA, AgMagic Baton Rouge, AgMagic On the River, and Ag Alley continue as signature events supporting this educational endeavor.

Merit and Scientific Peer Review Processes

Updates

None

Stakeholder Input

Actions to seek stakeholder input that encouraged their participation with a brief explanation

Most stakeholder inputs were collected virtually since stakeholders were not comfortable with in-person meetings.

Methods to identify individuals and groups and brief explanation

None

Methods for collecting stakeholder input and brief explanation

None

A statement of how the input will be considered and brief explanation of what you learned from your stakeholders

Stakeholder input was used to assist research and extension faculty, staff and administrators in identifying emerging issues and in evaluating ongoing programs, particularly in light of the changes wrought by the pandemic. Programs are shifting to focus on strategies to assist producers and families cope with rising costs and ongoing supply chain issues that continue to create economic hardships and social stresses for our families and youth.

Highlighted Results by Project or Program

Critical Issue

[Improving Safety and Health of Wildland Firefighters Through Personal Protective Clothing \(formerly WDC39\)](#)

Project Director

Casey Stannard

Organization

Louisiana State University and A&M College

Accession Number

1025955



Yearly report

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

The multi-state project seeks to create protective clothing for wildland firefighters that will enhance function and comfort. In addition, the research will allow information to be provided to wildland firefighters which will improve their understanding of the use and care of their protective clothing.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Our textile science team studied laundration of wildland firefighter PPE, these results were published in a peer-reviewed journal. Our apparel design team created and launched a PPE user survey to determine needs and wants of wildland firefighters.

Briefly describe how your target audience benefited from your project's activities.

The textile science team was able to convert the results of their research to a professional fire fighter's audience. We plan to take these results into account when designing the improved PPE.

Briefly describe how the broader public benefited from your project's activities.

We have determined how wildland firefighters currently care for their PPE. This will enable us to create educational materials to help them better care for PPE. Determining the wants and needs for the PPE from the apparel design survey will also help us to create better PPE for wildland firefighters.

[Evaluating and Addressing Financial Literacy and Financial Stress among College Students](#)

Project Director

PATRICIA MEYINSSE

Organization

Southern University and A&M College

Accession Number

1020359



Evaluating and Addressing Financial Literacy and Financial Stress among College Students

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

For several decades, college costs have outpaced income growth, forcing a majority of students and their families to use student loans to finance college. A large majority of these borrowers are financially illiterate which often lead them to borrow more money than they will be able to comfortably repay from future earnings. Research suggests that levels of financial

literacy and high levels of financial stress among college students can result in serious health problems, absenteeism, and withdrawal from college, among others. Thus, the project was undertaken to determine students' levels of financial knowledge and financial stress, and to enhance their financial literacy levels.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Our major activities to date have been on survey development and execution, data analyzes, class assignments, and on dissemination of information on personal financial management. For example, the survey generated data on self-assessments of financial literacy and self-efficacy; budgeting; credit and debt repayment; saving, investing, insurance, and taxes; student loan and loan literacy; financial stress and related measures; and on demographic characteristics. Thus, we are able to analyze the objectives empirically and tailor instructional materials accordingly. Selected survey results are presented below.

Average score on financial literacy questions: (52%)

Correct Responses to the Rule 72 Question: (39%)

Median Range for Student Loan Debt (\$10,000-\$19,999)

Highest level of Student Loan Debt (\$75,000+; 7% of Respondents)

Stressed About Personal Finances: Agree (38%); Strongly Agree (22%)

Worried About Paying for College: Agree (33%); Strongly Agree (25%)

Worried About Repaying Student Loans: Agree (25%); Strongly Agree (13%)

Briefly describe how your target audience benefited from your project's activities.

Our target audience consists of undergraduate and graduate students at Southern University and A&M College. All participants received copies of the Lessons on Money booklet containing information on budgeting, credit, debt, saving, and investing, among others.

The survey results revealed low levels of financial literacy among the participants and high levels of financial stress. A large majority of the participants did not use a budget to track monthly income and expenses and did not grasp concepts related to the time value of money or to investing. Therefore, the project director taught students enrolled her Applied Economics Principles course how to make a household budget and to compute interest rates, the basics of market investing, and how to record stock prices and compute quarterly portfolio balances for hypothetical investments in a publicly traded company and in mutual funds.

Quiz scores on these topics increased after instruction and some students reported that they would begin tracking their income and expenditures going forward and that the stock market exercises had triggered their interests in learning more about investing.

Briefly describe how the broader public benefited from your project's activities.

Financially literate individuals have the ability to make informed decisions regarding the current and future use and management of their money. Therefore, if students increase their financial literacy levels, they will be able to make more informed decisions about student loan debts and repayments and this in turn would benefit society because the national debt would not be increased by the federal government having to forgive massive amounts of student loan debts.

Critical Issue

Food Security and Systems

[The Louisiana State University Agricultural Center's \(LSU AgCenter\) Sugarcane Variety Development Program](#)

Project Director

Collins Kimbeng

Organization

Louisiana State University and A&M College

Accession Number

7000845



"The Louisiana State University Agricultural Center's (LSU AgCenter) Sugarcane Variety Development Program"

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

The sustainability and global competitiveness of the Louisiana sugar industry relies heavily on the availability of new, genetically improved cultivars of sugarcane. This project seeks to: 1) develop sugarcane cultivars with improved sugar yield, cold tolerance, ratooning ability, pest and disease resistance and general adaptability to Louisiana's temperate environment, 2) develop efficient crossing, selection, and variety testing techniques, 3) incorporate and utilize molecular breeding approaches to improve variety development activities, and 4) incorporate and utilize germplasm from the SRU basic breeding program into the breeding and selection program.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

In Objective 1, a new sugarcane cultivar, L 14-267, was released to the Louisiana sugar industry in 2021. Field plot techniques that improve selection efficiency in small plots were developed and utilized in accomplishing Objective 1. In collaboration with the molecular breeder, markers conferring brown rust resistance in sugarcane were used to genotype parents used for crossing. This led to a more informed pairing of parents during crossing. To bring in new genes for future breeding and selection, genotypes derived from the germplasm enhancement program at the USDA, Sugar Research Unit at Houma, LA were used as parents in crossing. The seedlings derived from these crosses were planted in the field in 2021. Several experimental varieties that continue to perform better than check cultivars in numerous tests and stages of the selection program were selected and replanted in more advanced stages of the program.

Briefly describe how your target audience benefited from your project's activities.

Sugarcane cultivar recommendations were made to growers and processors during several field day activities held across the state. Information from this project was shared with scientists and students via conference proceedings and journal publications. Several international sugarcane programs continue to seek seed and germplasm material from this project, via germplasm exchange agreements, for use, in either improving their breeding stock or as potential cultivars for their industry.

Briefly describe how the broader public benefited from your project's activities.

Sugarcane is the leading row crop in Louisiana. According to the American Sugarcane League of the USA, Inc., in 2019, the Louisiana sugar industry employed a total of 16,400 people and generated a total value of \$833.7 million for Louisiana producers, processors, and landlords. Several economic activities are reliant on a thriving sugar industry which in turn is reliant on the availability of new cultivars. New cultivars with improved agronomic and milling characteristics bring with them increased productivity and profitability to the Louisiana sugar industry and the state as a whole.



In 2-3 sentences, briefly describe the issue or problem that your project addresses.

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Basic and Applied Studies of the Soil Rot Pathogen of Sweetpotato

Project Director

Gregg Pettis

Organization

Louisiana State University and A&M College

Accession Number

7000559



Basic and Applied Studies of the Soil Rot Pathogen of Sweetpotato

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

The highly necrotic disease soil rot of sweetpotato is caused by the bacterium *Streptomyces ipomoeae*. Though disease-resistant varieties of sweetpotato are in use, resistance is incomplete and disease severity can still vary. We aim both to understand how *S. ipomoeae* causes soil rot and to develop applications that will be useful for sweetpotato production.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

During the first portion of this Hatch project, our efforts have been focused mainly on objective two, which involves developing an efficient and reliable method of laboratory (in vitro) screening for new soil rot-resistant varieties of sweetpotato. Current methodology typically involves lengthy field-based testing. Our initial in vitro assay involved Petri dishes containing water agar onto which we placed sweetpotato plantlets whose roots were then inoculated with a pathogenic *S. ipomoeae* strain. Plates were then incubated at 25 degrees centigrade with a 16-hour photoperiod and plantlets were examined daily for symptoms. Five varieties of sweetpotato (86-33, Bellevue, Beauregard, Bonita, and Jewel) were screened by this method. Based on previous field testing, 86-33 shows the strongest resistance to soil rot while Jewel is highly susceptible and the other three show intermediate levels of resistance. However, in these initial plate assays, all varieties appeared to be quickly and equally susceptible to disease. We hypothesized that the immune systems of resistant varieties may need to be primed by exposing them to bacteria (e.g., soil bacteria). To test this hypothesis, we screened resistant (86-33) and sensitive (Jewel) varieties using two different inoculation protocols. The first involved infecting the roots of plantlets with *S. ipomoeae*, as before, on water agar plates. For the second, the roots of plantlets were dipped in a suspension of *S. ipomoeae* and the plantlets were then planted in sterile (autoclaved) or non-sterile (non-autoclaved) soil in Magenta boxes. For both protocols, plantlets were again incubated at 25 degrees centigrade with a 16-hour photoperiod and examined daily for symptoms for a total of 20 days. For the soil assays, while it was not possible to examine roots daily for necrosis, other disease symptoms, including stem necrosis and leaf wilting and stunting, could be readily detected. For each data set, we then determined the AUDPCnc (i.e., The Area Under the Disease Progress Curve [normalized and corrected]) and subsequently subjected these results to single factor Anova statistical analysis. For plate assays, as expected, there was no significant difference in AUDPCnc results for 86-33 versus Jewel ($P=0.0535$). For soil experiments, there was no significant difference in the results for sterile versus non-sterile soil ($P=0.5253$); however, the average AUDPCnc value for 86-33 was significantly less than that of Jewel in either soil type ($P=0.0038$). Moreover, the difference in results between the soil and plate protocols was also significant ($P=0.0345$). Taken together, our results support the view that soil rot-resistant versus sensitive sweetpotato varieties can be quickly distinguished by priming resistance with live or dead bacteria.

Briefly describe how your target audience benefited from your project's activities.

Target audiences (e.g., sweetpotato farmers and sweetpotato processing industry personnel) benefited since we are one step closer to developing a useful application that can ultimately improve sweetpotato production.

Briefly describe how the broader public benefited from your project's activities.

The broader public benefited because the knowledge gained, and the applications developed from this project will lead to production of sweetpotato varieties of even greater quality.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Ph.D. candidate Natasha Soares performed the research described here and she is mentored by the PI. Natasha and the PI also met with collaborator Clark to discuss results and plan experiments. We are now testing whether the plate assays can be modified (e.g., by including varying percentages of sterile soil in the water agar), so that soil rot resistance can be primed in this manner and resistant versus sensitive varieties can be distinguished on plates.

[Assisted Reproductive Technologies \(ART\) to enhance reproductive performance and facilitate the application of Genetic Modification \(GM\) in cattle breeding](#)

Project Director

Kenneth Bondioli

Organization

Louisiana State University and A&M College

Accession Number

1026563



In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Freezing of germ cells has been a valuable breeding tool for livestock for decades but has been limited to sperm for cattle because the female gamete, the egg, does not survive freezing well. This problem has limited the ability to apply other techniques such as cloning and genetic modification to cattle breeding.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

The activities in this project have provided methods to improve the survival of major structures within cattle eggs following warming after freezing. These important structures within eggs provide energy for the embryo following fertilization and ensure the accurate transmission of genetic material from the egg to the resulting embryo, allowing development to occur normally.

Briefly describe how your target audience benefited from your project's activities.

The target audience of farm animal producers and reproductive physiologists in industry and academia has benefited from these activities by having access to the results through articles published in refereed journals and communications at international scientific meetings. This information has provided improved methods for the survival of bovine oocytes following freezing.

Briefly describe how the broader public benefited from your project's activities.

The broader public has benefited from the project's activities because the improved methods have the potential of providing lower cost and/or better cattle-based food products through the application of technologies such as cloning and genetic modification to cattle breeding programs.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

This project has provided significant opportunities for training and professional development to graduate and undergraduate students seeking careers in animal agriculture. The results from this project have been disseminated to communities of interest by the publication of articles in refereed scientific journals and presentation of abstracts at international meetings.

Articles published in refereed journals:

Diaz FA, Gutierrez-Castillo EJ, Foster BA, Hardin PT, **Bondioli, KR, Jiang Z.** Evaluation of seasonal heat stress on transcriptomic profiles and global DNA methylation of bovine oocytes. *Front Genet.* 2021. PMID: 34777457.

Gutierrez-Castillo, E., Hao, M., Foster, G., Gatenby, L., Chun, M., Pinto, C., **Bondioli, K., Jiang, Z.** 2021. "Effect of vitrification on global gene expression dynamics of bovine elongating embryos." *Reproduction, Fertility and Development* **33**(5): 338-348.

Abstracts presented at international meetings:

Gatenby, L. and Bondioli, K.R. Increasing Cytoplasmic Glutathione in Bovine Oocytes with Modified in Vitro Maturation systems. 2021. *Reprod. Fertil. Dev.* 34:281.

Girka, E., Giraldo, A.M., Bondioli, K. R. 2021 Characterizing cytoplasmic lipid profiles during *in vitro* maturation of porcine oocytes. 2021. *Reprod. Fertil. Dev.* 34:312.

Gutierrez-Castillo, E. Diaz, F., Talbod, S.A. Bondioli, K. R. 2021. Effect of Extended Culture After Vitrification-Warming on Mitochondrial Function of Bovine Oocytes. *Reprod. Fertil. Dev.* 34:251.

[Dynamic photorespiration: Molecular studies for improved understanding of diurnal and seasonal variation in photorespiration metabolism of crops in Louisiana.](#)

Project Director

Paul South

Organization

Louisiana State University and A&M College

Accession Number

1026259



Understanding genetic elements and stress response in photorespiration

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Photorespiration is a key component of plant central metabolism. Due to the energetic demand of photorespiration there can be a 15-50% drag on photosynthetic efficiency and reduction in plant growth. Understanding how photorespiration is regulated at the genetic level could make it possible to manipulate the metabolism for increased crop productivity.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

1. Photorespiration requires metabolites to be transported through different compartments within a plant leaf cell. Currently, there is little understanding at the genetic level how photorespiration transport works. Objective I's goal is to identify transport proteins important for photorespiration flux. Major activities have included biochemical testing of a putative transport protein called MFL1 that when mutated inhibits plant growth. Current work has determined that the transporter is important for growth at ambient CO₂ levels and is important for light stress. Two additional transport proteins previously characterized in photorespiration have also been tested for salt stress tolerance in roots. These findings have suggested that the process of photorespiration is also important for salt stress resistance. Additionally, a screening method for photorespiration transport proteins has been written and recorded. The protocol is currently under review in the Journal of Video Experimentation (JoVE).

2. Objective II is the characterization of genetic response elements important for gene regulation in photorespiration. Current progress towards this objective includes the characterization of a transcription factor ABF4. Analysis of DNA sequences shows that multiple genes important for photorespiration have DNA sequence elements for the transcription factor ABF4. Current work is underway analyzing ABF4 mutant plants in both low CO₂ and heat stress conditions. Both of these conditions are known to increase rates of photorespiration.

Analysis of additional genetic response elements in photorespiration genes identified sequences of DNA important for increasing gene expression under stress conditions. To characterize these identified DNA sequence elements synthetic DNA vectors were synthesized and tested to analyze response to temperature stress. The synthetic DNA constructs were tested and verified and resulted in a publication in *Frontiers in Plant Science* in a special issue on plant synthetic biology.

3. Objective III is the characterization of short and long term gene expression response to seasonal and abiotic stress conditions. Important crops such as rice and cowpea are the first target crops set up for characterization. Due to supply chain disruption there was a delay in seed delivery. Seed propagation has been recently completed and the first drought experiments on rice and cowpea are currently in progress.

Briefly describe how your target audience benefited from your project's activities.

As a key component to central metabolism, photorespiration has an impact on all aspects of plant growth. The target audience for basic research on photorespiration are scientists studying plant growth and development, breeders, and plant biotech companies, as well as growers and the general public. The current activities on objective I will benefit scientists involved in basic research adding fundamental knowledge to plant cellular transport. The project's activities have resulted in one publication on the development of synthetic DNA parts that can be used in plant engineering. This could lead to the development of agriculture biotech products benefiting all target audiences. Objective III activities will benefit scientists and breeders with the goal of understanding the genetic regulation of photorespiration under stress conditions. With the

knowledge that will result from objective III breeders can identify genetic elements and traits that could improve plant productivity under drought and heat wave conditions. This could then lead to the development of products and crops that are adapted to climate change conditions, benefiting growers and consumers.

Briefly describe how the broader public benefited from your project's activities.

Increasing the fundamental understanding of plant central metabolism provides insight into plant growth and better prediction on plant productivity and yields. Objective I and II have increased knowledge on photorespiration at the basic level. This information will be key to breeders and seed producers that want to target central metabolism for improved traits. Objective II focuses on a biotechnological approach to engineering plants so they can be developed with increased resistance to heat and drought stress. These activities and developments can benefit the broader public by providing tools for crop development. Crop products can then be developed for growers making food production more resistant to climate change, or increasing yields compared to other varieties. This benefits the broader public by adding products to maintain an affordable and reliable food supply.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

No major changes have been proposed in the approach. Supply chain issues with seeds and reagents delayed to bulking of seed samples for laboratory and field research. Progress has been made to generate seed for research purposes.

Research activities have resulted in a research publication in *Frontiers in Plant Science* and presentations at the American Society of Plant Biologists Plant Biology world summit, A Creative Economy for Sustainable Development, and The Southern Association of Agricultural Scientists annual conference.

[Alternative Barriers to Trade and their Implications for Louisiana Agriculture](#)

Project Director

Sunghun Lim

Organization

Louisiana State University and A&M College

Accession Number

1025785



[Alternative Barriers to Trade and their Implications for Louisiana Agriculture](#)

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

The United States supports the price of sugar through an import quota system. The purpose of this project is to determine how these price supports have impacted competing products, particularly High Fructose Corn Syrup.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Two models were developed to examine the relationship between the price of sugar and High Fructose Corn Syrup. The first model looks at the relationship between the price of sugar and the reaction of the High Fructose Corn Syrup Industry in adjusting their price. The second model looks at the relationship between the price of sugar and deliveries of High Fructose Corn Syrup.

Briefly describe how your target audience benefited from your project's activities.

The results of our analysis provide industry, policy-makers, and academic researchers with information showing the relationship between the government supported price in the sugar industry and the impacts on a competing industry.

Briefly describe how the broader public benefited from your project's activities.

The results of this analysis show that the supported price of sugar increases the price of High Fructose Corn Syrup and also increases deliveries of HFCS. This information has important implications for policy makers as they determine agricultural policies designed to create a safe and secure food supply.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Work from these analyses was presented at academic conferences and published in refereed journals.

Sugarcane Pathology Research

Project Director

Jeff Hoy

Organization

Louisiana State University and A&M College

Accession Number

1025373



Sugarcane Pathology Research

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Sugarcane production and profitability in Louisiana are adversely affected by a diverse group of diseases. A comprehensive sugarcane pathology research and extension program is needed to improve management practices and minimize losses to diseases. This is an essential contribution to the challenge of continuing to increase yield potential in the economically important sugarcane industry.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

To better manage diseases affecting sugarcane in Louisiana and minimize losses, a comprehensive research and extension program was continued to improve methods to breed and select disease resistant varieties, identify and implement integrated methods to manage stalk rot of seed-cane and improve the reliability of billet planting, and reduce the impact of systemic diseases through support for programs to provide growers with healthy planting material. Resistance to diseases was evaluated in various ways as part of a multidisciplinary sugarcane variety development program. Traditional screening methods were used to evaluate resistance responses and assign ratings to experimental varieties, and research continued to associate DNA markers with resistance to multiple diseases that could be utilized in marker-assisted selection for more reliable and efficient identification and incorporation of resistance to leaf scald, brown rust, smut, and mosaic in the breeding program. Multiple factors are creating a need to switch from planting of whole stalks to billet (stalk section) planting despite the fact that billets are more adversely affected by an interaction between stalk rot and environmental stress conditions. Treatment of billets at planting with a combination of fungicides and an insecticide has been shown to improve stand establishment and yield. Application of chemicals in combination with a set of optimized cultural practices to prevent disease conducive conditions is reducing risk to a level that will allow the industry to shift to billet planting. A public and private sector partnership continued to produce and provide healthy planting material to sugarcane growers in Louisiana. Disease monitoring and operation of a local quarantine were continued and helped provide successful management of multiple potentially important diseases, including ratoon stunt, smut, mosaic, leaf scald, and yellow leaf.

Briefly describe how your target audience benefited from your project's activities.

Target audiences benefitted from the project activities in multiple ways. Direct benefits were provided to sugarcane growers by the release of two new high yielding disease resistant varieties, treatment of billets in commercial plantings with fungicides labeled for control of stalk rot, and the availability of healthy planting material that has allowed successful cultivation of the number one variety, L 01-299, despite susceptibility to smut. Indirect benefits that will contribute to future improvements in disease management included implementation of marker-assisted selection for leaf scald resistance in the variety development program, continued progress in identifying additional markers associated with multiple other diseases,

identification of additional fungicides for stalk rot control, improved understanding of how the chemical treatments reduce stalk rot severity, and support for healthy seed-cane programs. Finally, sugarcane growers, industry representatives, County Agents and consultants benefited from extension of research findings on disease management through a variety of oral and written/electronic means.

Briefly describe how the broader public benefited from your project's activities.

The broader public benefited from project activities through the enhanced success of the economically important sugarcane industry. High industry yields in 2021 will continue to support the \$3 billion total value-added contribution to the state economy and the 17,000 jobs associated with the industry.

Closing Out (end date 09/07/2023)

Management of the Brown Marmorated Stink Bug

Project Director

Jeff Davis

Organization

Louisiana State University and A&M College

Accession Number

1024233



Progress Report

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Monitoring for reproducing populations of brown marmorated stink bug, *Halyomorpha halys* (Stål),

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

In June of 2021r, we confirmed a reproducing population at a property in Iberville Parish. Because this pest has the potential to become a serious problem in Louisiana row crops, we began monitoring the area to determine extent of spread.

Briefly describe how your target audience benefited from your project's activities.

We identified local population of brown marmorated stink bug and began monitoring it's movement into field crops.

Briefly describe how the broader public benefited from your project's activities.

The public benefited by knowing this pest is now established in Louisiana and will need to be controlled.

Closing Out (end date 09/07/2023)

Early and Artificial Weaning of Kids Born to Does in Intensive Breeding and Diverse Systems in Southeastern Louisiana

Project Director

Harold Mellieon

Organization

Southern University and A&M College

Accession Number

1023793



Early and Artificial Weaning of Kids Born to Does in Intensive Breeding and Diverse Systems in Southeastern Louisiana

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

In this project, we are looking to breed goat does early to increase profits for producers. With goat does being seasonal breeders, they typically have kids (offspring) once per year. This study aims to increase the amounts of kiddings per year for producers.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

By incorporating early weaning into the goat herd, we expect it will assist in the does going into estrus sooner to begin a second pregnancy in less than 1 year. By having the does become pregnant sooner, this will give the producer an extra crop of kids to sell or even replace his older animals.

Briefly describe how your target audience benefited from your project's activities.

The target audience will benefit from this research because it will allow them to see how they can have these seasonal breeders increase pregnancies and make more money on their farm. Determining the best way to wean these goat kids early will allow them to have a starting point to improve upon in their operation. Small producers typically have 1 crop of goat kids to sell but with this research, they should be able to produce 2 crops to enhance their profits and livelihood.

Briefly describe how the broader public benefited from your project's activities.

As more producers are able to increase the amount of pregnancies in their goat herd, they will have more to sell to private buyers and the public. It will also allow them to have more than one (1) season they can make money in their operation. Being able to wean the kids earlier will allow for does to be placed in estrus artificially for their 2nd pregnancy in less than 1 year and improve the producers ability to make more money on their operation.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Working during the Covid-19 pandemic has delayed some things as it pertains to research projects as feed prices have risen and parts for equipment have become scarce. We have worked to overcome these and similar challenges to continue with the research to gain feasible data for our target clientele.

[Development of Industrial Technologies to Reduce Undesirable Effects of Fructan Polysaccharide on Sugarcane Processing Efficiency](#)

Project Director

Gillian Eggleston

Organization

Louisiana State University and A&M College

Accession Number

1024020



Development of Industrial Technologies to Reduce Undesirable Effects of Fructan Polysaccharide on Sugarcane Processing Efficiency

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Sugarcane is a significant component of the agricultural landscape in the United States, being currently cultivated and processed in Louisiana, Florida, and Texas. Profitable and continued sugar production are challenged by ongoing sugarcane deterioration in the cane supply as well as at the factory, that not only causes expensive losses of sucrose but also produces deterioration products that elevate the viscosity of cane products in the factory and reduce processing efficiencies. Such

products are mainly polysaccharides (long chain sugars), including fructan, that reduce process efficiencies and depress raw sugar yields and quality as well as their marketability. Little information is known about fructans in cane processing and how to measure and control them.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Fructans in Factory Downstream Products

An in-depth study of select final "C" molasses (a by-product of sugarcane processing) from one Louisiana factory across one processing season was conducted, and the results compared to equivalent molasses from the previous season. In the season where molasses exhaustion (the recovery of sucrose from final molasses) was good, the concentrations of polysaccharides (long chain sugars) were found to be a strong contributing factor. Cane starch, dextran, and fructan polysaccharide concentrations were all lower-than-normal and caused lower viscosities of the final molasses, hence better sucrose exhaustion. By using a new enzymatic kit by Megazyme™, which represents a useful research tool, it was shown for the first time that considerable and consistent amounts of fructan (>9000 ppm or parts per million) occurs in final molasses from Louisiana and that this polysaccharide has been underestimated. Result findings also suggested that just a reduction of 1000 to 3000 ppm of fructans in molasses may have a strong effect on improving the removal of sucrose from molasses. The presence of fructans was also investigated in other downstream cane products: A, B, and C massecuites (sucrose crystals in a sea of molasses before separation via centrifugation), A, B, and C molasses, and A, B, and C raw sugars. Like other impurities, fructan increased from A to C products which means that fructans are concentrated across the A to C crystallization processes. Moreover, there was a strong relationship between fructans and the sucrose concentrations, which strongly suggested that sucrose yields could be controlled if fructan is controlled.

Source of Fructans at the Cane Factory

By undertaking experiments in the laboratory where sugarcane juices from Louisiana factories were allowed to deteriorate at 25 °C, it was repeatedly observed that fructan formed on microbial deterioration of the juice along with dextran and mannitol (metabolites of lactic acid bacteria). In all the experiments, dextran formation eventually predominated over the microbial deterioration causing fructan formation, which may be due to glucose inhibiting fructansucrase activity. In some of the sugarcane juices, fructans existed before deterioration which is most likely due to short chain fructooligosaccharides from the cane plant or from rotting cane leaves, and further research is being conducted. Another important finding from this research was that fructans contributed to the factory measurement of dextran - a non-specific, haze forming method used all over the world. It was previously known that this "Haze Dextran" method was not specific to dextran but this was the first time that fructan was shown to be a major contributor.

Identification of Commercial Biocides that Can Control Fructan Formation at the Factory.

Using a new enzymatic kit specific for fructans, it was repeatedly shown that fructans can occur in large amounts in crusher (first extraction) juices and slimy mill areas (where biofilm had built up) of factories. A large factory study was undertaken to investigate if three commercially-available biocides (bleach or sodium hypochlorite; sodium carbamate; sodium permanganate), all of which have been used to control dextran polysaccharide at sugarcane factories, could also control fructan. At a dose of 5 ppm (parts per million), bleach was able to control fructans and dextrans as well as reduce sucrose losses. At a slightly higher dose of 10-15 ppm, sodium carbamate behaved similarly to bleach. From 5 to 40 ppm doses, sodium permanganate neither controlled fructans nor dextrans. A second large factory study was undertaken to evaluate if the biocides could control fructans in biofilm development at a clarification mud dewatering system. Bleach significantly controlled biofilm production but no significant reductions of fructan in biofilms was found with the carbamate biocide. Sodium permanganate performed worse than a water control. These research findings were the first reported studies on the control of fructans at a factory.

Interactions of Fructan and Other Sugarcane Polysaccharides on the Viscosity of Downstream Factory Products

Fructan and other polysaccharides can act individually or possibly synergistically to contribute to unwanted high viscosities of downstream products at the sugarcane factory and other processing problems. Solutions of bacterial fructan of high molecular weight (HMW) were mixed with other solutions of cane polysaccharides: dextran (HMW), amylose, and amylopectin, at approximately the same starting viscosity. Amylose and amylopectin are polysaccharides present in sugarcane starch and formed in the field cane. When fructan was mixed with dextran in ratios (volume to volume) of 25:75, 50:50, and 75:25, there was no enhancement of the dextran viscosity which indicated there was no interaction. There was, however, no suppression either which was surprising as fructan suppresses the viscosity of plant polysaccharides (pectin).

When fructan was mixed with amylose there was always a repeated increase in viscosity suggesting an interaction with amylose. Since both fructans and starch have recently been shown to reduce the recovery of sucrose in the factory and reduces molasses exhaustion, this is an important research finding that may lead to more sugar production if controlled.

Briefly describe how your target audience benefited from your project's activities.

The main target audience for research resulting from this project are both sugarcane processors and refiners who manufacture raw and white sugar, respectively. The increased factory efficiency from the greater control of fructans will have also benefited sugarcane growers as they share in profits with the factory processors. Other target audiences who have benefited from this research are sugar beet processors in the northern States of the USA, since fructans are also a problem for them. Other researchers in the fields of sugar research, food science, biotechnology, biochemistry and engineering also benefited from the sharing of the research results via presentations, peer-reviewed publications, proceeding papers, and meetings.

Briefly describe how the broader public benefited from your project's activities.

This project focuses on improved efficiencies of sugar factories that also lead to improved quantity and quality of sugar products. Consumers have also benefited through the availability of superior commercial sugar products. Other industries that utilize sugar rich feedstocks will also benefit including the renewable biomass, fermentation, and bioproducts industries. All research findings that have been published can be accessed by the public, academic, and industry sectors.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

No major changes or problems were encountered during the reporting period.

Training/Professional Development Provided. Mentored and trained a graduate student on research to control fructan at the factories. Mentored Research Associate on interactions of fructan with other polysaccharides and allowed them to give presentations at professional meetings. Obtained several grants from the private sector and LSU University to support my research program at LSU AgCenter. Continued to serve as a leader within LSU AgCenter and the scientific community by serving as the Director of the Audubon Sugar Institute, the Commissioner of Processing for the International Society of Sugar Cane Technologists, the General Referee of Cane Processing for the International Commission for Uniform Methods in Sugar Analysis, Guest Editor for Scientific Journals, and Editor of local Factory Seminar Proceedings.

Dissemination of Findings. Dissemination of findings resulting from this work included presentations at local and national scales; three peer-reviewed journal papers, four seminar proceedings papers. Also discussed findings with personnel from all Louisiana factories.

Next Reporting Period. Continue work on interactions of fructans with other cane polysaccharides, sucrose, and mineral ions on the viscosity of downstream factory products. Develop a rapid and inexpensive method to measure fructans at the factory. Continue to develop and optimize the application of commercially-available enzymes to control fructans at the factory.

[Developing and evaluating a behavior-based food safety management model for the healthcare foodservice industry](#)

Project Director

Wenqing Xu

Organization

Louisiana State University and A&M College

Accession Number

1023870



Developing and evaluating a behavior-based food safety management model for the healthcare foodservice industry

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

The neutropenic diet has long been a dietary prescription for immunocompromised patients. Its effectiveness and consistency, unfortunately, have been constantly challenged. Researchers and healthcare policymakers call for liberalization of the neutropenic diet, which shifts risk management strategies from excluding claimed “high-risk” food items to focus on safe food handling. The responsibility of food safety falls on foodservice workers in a healthcare setting. This project aims to 1) investigate the beliefs, attitudes, and behaviors of safe food handling practices for healthcare foodservice workers; 2) investigate the beliefs and attitudes of doctors on switching from neutropenic diets to food safety guidelines; and 3) develop interventions using a multiple-baseline design targeting safe food practice.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

The neutropenic diet restricts the diet of cancer patients to reduce risk of infection. However, research showed that the infection rate is similar among cancer patients on a neutropenic diet or a regular diet. Some institutions in the US are moving away from the restricted diet and moving towards the FDA's safe food handling for cancer patients' guidelines. Some other institutions are hesitant to make the switch until their foodservice staff are trained to understand the importance of food safety for cancer patients who are considered as a high risk population.

In this reporting period, a reliable and valid self-assessment survey instrument tool was developed for use in a healthcare foodservice operation. Results of this tool can help organizations pinpoint areas to improve food safety practices of foodservice workers who serve an immunocompromised population. In addition, food safety behaviors of food handlers in the foodservice area in a cancer center have been collected using the tool we developed.

Briefly describe how your target audience benefited from your project's activities.

As we complete the project, the cancer centers who are hesitant to switch from a neutropenic diet to safe food handling could implement or instruct their foodservice company to implement science-based training for their foodservice staff. Our study will provide the foundation for such a food safety training program, which will eventually benefit the cancer patients.

Briefly describe how the broader public benefited from your project's activities.

Besides our main target audiences - cancer centers, foodservice staff in health care settings, and cancer patients - our project benefited other communities of interest such as food safety professionals and Registered Dietitians. In this reporting period, our results have been presented at a Regional Medical Center administration meeting, state RD association annual meeting, as well as the International Association for Food Protection (IAFP) annual conference.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

The major challenge was that the COVID-19 pandemic limited and delayed our data collection, considering our target audiences work in regional cancer centers with high-risk populations. Restrictions were in place for 6 months, which prevented us from collecting survey data.

Closing Out (end date 09/07/2023)

[Improving Soybean Arthropod Pest Management in the U.S.](#)

Project Director

Jeff Davis

Organization

Louisiana State University and A&M College

Accession Number

1024232



In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Soybean is an established crop with a high production value in the United States. The insects that utilize soybean as a food source have changed drastically over the last 20 yr. Much of the extension literature summarizing pest species distribution and abundance is out of date. We created a new article that provides profiles for five common soybean caterpillars, including description, life cycle, and injury to plant.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

The distribution of lepidopteran pests in soybean (*Glycine max* (L.) Merr.) is a current knowledge gap limiting accurate prioritization of Integrated Pest Management (IPM) research. Regional characterizations of lepidopteran distribution in soybean are now more than 25 yr old. The goal of this study was to generate a contemporary assessment of the distribution and population persistence of lepidopteran soybean pests. To understand which species are currently infesting soybean and their persistence, we conducted a survey of soybean entomologists with responsibility for approximately 33.6 million hectares of production in 31 U.S. states. We focused this survey on five lepidopteran pests: corn earworm (*Helicoverpa zea* Boddie) (Lepidoptera: Noctuidae), green cloverworm (*Hypena scabra* Fabricius) (Lepidoptera: Erebidae), painted lady (*Vanessa cardui* L.) (Lepidoptera: Nymphalidae), soybean looper (*Chrysodeixis includens* Walker) (Lepidoptera: Noctuidae), and velvetbean caterpillar (*Anticarsia gemmatalis* Hübner) (Lepidoptera: Erebidae).

Estimated insect management costs and losses due to insects in soybean during the 2020 growing season were collected and compiled from 18 states to provide a record of insect pressure and management practices for the year. Participating states represented 48% of soybean acreage grown in the United States, with near 100% participation in southern states

Briefly describe how your target audience benefited from your project's activities.

Results of this survey highlight dissimilar geographic distribution and relative persistence of lepidopteran pests in soybean. Clear differences in occurrence and abundance among species provide important contemporary distributions and persistence estimates. Assessments of scouting practices demonstrate a need to improve IPM adoption in some states.

Overall, the stink bug complex was the costliest insect pest in soybean followed by corn earworm. Total insect management costs were \$15.80 per acre, with estimated crop losses to insects at \$13.85 per acre, making the 2020 total costs plus losses \$29.65 per acre.

Briefly describe how the broader public benefited from your project's activities.

Producers will now know which are the most damaging soybean pests across all states and within their local area.

Nutritional Requirements of Farmed American Alligator

Project Director

ROBERT REIGH

Organization

Louisiana State University and A&M College

Accession Number

1021432



In 2-3 sentences, briefly describe the issue or problem that your project addresses.

The purpose of the project is to develop improved diets for alligator aquaculture by (1) determining minimum requirements for dietary essential amino acids, and (2) quantifying amino acid availability coefficients for a range of feedstuffs of potential value in alligator diet formulation. Results of the research will be used to produce a nutrition database that will allow improved least-cost diet formulation for American alligator.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

I. Dietary lysine requirement

A feeding trial to estimate the minimum dietary lysine requirement of American alligator was completed in September 2021. The trial involved 192 hatchling alligators fed experimental diets composed primarily of practical ingredients (i.e., corn gluten meal, menhaden fish meal, poultry byproduct meal, and porcine blood meal) with vitamin, mineral, and selected amino acid supplements. Diets provided 1.5–3.75% lysine as percentages of diet weight. Body lengths and body weights of alligators were measured at two-month intervals for 326 days and blood samples were collected at the end of the trial to measure concentrations of free lysine in plasma.

Results indicated that a concentration of at least 2.25% lysine (about 4.5% of dietary protein) was sufficient for alligator fed compounded diets under the conditions of the study. This is similar to published lysine requirements for a number of other aquatic species, including some fishes and crustaceans.

II. Apparent amino acid availability coefficients of feedstuffs

Amino acid availability coefficients (AAAC) are used in diet formulation to improve nutrient balance and avoid deficiencies of dietary-essential amino acids (i.e., those amino acids that must be consumed in the diet because they cannot be synthesized by the alligator). AAAC information is needed for a variety of ingredients to optimize the benefits of least-cost feed formulation, which combines feedstuffs of known nutritional value for a target species to produce an effective diet at lowest cost.

Feeding trials were completed in 2021 to measure apparent availability for alligator of dietary essential amino acids in a selection of practical feed ingredients. Results indicated that AAAC of dietary essential amino acids ranged from 14–80% in feather meal; 33–90% in porcine meat and bone meal; 21–64% in poultry blood meal; 81–99% in poultry byproduct meal; and 76–91% in soybean protein isolate.

Briefly describe how your target audience benefited from your project's activities.

Target audiences of the project are members of the scientific community, alligator feed manufacturers, and farmers involved in production of American alligator for skins and meat. These audiences benefited from new information generated by original research. Outreach to these audiences was achieved through publication of research results; submission of research reports to the Louisiana Department of Wildlife and Fisheries, the agency involved in regulation of the farm-raised alligator industry; and consultations with feed manufacturers and other interested businesspeople.

Briefly describe how the broader public benefited from your project's activities.

The information obtained from this project will be used to improve the ingredient composition of alligator diets, increase the biological value of formulated feeds by improving nutrient balance, decrease waste production by increasing nutrient retention, and reduce feed cost by providing more least-cost formulation options. Results will contribute to more sustainable alligator production, reduced production cost, and better environmental quality in alligator production systems.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

The project provided training opportunities for several undergraduate students in the LSU School of Renewable Natural Resources who assisted the project director and a research associate in conducting the research. These students gained knowledge of, and experience with, laboratory analytical procedures, proper animal husbandry practices, and development

of aquacultural production practices for captive-reared alligator as a result of their work on this project.

Results were disseminated to scientists and alligator industry stakeholders in a peer-reviewed journal article, written reports to the Louisiana Department of Wildlife & Fisheries, and in consultations with feed manufacturers and other interested businesspeople.

Research will continue during the next reporting period to evaluate the effects of different concentrations of dietary methionine on growth of alligators fed compounded diets. A feeding trial in progress will terminate in September 2022.

Prevalence and Characterization of Emerging Pathogens in Small Ruminants In order to Mitigate Illness Associated with Food-Borne Infections in Humans: A One Health Perspective

Project Director

Renita Marshall

Organization

Southern University and A&M College

Accession Number

1021121

★ Prevalence and Characterization of Emerging Pathogens in Small Ruminants In order to Mitigate Illness Associated with Food-Borne Infections in Humans: A One Health Perspective

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

We aim to determine the prevalence of foodborne pathogens in small ruminants, as unique food vehicles, at both pre-harvest and processing levels. Small ruminants such as goat and sheep remain “under-researched food vehicles”, with limited science-based information on food pathogens in these food animals and their products. Management procedures, economic information, behaviors and attitudes that are critical control points will be emphasized to help small farmers and processors prioritize changes in foodborne pathogen control practices.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

We have been able to make contact with small ruminant producers and build a repoir with them. Due to COVID we have not been able to visit the farming operations but the visits are planned for April 2022. All of our original farmer contacts are still on board to participate and they are eager to get started.

Briefly describe how your target audience benefited from your project's activities.

The small ruminant farmers have knowledge of the SU Ag Center research efforts in the area of sheep and goats.

Briefly describe how the broader public benefited from your project's activities.

None due to COVID

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Due to COVID we were not able to start our project. During the next reporting period;

1. Vist a minimum of 5 farms in LA every three months for a period of one year (4 sampling times) to collect blood and fecal samples from at least 10 animals on each farm.

2. Two local processing plants in LA will be selected to obtain samples at harvest. Carcass swabs (immediately after slaughter and hide removal), blood and hearts from at least 10 animals and 10 samples of raw ground meat (1 lb each) for determination of *E. coli* O157:H7, *Salmonella*, and *Toxoplasma gondii* populations.

Effects of Insecticide Application on Target and Non-Target Species

Project Director

James Ottea

Organization

Louisiana State University and A&M College

Accession Number

1021823



"Effects of Insecticide Application on Target and Non-Target Species"

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Insecticide resistance hampers efforts to manage vectors of pathogens associated with important human and animal diseases. This project evaluates the impact of off-target insecticide sprays on resistance in the Southern house mosquito, *Culex quinquefasciatus*. Specific objectives examined this year include measurement of decreased susceptibilities in populations impacted by agricultural and residential sprays, and validation of methods for measuring enhanced metabolism as a resistance mechanism in those populations.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

We found significant resistance to mosquito adulticides in both agricultural and residential settings. There was significant levels of resistance to both malathion and chlorantraniliprole in populations collected near rice and sugarcane fields. Because chlorantraniliprole is applied as an agricultural insecticide, not a mosquito adulticide, this resistance resulted from off-target exposure to insecticide that was applied in rice and sugarcane fields. Further, levels of resistance measured in these field populations and those collected in a residential setting where organophosphates and pyrethroids had been applied repeatedly by a commercial concern were high and correlated with increased esterase activities, as measured with insecticide (i.e., malathion) and non-insecticide (i.e., naphthyl acetate) substrates suggesting that resistance was associated with elevated metabolism by these detoxifying enzymes.

Briefly describe how your target audience benefited from your project's activities.

These results suggest that resistance to bifenthrin, a pyrethroid, is high and that to malathion, an organophosphate, is moderate and increasing. Resistance to both appears to be associated with esterases, which would predict reduced efficacy of other, esterase-containing insecticides. We have shared these data during meetings with mosquito abatement personnel in East Baton Rouge and Tammany Parishes, as well as the commercial concern involved (Mosquito Joe).

Briefly describe how the broader public benefited from your project's activities.

Improved chemical management of populations of these mosquitoes reduces the probability of pathogen transmission and the nuisance associated with biting mosquitoes.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Results were presented during the annual meetings of the Louisiana Mosquito Control Association and the Mosquito Academy, both in New Orleans, LA.

Project Director

Witoon Prinyawiwatkul

Organization

Louisiana State University and A&M College

Accession Number

1022270



Sodium Reduction in Foods via Salt Substitute Mixtures and Sensory Visual Cues: A Case of Barbeque Sauces and Cheese Dips

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

The current high levels of dietary sodium intake are negatively affecting consumers' health. However, reducing sodium and salt is a challenge faced by the food industry as it may negatively affect sensory quality and product acceptance. This project generally evaluated the effects of salt substitutes and visual cues on product quality and consumer perception and purchase intent.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

In the United States, high blood pressure alone affects over 75 million adults, which leads to heart disease and stroke, the leading cause of death regardless of gender or age. High sodium consumption is related to high blood pressure, thus increasing the risk of heart disease and strokes. It is estimated that 75% of the sodium is consumed through restaurants and processed foods, promoting overconsumption of sodium. However, reducing sodium and salt is a challenge faced by the food industry as it may negatively affect sensory quality, product acceptance, human emotion, and purchase intent. For this Hatch project period (2021 Fiscal year), one study was performed to evaluate some physical properties and potential application of chitin nanoparticles as a saltiness enhancer. Chitin was prepared from shrimp shells (CSh) and/or squid pen (CSq) and subjected to ultrasonication (the act of energy used to agitate particles into a smaller size) for 30, 45 and 60 min to obtain ultrasonic-assisted chitin nanoparticles with different sizes (diameter, nm) of 41.33, 35.00 and 32.67, respectively, for CSh, while 50.67, 43.83 and 42.60, respectively, for CSq. The ultrasonication time had negligible effects on chitin chemical structure. Results from sensory descriptive analysis showed that as ultrasonication time increased, saltiness intensity of chitin increased. CSh and CSq chitins can potentially serve as saltiness enhancers. In another study, foods' overall liking (OL) and purchase intent (PI) are influenced by visual inputs, such as color cues and serving plate types. Cheese-flavored chips (CFC) from two formulations (A and B) with a noticeable color difference ($\Delta E = 4.81$) were placed on different serving plates (plastic, foam, and paper) and presented monadically to consumers using a randomized balanced block design in two sessions. Consumers evaluated likings of overall visual quality, color, crunchiness, saltiness, overall flavor (OF), and OL using a 9-point-hedonic scale, attribute appropriateness on a 3-point-just-about-right (JAR) scale, and PI using a binomial (Yes/No) scale. Color differences between A and B influenced crunchiness and saltiness liking and perception, which together with OF liking and formulation, mainly determined OL of CFC. Although having similar sodium content, formulation A had higher saltiness likings. PI was influenced by crunchiness, saltiness, and OF liking with 37, 49, and 60% increases in PI odds per liking-unit increase, respectively. The brighter and less-yellow color of CFC could positively influence liking of crunchiness and saltiness, which significantly contributed to OL and PI. These findings are useful to understand consumers' acceptability and perception of foods when varying visual inputs. Another study was performed to develop and evaluate the texture, color, and sensory acceptability of reduced sodium Vienna sausage. A three-component mixture design (0-65% NaCl; 35-100% KCl; 0-20% glycine [Gly]) was performed to obtain an optimal salt mixture based on 14 sausage formulations. Mixture response surface plots revealed that the optimal reduced-sodium Vienna sausage contained 20.13-65.00% NaCl, 35.00-60.15% KCl, and 0.00-20.00% Gly (this salt mixture constituted 1.35% of the formulation). One optimal laboratory-scale sausage, formulated with 21.43% NaCl, 59.71% KCl, and 18.86% Gly, was further selected for commercial scale-up production (a 25-kg batch). Both laboratory-scale and scale-up products were comparably acceptable (5.9-6.6 vs. 5.9-6.7) for overall liking, flavor, saltiness, and texture, and contained 315.4-333.5 mg sodium/100 g, hence having >25% sodium reduction compared to the control (569.5 mg/100 g) according to US Food and Drug Administration regulation. This study demonstrated the feasibility of a scale-up production of acceptable reduced-sodium Vienna sausage formulated with a salt mixture of NaCl/KCl/Gly. The methods used here can be applicable to development of other sodium-reduced food products.

Briefly describe how your target audience benefited from your project's activities.

Salt is the second most used food additive serving as a flavor enhancer and a food preservative. Although sodium is vital for the human body, diets in the United States have surpassed the recommended daily amounts of sodium. High sodium intake has shown to be associated with increased blood pressure, hence the correlation with cardiovascular disease. Despite the clear need to reduce sodium consumption, considerable reduction in saltiness could adversely affect sensory quality and product acceptance. One well-known strategy on sodium reduction is through salt substitutes, in which potassium chloride (KCl) is the most used alternative. At higher proportions, however, KCl exhibits a distinctive bitter off-flavor and metallic aftertaste that has a detrimental effect on the perceived flavor of the products. Chitin nanomaterial may be used as a saltiness enhancer. NaCl solution (0.3% w/v) containing chitin nanomaterials produced significantly higher saltiness perception than did the NaCl solution alone. Enhanced saltiness perception through multisensory perception of flavor is another strategy that can help reduce the sodium content in foods. Color is the single most important intrinsic sensory cue in eliciting expectations about food products. Visual cues play a key role in eliciting consumers' expectations. Research regarding the influence of color on salty taste perception is critical. However, there is very limited research regarding the influence of color on salty taste perception.

From the Hatch project activities, the target audiences would learn the followings:

Overall knowledge:

- It is possible to reduce sodium content in foods using different methods as demonstrated in this Hatch project.

Specific knowledge:

- Based on sensory descriptive analysis, chitin nanoparticles could enhance saltiness perception. As ultrasonication time increased, saltiness intensity of chitin nanoparticle increased.
- Visual color cues can influence saltiness liking. The brighter and less-yellow color of chip samples could positively influence liking of crunchiness and saltiness, which significantly contributed to overall liking and purchase intent.
- Acceptable reduced sodium Vienna sausage could be successfully developed using a salt mixture of 20.13–65.00% NaCl, 35.00–60.15% KCl, and 0.00–20.00% Gly. The product contained 315.4–333.5 mg sodium/100 g, hence having >25% sodium reduction compared to the control (569.5 mg/100 g). According to US Food and Drug Administration regulation, “reduced sodium” can be claimed.

Briefly describe how the broader public benefited from your project's activities.

Table salt is the primary source of sodium in the diet. Sodium is an essential nutrient for humans. However, high sodium intake is a major public health concern as it can lead to an increased risk of stroke and cardiovascular disease. According to the World Health Organization (WHO), people consume an average of 9-12 grams of salt per day, which is almost twice as much as the recommended intake of 5-6 grams. Over 75% of all sodium intake is associated with processed foods sold in stores or used as ingredients by restaurants. Food companies are encouraged to develop more reduced-sodium products. Therefore, there is an undeniable need to generate more strategies to reduce sodium without affecting the product's properties, particularly sensory quality (texture, taste and flavor) and acceptability. Several approaches such as the use of salt enhancers, modification of the food structure, and the multi-sensory approach are good examples.

From the Hatch project activities, the broader public audiences would learn that it is possible to reduce salt in foods without drastically compromising sensory quality. The methods used in this Hatch project can be adapted or adopted by food industries.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to

communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

None

Germ Cell and Embryo Development and Manipulation for the Improvement of Livestock

Project Director

Kenneth Bondioli

Organization

Louisiana State University and A&M College

Accession Number

1021181



Germ Cell and Embryo Development and Manipulation for the improvement of Livestock

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

This project aims to provide state of the art technologies to the goal of improving livestock performance through the enhancement of genetic breeding value. This is particularly important for the Louisiana animal agriculture industry since it is centered around the breeding and marketing of genetically elite animals.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Cryopreservation (freezing) of cattle oocytes and embryos is an important technique for genetic selection for the goal of improving livestock production. Application of methods developed in other species has led to poor results and inefficiency. The activities in this project have provided methods to improve these results when applied to cattle breeding.

Understanding the molecular mechanisms which control the ability of embryos to continue development and yield live offspring provides opportunities to improve the efficiency of technologies such as in vitro embryo production, nuclear transfer and embryo transfer. The activities in this project provide significant information concerning these molecular mechanisms which will allow for significant progress in improving the results from such technologies when applied to cattle breeding programs.

Briefly describe how your target audience benefited from your project's activities.

The target audience of livestock producers and reproductive physiologists in industry and academia benefit from the activities in this project by having more efficient technologies to apply to cattle breeding programs.

Briefly describe how the broader public benefited from your project's activities.

The broader public benefited from the project's activities by having enhanced access to lower cost and/or higher quality food products resulting from cattle production programs.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

This project has provided considerable opportunities for training and professional development of graduate and undergraduate students pursuing careers in animal agriculture.

The results from this project have been disseminated to the communities of interest by the publication of articles in refereed scientific journals and the presentation at international scientific meetings.

Articles in refereed journals:

Diaz FA, Gutierrez-Castillo EJ, Foster BA, Hardin PT, **Bondioli, KR, Jiang Z**. Evaluation of seasonal heat stress on transcriptomic profiles and global DNA methylation of bovine oocytes. *Front Genet.* 2021. PMID: 34777457.

Sang L, Xiao Y, **Jiang Z**, Forde N, Tian XC, Lonergan P, Hansen PJ. Atlas of receptor genes expressed by the bovine morula and corresponding ligand-related genes expressed by uterine endometrium. *Mol Reprod Dev.* 2021 Oct. PMID: 34596291.

Li C, Sun J, Liu Q, Ming H, Wang L, Li Y, Li R, **Jiang Z**, Francis J, Fu X. The landscape of accessible chromatin in quiescent and post-myocardial infarction cardiac fibroblasts. *Epigenetics* 2021. PMID: 34551670.

Iyyappan R, Aleshkina D, Zhu L, **Jiang Z**, Kinterova V, Susor A. Oocyte specific lncRNA variant Rose influences oocyte and embryo development. *Non-coding RNA research.* 2021 June. PMID: 34278057.

Zhu L, Marjani SL, **Jiang Z**. The epigenetics of gametes and early embryos and potential long-range consequences in livestock species - filling in the picture with epigenomic analyses. *Front Genet.* 2021 Mar 2. PMID: 33747031.

Gutierrez-Castillo, E., Hao, M., Foster, G., Gatenby, L., Chun, M., Pinto, C., **Bondioli, K.**, Jiang, Z. 2021. "Effect of vitrification on global gene expression dynamics of bovine elongating embryos." *Reproduction, Fertility and Development* **33**(5): 338-348.

Abstracts presented at international meetings:

Wang Y, Zhu L, Ming H, Wu J, **Jiang Z**. Derivation of bovine trophoblast stem cells. *Reprod Fertil Dev.* 7 December 2021.

Zhu L, Chen Q, Govoni K, **Jiang Z**. Maternal gestational nutrition perturbs offspring sperm small RNA code in sheep. *Reprod Fertil Dev.* 7 December 2021.

Zhu L, Ming H, Liu S, Iyyappan R, Liano ED, Dvoran M, Chen Q, Susor A, Zhou T, and **Jiang Z**. High-resolution ribosome profiling reveals translational selectivity during bovine preimplantation embryo development. *54th Annual conference of Society for the Study of Reproduction (SSR)*, 2021.

Gatenby, L. and Bondioli, K.R. Increasing Cytoplasmic Glutathione in Bovine Oocytes with Modified in Vitro Maturation systems. 2021. *Reprod. Fertil. Dev.* 34:281.

Girka, E., Giraldo, A.M., Bondioli, K. R. 2021 Characterizing cytoplasmic lipid profiles during *in vitro* maturation of porcine oocytes. 2021. *Reprod. Fertil. Dev.* 34:312.

Gutierrez-Castillo, E. Diaz, F., Talbod, S.A. Bondioli, K. R. 2021. Effect of Extended Culture After Vitrification-Warming on Mitochondrial Function of Bovine Oocytes. *Reprod. Fertil. Dev.* 34:251.

Closing Out (end date 09/07/2023)

Development of Food Products with New Ingredients

Project Director

Joan King

Organization

Louisiana State University and A&M College

Accession Number

1021431



Development of Food Products with New Ingredients

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

The goal of this research is to develop and test food products using new and current food ingredients produced from Louisiana commodities and elsewhere, which in turn will economically benefit farmers, processors, the food industry and consumers. Determination of the influence of non-starch constituents on the chemical and functional properties of flours and starch is important for evaluating the potential success of flours and starch as functional value-added food ingredients.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

A new clean label starch ingredient that was developed in our lab using natural additives like amino acids and fatty acids with similar properties to chemical modified starch was successfully tested in frozen gravy and cooked pudding. The clean label starch was prepared with rice starch, 1% stearic acid and 6% lysine, which was gelatinized, freeze-dried, and ground. Both products were made with three different starch types: rice starch, commercial modified starch, and clean label starch. These starches were analyzed with Differential Scanning Calorimetry (DSC), Scanning Electron Microscopy (SEM), Megazyme Amylose/Amylopectin kit, and Rapid Visco Analyzer (RVA). With the results from the RVA, SEM and DCS, it is inferred that the freeze-drying process altered the structure of the clean label starch, causing significant damage. The gravies were prepared with starch, butter, beef broth, garlic powder, and black pepper then stored at -18 ± 2 degrees C for three months; and samples were taken every two weeks. Before analyzing, the gravy samples were heated in the microwave for three minutes. The viscosity was measured with the RVA. Another analysis was performed in which the gravy was stored for three weeks, and the viscosity was measured using the Brookfield viscometer. Both studies showed that there is a significant difference in viscosity over time and between starches. The formulation for the pudding contained dry non-fat milk, water, sugar, vanilla, butter, salt, and starch. Pudding samples were prepared and placed hot into glass containers then refrigerated for three weeks. The pH was weekly monitored, and after three weeks it remained constant at 6.4. The microbiology tests included *Staphylococcus aureus*, *E. coli*, coliforms, yeast, molds, *Salmonella*, *Listeria*, and aerobic bacteria; and there were no bacteria detected for either product, making them safe for consumption. The rice starch tended to increase pudding syneresis (water loss) and lose viscosity over the three weeks. Clean label starch syneresis was constant over three weeks while viscosity decreased over two weeks and then increased in the third week of storage similar to modified corn starch pudding. The syneresis of modified starch decreased after the first week, then stayed constant in week two and three. A consumer study was conducted for both products, pudding and gravy, in which the acceptability and the purchase intent of the products were evaluated. The pudding with clean label starch was more liked than the modified starch, while there were no statistical differences between clean label and modified corn starch gravies in sensory attributes. More than 70% of the consumers gave a score above 6 (like slightly) to both products, concluding that the products were accepted. Their purchase intent was influenced after knowing that the product contained a clean label ingredient, with an increase of 36.4% for gravy and 10.3% for pudding.

A new higher protein rice was developed by the LSU AgCenter Rice Research Station for which the rights were purchased by a small company. The company provided a grant to my lab to test the flours of the rice in food products. This work helped the company to display the possible uses of these flours at national professional meetings. We worked on gluten-free products using these flours to help consumers with celiac disease by providing more choices of food items with more protein.

Different pastas made with high-protein-white-rice-flour (HPWRP), high-protein-brown-rice flour (HPBRP), commercial-white-rice flour (CWRP), commercial-brown-rice flour (CBRP), and wheat-pasta (WP) as a control were prepared and dried. The cooking quality of the pasta was evaluated by measuring pasting properties, cooking time, water absorption capacity and cooking loss. Physical properties such as color and texture (firmness, compression energy, and work of shear) were measured for dry and cooked pasta. A proximate analysis (moisture, protein, fat, ash, and dietary fiber) was also done. A sensory test was done to determine consumer acceptability and purchase intent of HPWRP and HPBRP in comparison to WP. HPWRP and HPBRP had less cooking loss than CWRP and CBRP; all treatments had similar water absorption capacity (around 130%) except for WP that was higher (140%). White rice pastas along with WP took more time to cook than brown rice pastas. HPWRP and HPBRP had higher protein (around 7.5%) and fat content, creating a firmer cooked pasta (138.23 g HPBRP, 179.82 g HPWRP) that required more compression energy than commercial rice pastas. Consumers' (83) overall liking of HPBRP (5.37), HPWRP (6.00), WP (6.81) was acceptable. Color, firmness, and stickiness attributes negatively affected the overall liking of HPWRP and HPBRP. High protein rice flours improve firmness and cooking loss properties of gluten-free rice pasta which was acceptable in terms of sensory overall liking. It is recommended to improve color, firmness, and stickiness of the pasta to reach higher sensory acceptability.

Briefly describe how your target audience benefited from your project's activities.

The company we worked with on the project was able to use our information to show successful products made with the new rice flour at professional meetings which resulted in increased interest in the new rice variety.

Briefly describe how the broader public benefited from your project's activities.

Consumers desire labels that have less chemicals on the ingredient list. Rather than labeling this newly developed clean label starch as modified starch, it could be just labeled as starch. Also the consumers would be consuming a more natural product rather than a chemically modified starch. Consumer with celiac disease would have more options for gluten-free products.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

We had some delays in sensory testing due to COVID but were able to eventually complete the testing. Two graduate students graduated with master's degrees last year. We published two manuscripts from the cupcake work with rice flour in scientific journals and presented the work on cupcakes and pasta at the Institute of Food Technologists meeting. Our next work will be on making plant-based yogurt with the higher protein rice flour.

Refereed Publications

Ricardo S. Aleman, Anita Morris, Witoon Prinyawiwatkul, Marvin Moncada, Joan M. King. 2021. Physicochemical properties of Frontière rice flour and its application in a gluten-free cupcake. *Cereal Chemistry*. 00:1–13. Published online September 22, 2021. <https://doi.org/10.1002/cche.10484>

Ricardo S. Aleman, Gabriella Paz, Anita Morris, Witoon Prinyawiwatkul, Marvin Moncada, Joan M. King. 2021. High protein brown rice flour, tapioca starch & potato starch in the development of gluten-free cupcakes. *LWT - Food Science and Technology*. Volume 152. 112326. Published online August 17, 2021. <https://doi.org/10.1016/j.lwt.2021.112326>.

Presentations/Abstracts

Anita Morris, Joan King and Witoon Prinyawiwatkul. Consumer Perception and Acceptance of Brown and White Rice Flour-based Yogurt Alternatives. Presented at the IFT annual meeting. Sensory and Consumer Sciences Division. Virtual Meeting. July 2021.

Anna Serrano, Joan King and Witoon Prinyawiwatkul. High Protein Rice Flour in the Development of Gluten-Free Pasta. Presented at the IFT annual meeting. Food Chemistry Division. Virtual Meeting. July 2021.

Ricardo Aleman, Joan King, Marvin Moncada, Anita Morris and Witoon Prinyawiwatkul. Chemical Characterization, Thermal, Functional and Rheological Properties of Flour from Frontière Rice. Presented at the IFT annual meeting. Food Chemistry Division. Virtual Meeting. July 2021.

Ricardo Aleman, Joan King, Marvin Moncada, Anita Morris, Gabriella Paz, and Witoon Prinyawiwatkul. High Protein Brown Rice Flour, Tapioca Flour & Potato Starch in the Development of Gluten-Free Cupcakes. Presented at the IFT annual meeting. Product Development and Ingredient Innovation. Virtual Meeting. July 2021.

[Development of climate resilient rice cultivars for Louisiana](#)

Project Director

Prasanta Subudhi

Organization

Louisiana State University and A&M College

Accession Number

1021401



Development of climate resilient rice cultivars for Louisiana

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Rice, a major field crop of the southern states of the USA, is affected by various abiotic stresses due to climate change. Among the abiotic stresses, drought and salinity are the major constraint for rice production. The overall goal of this proposal is to develop climate resilient high yielding rice cultivars for Louisiana and other southern rice growing states with emphasis on salinity and drought tolerance.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Using multiple salt tolerant donors such as Pokkali, Hasawi, and FL478, advanced introgression lines (ILs) were developed in the genetic background of US rice cultivars Mermentau, Jupiter, and Cheniere and evaluated in sand culture. Thirty six salt tolerant ILs were identified and validated in hydroponic experiments. The selected tolerant ILs were grouped with tolerant donors in a cluster analysis and showed lower root and shoot Na/K ratio compared with susceptible recurrent parents. Molecular marker analysis revealed a low level of genetic diversity among genotypes and ILs grouped with the recurrent parents. These salt tolerant ILs can be used as prebreeding line or potential future release in rice breeding program. Due to near-isogenic nature, these ILs can also be exploited to investigate molecular and physiological basis of salt tolerance.

Pyramiding approach was used to accumulate genes for salt tolerance using ILs developed using salt tolerant donors Pokkali and Nona Bokra. Phenotypic screening and marker-assisted selection were conducted, and salt tolerant lines were developed. The identified salt tolerant pyramided lines will be genotyped for target QTLs associated with salt tolerance.

Briefly describe how your target audience benefited from your project's activities.

Rice producers, plant breeders, geneticists, pathologists and other researchers working with rice and abiotic stresses.

Briefly describe how the broader public benefited from your project's activities.

Our published QTL and molecular marker associated with salt tolerance will be useful for other researchers particularly the rice breeders to develop high yielding rice varieties with salt tolerance.

The advanced salt tolerant breeding lines developed in this project have potential to be released for cultivation in salinity affected areas.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

The project provided opportunities for training and professional development for two graduate students.

Research findings from this project was presented at the ASA, CSSA, and SSSA International Annual Meeting held at Salt Lake City, Utah, November 7-10, 2021, and an International Symposium on Coastal Agriculture: Transforming Coastal Zone for Sustainable Food and Income Security, March 16-19, 2021. Details of presentations and publications are given below.

Chapagain S, Concepcion J, Pruthi R, Singh LP, Famoso A, Subudhi PK (2021) Genetic variation among the salinity tolerant breeding lines identified from two multi-parent advanced generation introgression lines (MAGIL) populations in rice (*Oryza sativa*). *J. Agron. Crop Sci.* (accepted)

Chapagain S, Singh L, Garcia R, Pruthi R, Concepcion J, Coronejo S, Subudhi PK (2021) Molecular breeding for improving salinity tolerance in rice: Recent progress and future prospects. In: *Molecular breeding for Rice Abiotic Stress Tolerance and Nutritional Quality*, Hossain MA, Hassan L, Ifterkharuddaula KM, Kumar A, and Henry R (Eds). John Wiley & Sons, Inc. PP 26-52.

Subudhi PK, Concepcion J, Coronejo S, Garcia R (2021) QTL-Seq-based identification of genomic regions and candidate genes for nitrogen uptake in rice. ASA, CSSA, and SSSA International Annual Meeting, Salt Lake City, Utah, Nov 7-10, 2021 (poster presentation).

Chapagain S, Pruthi R, Singh L, Subudhi PK (2021) Genetic dissection and QTL pyramiding using multiple donors to improve salt tolerance in rice. ASA, CSSA, and SSSA International Annual Meeting, Salt Lake City, Utah, Nov 7-10, 2021 (Oral presentation).

Pruthi R, Puram VRR, Ontoy J, Subudhi PK (2021) Genetic dissection of agronomic and yield related components under salinity stress in rice (*Oryza sativa* L.). ASA, CSSA, and SSSA International Annual Meeting, ASA, CSSA, and SSSA International Annual Meetings, Salt Lake City, Utah, Nov 7-10, 2021 (poster presentation).

Subudhi PK (2021) Challenges and opportunities in designing salt tolerant rice. ISCA Webinar - International Symposium on Coastal Agriculture: Transforming Coastal Zone for Sustainable Food and Income Security. organized by Indian Society of Coastal Agricultural Research (ISCAR) in collaboration with ICAR-Central Soil Salinity Research Institute, Karnal, India, 16th March – 19th March 2021 (Oral presentation).

We plan to identify salt tolerant lines using both phenotypic screening and marker-assisted pyramiding. We also plan to confirm the pyramided QTLs and conduct both whole genome sequencing and RNA-sequencing in recurrent parents, donors, and salt tolerant multiparental advanced introgression lines to identify superior salt tolerant alleles.

Closing Out (end date 09/07/2023)

Epidemiology and management of soybean diseases

Project Director

Sara Thomas-Sharma

Organization

Louisiana State University and A&M College

Accession Number

1019871



2021 Progress Report

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Diseases, particularly *Cercospora* leaf blight (CLB) of soybean is a major production constraint for soybean in Louisiana. The aim of the project will be to fill knowledge-gaps in the biology and epidemiology of CLB and other economically important soybean diseases to develop new/improved disease management tools for growers.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

The goals of the research project and progress are described below:

1. Elucidate pathogenicity factors of select soybean diseases, to devise new targets for disease management

We have been exploring if the amount of lipid droplets in the CLB pathogen correlates with the amount of toxin (cercosporin) it produces. Although we do see variability in toxin and lipid droplet levels, contrary to our expectations, one isolate each of *Cercospora cf. flagellaris* that had high and low levels of cercosporin showed the opposite trend of lipid droplets, 5.7LD/ μ l and 6.9 LD/ μ l, respectively. We are testing more isolates to better understand this relationship. Lipid droplets were stained with LipidTox dye and we are exploring the co-localization of cercosporin in lipid droplets. If lipid droplets affect cercosporin production, we are interested to see if lipid droplet inhibitors can inhibit cercosporin production.

2. Address epidemiological knowledge-gaps in disease development and spread of major soybean diseases

The Taqman probe assay that was developed to detect *C. cf. flagellaris* was used to determine the major spore peaks in different spore traps, at three locations, over three years. There was considerable temporal and spatial variation of spore peaks, but at most locations there were one or two spore peaks that occurred prior to symptoms. We will be expanding spore monitoring to more locations and continue to develop primers specific to other species of *Cercospora* known to cause CLB. These studies add evidence to the hypothesis that CLB epidemics are likely initiated by airborne rather than seed borne inoculum.

3. Develop tools to support breeding for disease resistance to soybean diseases

We are currently aiming to publish the leaf disk assay developed for CLB although it appears that the assay might not correlate with field resistance. We are also exploring ionomics as a tool to better understand the role of nutrition in cultivar resistance.

4. Develop new/improved disease management tools for soybean diseases

The spore peaks that were identified for CLB were targeted with one or two fungicide applications to determine if such targeted fungicide applications was more effective than growth stage based applications. Although yield impact was not statistically significant, two spore peak-based applications was numerically better than two growth stage-based applications.

We will continue these experiments to determine if spore peak-based fungicide applications can be optimized by location and variety planted. Our studies with foliar and soil iron applications to control CLB did not indicate significant disease control and we aim to publish the latter.

Briefly describe how your target audience benefited from your project's activities.

The project activities are shedding light on the biology and epidemiology of CLB pathogens, to ultimately use the information for disease management. We have documented early production of cercosporin in the fungus growing in culture (24 h), likely associated with lipid droplets. The latter might provide opportunities to identify new fungicide chemistries against this disease. The spore trapping has provided direct evidence that CLB epidemics may be initiated by airborne spores rather than seed as assumed previously. This may provide opportunities to increase the efficacy of fungicide applications and is currently being tested. We are also exploring new tools to improve screening for disease resistance and whether nutrition management can affect CLB epidemics. Together the project aims to develop an integrated disease management approach for CLB.

Briefly describe how the broader public benefited from your project's activities.

The research work described in this project is being conducted by three graduate students, a research associate, and three undergraduate students. Thus, personnel trained in plant pathology and scientific experimentation is being added to the workforce. The goals of the research are also to promote an integrated management approach for CLB and reduce the negative environmental and societal impact of agriculture by improving the efficacy of fungicides and encouraging the use of resistant varieties. The latter together with the positive impact on soybean farmers will directly impact Louisiana's agricultural economy.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Changes to approach:

Yet another disease, aerial blight is becoming a problem for soybean growers in Louisiana. Problems of fungicide resistance is increasing the need for soybean cultivars that can resist aerial blight. We are therefore developing a greenhouse cultivar screening protocol for aerial blight under the goal 'Develop tools to support breeding for disease resistance to soybean diseases'. The protocol will be used to develop short- and long-term solutions for managing aerial blight using host resistance.

Dissemination:

The results have been presented to scientists and other researchers at regional and national scientific meetings, by the personnel working on the projects. The findings were also used to develop talks that were presented to soybean growers and consultants.

[Building Research Capacity in Viticulture at Southern University to Increase the Competitiveness of Niche Market Crops in Louisiana](#)

Project Director

James Obuya

Organization

Southern University and A&M College

Accession Number

1021199



Building Research Capacity in Viticulture at Southern University to Increase the Competitiveness of Niche Market Crops in Louisiana

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Viticulture, the production and utilization of grapes is a small industry in Louisiana with seven wineries. Although wine consumption in Louisiana is increasing over the years, commercial production is limited currently to few wineries. The growth potential of this industry offers potential for local economic development in the state. Accordingly, the demand for evaluating existing and newly developed grape cultivars with enhanced fruit/vinification qualities has become an urgent need for developing, diversity and sustainability of the Louisiana grown specialty crop.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

The objective of the project is to build viticulture research at Southern University AG center and evaluate the new and existing popular grape varieties for Louisiana and the Southern region. Pierce's disease tolerant American hybrids and French American hybrid bunch grapes were planted in a randomized complete block design. Grapevine planted in year 1 were winter pruned and monitored for growth characteristics. Pruning was performed by leaving the spurs with the three to five buds. The drip irrigation system was installed with a fertigation system to manage the nutrient requirement for the vineyard. Screening for mildews and other fungal diseases indicated that bunch grapes was affected by Anthracnose disease. Leaf and berries were displaying lesions and more than 80% of the leaves and berries were affected by Anthracnose disease. Among the hybrids, Blanc du Bois and Villard blanc were heavily infected compared to other hybrids. Highest fruiting clusters were observed in Blanc du Bois compared to other bunch grapes planted in the vineyard. An average of 10 + 3 clusters with 35 + 6 berries per cluster were present. Only one fruiting cluster was observed in table bunch grape Victoria red. Among the muscadines, Sweet jenny, Ison, Pineapple, Welder, Florida fry, Pride, Lane, Pam, and Alachua did not bear any fruiting clusters. Data was collected from muscadines, Suagargate, Janet, Tara, Carlos, Noble, Dixie red, Creek, Supreme, Magnolia, Darlene, Hall, Truimp, and Late fry. The average number of clusters per vine is 7.43 + 3.74. Highest fruiting clusters were observed in Noble, Carlos, Fry seedless, Dixie red, and Hall. The lowest number of clusters was observed in Black beauty and Janet. Average Brix ° for the muscadine varieties ranged from 10.5 + 2.64 to 21.5 + 3.5. Lowest brix was observed in table muscadines Creek, and Darlene. Commercial wine varieties Noble and Carlos had a brix of 16.5 + 2.2 and 13.7 + 0.65 respectively. Colletotrichum spp. infections were observed in Carlos and other bronze cultivars. Black rot and Angular leaf spot were the most common diseases infecting the muscadine foliage during the vintage. PD symptoms were also observed in muscadine cultivar Carlos.

Briefly describe how your target audience benefited from your project's activities.

Two minority undergraduate students completed their honors college thesis work in viticulture research. Muscadine grapes harvested from the established vineyard were used to extract secondary metabolites, gene expression studies, and HPLC quantification of metabolites. Grape research at the SU AG Center was presented at the BAYOU 2021 High school summer training program, Orientation to the AG science and plant science courses. The PI has also presented the research and provided information about Pierce's disease (PD) tolerant grape cultivars in the 2021 Fall workshop. Undergraduate students from the plant science program are actively involved in vineyard management, learning to grow grapes, pruning, fertilization, sample collection, processing, and laboratory assays. The target audiences of the project are the grape growers, wineries, and grape breeders who are interested in the outcome of the research.

Publications

Tiffany Poydras, 2021, Anti-inflammatory effects of phyto-melatonin on Cigarette smoke

challenged human epithelial cells. Dolores Margaret Richard (D. M. R.) Spikes Honors College, Southern University, Baton Rouge, LA

Christopher Amos, 2020, Detection of melatonin pathway genes in muscadine grapes, Honor Thesis, Dolores Margaret Richard (D. M. R.) Spikes Honors College, Southern University, Baton Rouge, LA

Briefly describe how the broader public benefited from your project's activities.

The data generated from this project was presented to grape growers, community members, high school students, and undergraduates. The grapevines growing at the Horticultural farm were used for teaching Horticultural and plant science courses. New muscadine and PD tolerant hybrid cultivars are currently being evaluated for their suitability in the region and common diseases and pests. The information will be presented to growers in the Southern region. The PI and project personnel have trained eight undergraduate students majoring in agricultural sciences. The students were trained in plant phenotyping, disease scouting, plant measurements including leaf area, fruiting, flowering, and yield. Two undergraduate students were mentored by the PI to complete Honors thesis. Funds from the project were used to buy supplies for research and training students. The grapes planted on the campus have enabled teaching students to manage fruit crops, pruning, and provided samples for undergraduate and graduate students' research. Graduate students have also presented their work in workshops and conferences. The research plot was also used to teach high school students during the summer about growing grapes, soil nutrient management, weed, and water management.

Oral Presentations

Kambiranda D, November 21, Growing Grapes for Fresh Fruit and Wine Production. Fall Garden workshop. Southern University AG Center.

Kambiranda D, June 2021, Grape Research at Southern University, BAYOU Virtual High School Summer program.

Poster Presentation

Jeffery Stewart, Srinivasa Mentreddy, Karolina Mukhtar, Devaiah Kambiranda. Specific STS

Gene Sequences in *Vitis rotundifolia* as Possible Modulators of Resveratrol (RSV) Synthesis. 10th Annual ACMAP Virtual Conference, June 24-25, 2021.

Begum R, Thota S, Kambiranda D, Batra S. Urolithins rescue e-cigarette vapor condensate induced distinct histone signatures-in-vitro study. 19th Annual meeting, LBRN, LSU, Baton Rouge, Virtual Event.

Begum R, Singh DP, Thota S, Kambiranda D, Batra S. Lipid raft-mediated regulation of NADPH Oxidase: Vaping-induced Inflammation. 2021 SOT Annual Meeting and Tox Expo Virtual meeting, March 2021

Begum R, Singh DP, Thota S, Kambiranda D, Batra S. Urolithins rescue e-cigarette condensate induced lipid raft-mediated inflammation in lung epithelial cells. 2020 SC-SOT Virtual meeting, November 13, 2020, Mississippi State University, Starkville, MS

Undergraduate Students Honors College Thesis

Presentation

Tiffany Poydras, Anti-inflammatory effects of phyto-melatonin on Cigarette smoke challenged human epithelial cells. Honor Thesis Virtual presentation May 5, 2021, Dolores Margaret Richard (D. M. R.) Spikes Honors College, Southern University, Baton Rouge, LA.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

COVID-19 adversely impacted our ability to travel to different vineyards, network with clientele and present at regional and national meetings.

Management of Soil Fertility in Conservation Tillage Agriculture

Project Director

Syam Dodla

Organization

Louisiana State University and A&M College

Accession Number

1020246



Annual Progress Report for Year 2021

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

The project is aimed at determining the optimum nutrient management practices that are more specific to conservation tillage as most of the current nutrient management practices are developed for conventional tillage. This is critical as adoption of conservation tillage modifies various soil properties including nutrient cycling as well as these changes depends on soil type.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Objective 1. Evaluate corn N fertilization strategies for conservation tillage systems in different soil types:

Adoption of conservation tillage specifically no-tillage (NT) and further incorporation of winter cover crops (CC) significantly effect soil nutrient cycling that necessitates modified nutrient management to maximize crop yields. Field experiments were continued to evaluate N-sources (UAN, urea, and urea+N-stabilizer (urea+stab)) and N-split applications (100% N at V2; 25% N at V2 +75% N at V6; 25% N at V2 + 50% at V6 and 25% N at VT) in a very fine sandy loam soil (VFSL) and a clay soil (CL) and five winter CC (control, wheat, vetch, wheat+vetch, wheat+vetch+ radish) treatments along with three N-rates (67, 135 and 202 kg N ha⁻¹) in a silt loam soil on corn growth and yield in NT compared to conventional tillage (CT). In the VFSL soil, among N-sources urea+stab produced the highest corn growth and yield compared to UAN and urea under NT while no differences were observed in CT. Though N-split applications improved yield under both tillage-systems, response was higher under NT. Interactions of N-source and N-split applications showed urea+stab and UAN improved corn grain yield by both two-split and three-split applications while only by two-split for urea under NT. Under CT, N-split applications improved yield for urea+stab and UAN, but not for urea. In the CL soil, among N-sources, urea+stab produced higher results in both the CT and NT while no yield gain was observed from higher N-split applications under both tillage systems. The higher yield from urea+stab was different from no significant difference observed in 2019 which could be attributed to the late planting of corn in 2021. Under delayed planting conditions, relatively higher soil temperatures lead to higher N-losses that could be partly minimized by N-stabilizer compounds. In both the soils, NT had significantly lower grain yield which could be attributed to higher weed intensity as well as higher bulk density for VFSL soil. Cover crop study showed that regardless of the tillage system, the vetch increased corn growth and yield, whereas wheat decreased yields. The decrease in corn yield from wheat CC was relatively lower in the NT than CT potentially due to slower decomposition of residue from poor soil contact. No-tillage had lower yields than CT under all CC treatments; however, the gap became insignificant at higher N-rate. High bulk density, surface residue, and weed pressure in NT than CT attributed to the differential corn response to N-source, N-split, and CC treatments between the tillage systems.

Objective 2: Develop optimum P and K fertilization rates for soybean under conservation tillage across different soil types.

Field studies in a very fine sandy loam (VFSL) and clay soil (CL) continued for the third year to evaluate the effect of tillage on soybean P and K fertilization. The grain yield data displayed no significant effect of P and K fertilization on soybean grain yield in both CT and NT systems. However, the average yields of each tillage system showed 6.3% lower grain yield under NT compared to CT. These results were consistent with the previous findings. The lower yield in NT was mainly due to the higher weed pressure. Similarly, in the VFSL soil, P and K fertilization did not have significant effect on soybean yield under both tillage systems. Between the tillage systems, both NT and CT had similar yield as compared to up to 5% lower yield in NT in the previous two years.

Objective 3: Evaluate application of N fertilizer, P and K use efficiency, and application rates under conservation tillage on soybean.

Similar to the previous years, N-fertilization did not improve soybean P and K uptake as well as grain yields under both tillage systems and in both VFSL and CL soils. All the data from the three years of study confirmed that application of small amounts of N (30 kg/ha) before V4 stage do not have beneficial effect under both CT and NT as well as in both VFSL and CL soils.

Objective 4: Evaluate effects of irrigation on corn N management under conservation tillage.

This study will be initiated in the next season based on the findings of objectives 1 for optimum N-fertilization.

Briefly describe how your target audience benefited from your project's activities.

Over the years, there is a continuous push for the adoption of conservation tillage and winter cover crops to improve soil health and attain long term yield sustainability. This study findings will help the local producers as well as the producers in the mid-south to optimize their N fertilization of corn under the conservation tillage as well as when they adopt winter cover crops. Towards this, the findings of the study were disseminated to growers through talks at local and state level producer meetings, field days, and individual farm visits. Also, the findings of the study were shared with fellow scientific community through multiple presentations at the American Society of Agronomy conference. Further, many of these results were shared with broader farming community through extension publications.

Briefly describe how the broader public benefited from your project's activities.

Availability of conservation tillage specific nutrient management practices will help to increase the adoption of conservation tillage by the farming community. The increased adoption of conservation tillage and winter cover crops lead to the minimized non-point source pollution from agricultural lands and eventual improvement in ecosystem health.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

The project has provided great opportunity to two graduate students and multiple undergraduate students. One of the graduate students received her MS degree based on her project from objective 1. The project also provided opportunity for PI's professional development by giving opportunity to attend local producer meetings and commodity boards and local agencies to present the study findings as well as to request research funding.

[Slip Priming for Consistent Yields and Evaluation of Sensor Technologies for Use in Nutrient Management and Monitoring in Sweetpotato](#)

Project Director

Arthur Villordon

Organization

Louisiana State University and A&M College

Accession Number

1019174



Slip Priming for Consistent Yields and Evaluation of Sensor Technologies for Use in Nutrient Management and Monitoring in Sweetpotato

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Unexplained hill-to-hill yield variability continues to be a concern despite the use of clean seed and recent advances in knowledge about variables that influence storage root formation. This variability is due in large part to inconsistent slip quality, leading to variation in root emergence, plant establishment, and storage root yield sizing. This project aims to reduce this variability by accelerating adventitious root emergence and enhancing plant establishment.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

First, a potassium fertilization study focused on calibrating the response of 'Beauregard' and 'Bayou Belle' to potassium omission treatment in field conditions with moderate potassium level (82 ppm). There were no statistical differences within each cultivar for all yield grades between the untreated controls and plots applied with 200 lb/ac K₂O. This information is consistent with findings in other locations that under certain conditions, there are no yield responses to potassium applied at higher rates. The significance of these findings are increasing in the light of increased fertilizer costs and growers asking more questions about how to reduce fertilizer inputs without sacrificing storage root yield production. Second, a sulfur fertilization study was conducted to respond to growers' questions about sulfur application rates and to generate further calibration data on 'Beauregard' and 'Bayou Belle' response to sulfur applications under low (5 ppm) sulfur conditions. There were no significant differences for all yield grades to applications of 10 and 20 lb/ac of sulfur. Third, a boron fertilization study was conducted to generate further data on the response of cultivars to boron application rates under low boron (0.2 ppm) conditions. There were no significant differences for all yield grades within 'Beauregard' and 'Bayou Belle' cultivars. Fourth, the use of narrow row widths (28" and 32") was investigated in response to the need by the processing industry to improve production efficiency. The results indicate that there were no benefits in using narrow row widths relative to conventional row width (40") using processing grading standards.

Briefly describe how your target audience benefited from your project's activities.

First, producers are using information about adjusting optimum fertilizer rates based on soil test data decision making about fertilizer applications.

Second, producers now understand that narrow row widths do not necessarily improve storage root yields compared to standard practices and are focusing more on slip quality and uniformity to further improve yield and quality.

Briefly describe how the broader public benefited from your project's activities.

The public will benefit from improved production efficiencies by increased availability of lower-cost sweetpotatoes with more consistent quality.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Opportunities for training:

Upon invitation by the ICAR-Central Tuber Crops Research Institute (ICAR-CTRI), Kerala, India, the project conducted an online workshop on root architecture imaging and analysis on January 20-22, 2021. It also conducted another online workshop on the same subject to researchers in PhilRootCrops, Visayas State University, Philippines on August 18-20, 2021.

Dissemination:

1. During the annual meeting (virtual) of the Louisiana Sweet Potato Association on January 14 2021, the researcher presented a talk titled "Notes on plant bed management under variable weather conditions in 2020 and the role of slip length and leaf removal on yield determination" (online format).

2. During the annual meeting (virtual) of the Louisiana Agricultural Consultants Association on February 10 2021, the researcher presented a talk titled “Sweet Potato Research Notes: Critical Nutrient Thresholds, Visual Nutrient Deficiency Symptoms, and Up-Close and Hands-On with the Teralytic Wireless NPK Soil Probe.

3. During the 2021 LSU AgCenter Sweet Potato Research Station Virtual Field Day on September 27, 2021, the researcher presented a video titled “NPK Reference Strips and Plant Quality.”

4. On October 15, 2021, the researcher presented updates on row width trials to stakeholders from Black Gold Farms and LambWeston.

Project plan during the next reporting period to accomplish project goals:

Field and greenhouse follow-up studies will be conducted to further investigate optimization of fertilizer rates based on soil testing and cultivar. These studies are in direct response to multiple producer concerns about the increasing costs of fertilizer inputs.

Breeding and Genetic Studies of the Sweetpotato

Project Director

Don LaBonte

Organization

Louisiana State University and A&M College

Accession Number

1018756



Breeding and Genetic Studies of the Sweetpotato

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Sweetpotato growers need varieties with higher yield, better shape for the fresh market, and disease and insect resistance. This project is about developing new varieties which meet most of these goals.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

A number of sweetpotato crossing nurseries were used to generate true seed. This true seed was evaluated in the reporting year for economic utility. Other lines further along in evaluation were trialed on grower farms for evaluation for yield, shape and utility. Several lines were found to have superior yield to check varieties. This meets a primary goal of this project - improved yield.

Briefly describe how your target audience benefited from your project's activities.

Several early adoption growers are increasing plantings of several key lines with the potential for future release. A recent variety release 'Vermillion' has seen strong acreage increases in California to replace, in part, the 'Diane' variety. 'Vermillion' is a red skin variety and has longer storage time than 'Diane' and meets grower needs for a long storing variety.

Briefly describe how the broader public benefited from your project's activities.

New varieties with improved flavor and more attractive appearance make it to retail for the public. Higher yield means more economy of scale and may aid in keeping prices from rising.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Closing Out (end date 09/07/2023)

Exploring mechanisms regulating adipogenesis and fibrogenesis in progenitor cells at subcutaneous and intramuscular fat depots in beef cattle

Project Director

Xing Fu

Organization

Louisiana State University and A&M College

Accession Number

1018196



Exploring mechanisms regulating adipogenesis and fibrogenesis in progenitor cells at subcutaneous and intramuscular fat depots in beef cattle

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Fat and collagen deposition in different fat depots varies greatly. The goal of this project is to understand the molecular mechanisms regulating the differentiation of progenitor cells that give rise to adipocytes and fibroblasts.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

We collected muscle biopsy samples from cattle of different breeds at different ages for sequencing and in vitro experiments. We identified multiple cell types in cattle intramuscular adipose tissue including several related progenitor cell populations that have differential gene expression. Some genes that are differentially expressed between different breeds or between different progenitor cell populations have been selected for further experiments to validate their functions.

Briefly describe how your target audience benefited from your project's activities.

The generated results will help beef cattle producers to select individuals with desired traits such as high intramuscular fat content and low subcutaneous fat content. Our study will also facilitate the development of effective approaches that promote intramuscular fat accumulation through nutritional management and supplementation.

Briefly describe how the broader public benefited from your project's activities.

Fat deposition not only affects the value of agricultural species but also directly influences human health. Fat accumulation in different fat depots is known to have differential effects on the metabolism of humans. The results generated in our study may provide some insights into the development and expansion of adipose and connective tissues that studies using other model organisms, such as mouse and rat, are not able to provide.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

The generated results were disseminated to the public in a presentation entitled "Differential gene expression of fibro/adipogenic progenitors between Wagyu and Brahman cattle – a possible contribution to their different meat quality" at the 2021 American Society of Animal Science Annual Meeting. Some of the results were also presented at the 2021 multistate project NC1184 annual meeting.

We are preparing a manuscript including some of the results generated in this project. We plan to collect samples at additional developmental stages to identify stage-specific activity and gene expression of progenitor cells.

Project Director

Organization

Louisiana State University and A&M College

Accession Number

1016316



Epigenetic Control of Bovine Preimplantation Embryo Development: Roles of 5-mC and 6-mA

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

The greatest limitation to reproductive efficiency across mammalian species is embryonic mortality; however, the epigenetic mechanisms controlling embryo viability are not well understood. The overarching goal in this project is to understand moments in developmental time where the epigenome undergoes dramatic changes in regulation, as well as their purpose and underlying molecular machinery.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Dynamic changes in DNA modification are crucial in the epigenetic regulation of mammalian embryonic development. These changes are required for degradation of maternally stored RNAs and activation of embryonic genome. Abnormalities in these transitions are likely to result in embryonic arrest at early preimplantation stages. Early embryonic mortality is a major cause of infertility in humans and cattle. In vitro fertilization (IVF) is routinely used for treating infertility and improving genetic selection from genetically superior individuals, respectively. Erroneous epigenetic modifications due to environmental perturbations, such as in vitro maturation (IVM) of oocytes and culture (IVC) of embryos after IVF, are linked to various consequences. DNA methylation (5-mC) is a major form of epigenetic modification that has been extensively characterized. A novel DNA methylation, 6-mA, was recently reported in the mammalian genome, and its function is still largely unknown. We hypothesize that 5-mC and 6-mA play specific methylation regulatory roles in bovine preimplantation development, and abnormalities in 5-mC and 6-mA methylation induced by in vitro manipulation is a determinant of embryo viability. The goal of this work is to characterize the 5-mC and 6-mA dynamics in bovine preimplantation embryos derived in vivo and in vitro and decode the distinct developmental signatures induced by in vitro manipulation. These epigenetic regulatory mechanisms can then be leveraged into new diagnostic tools to treat infertility disorders in humans and animals.

Briefly describe how your target audience benefited from your project's activities.

The primary target audience includes research scientists with a focus on embryology, reproductive biology, and epigenetics. The results of the research are also relevant to dairy farmers, cattle ranchers, and embryo technology practitioners. Efforts will be made at the appropriate time to convey results and recommendations for changes in reproductive management and embryo production to these groups.

Briefly describe how the broader public benefited from your project's activities.

The bovine is recognized as a highly informative model for studying human embryo development and the identification of DNA methylation signatures associated with embryo viability in this study is critical. The new information generated will facilitate improvement of the media formulation for embryo culture and allow us to develop biomarker assays for oocyte and embryo competence and new diagnostic tools to treat infertility disorders in humans and domestic species.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Publications (#corresponding author):

1. Smith R, Susor A, Ming Hao, Tait J, Conti M, **Jiang Z#**, Lin CJ#. The H3.3 chaperone Hira complex orchestrates oocyte developmental competence. *Development*. 2022 Jan 16, PMID: 35112132.

2. Diaz FA, Gutierrez-Castillo EJ, Foster BA, Hardin PT, Bondioli, KR, **Jiang Z#**. Evaluation of seasonal heat stress on transcriptomic profiles and global DNA methylation of bovine oocytes. *Front Genet.* 2021 Oct 29. PMID: 34777457.
 3. Sang L, Xiao Y, **Jiang Z**, Forde N, Tian X, Lonergan P, Hansen PJ. Atlas of receptor genes expressed by the bovine morula and corresponding ligand-related genes expressed by uterine endometrium. *Molecular Reproduction and Development.* 2021. DOI: 10.1002/mrd.23534.
 4. Iyyappan R, Aleshkina D, Zhu L, **Jiang Z**, Kinterova V, Susor A. Oocyte specific LncRNA variant Rose influences oocyte and embryo development. *Noncoding RNA research* 2021 Jun 26. PMID: 34278057.
 5. Li C, Sun J, Liu Q, Ming H, Wang L, Li Y, Li R, **Jiang Z**, Francis J, Fu X. The landscape of accessible chromatin in quiescent and post-myocardial infarction cardiac fibroblasts. *Epigenetics* 2021 Sep 23. PMID: 34551670.
 6. Zhu L, Marjani SL, **Jiang Z#**. The epigenetics of gametes and early embryos and potential long-range consequences in livestock species - filling in the picture with epigenomic analyses. *Front Genet.* 2021 Mar 2; 12:557934. PMID: 33747031.
 7. Gutierrez E, Ming H, Foster B, Gatenby L, Mak CK, Pinto C, Bondioli K, **Jiang Z#**. Effect of vitrification on global gene expression dynamics of bovine elongating embryos. *Reprod Fertil Dev.* 2021 February 19. PMID: 33602389.
 8. Li C, Sun J, Liu Q, Ming H, Wang L, Li Y, Li R, **Jiang Z**, Francis J, Fu X. The landscape of accessible chromatin in quiescent and post-myocardial infarction cardiac fibroblasts. *bioRxiv.* 2021 March 4.
- Conference presentations:
1. Zhu L, Tillquist N, Shi J, Chen Q, Govoni K, Reed S, Zinn S, **Jiang Z#**. Maternal gestational nutrition perturbs offspring sperm small RNA code in sheep. *Reprod, Fertil. Dev.* 3 December 2021. (Oral)
 2. Wang Y, Zhu L, Ming H, Wu J, **Jiang Z#**. Derivation of bovine trophoblast stem cells. *Reprod, Fertil. Dev.* 3 December 2021. (Oral)
 3. Zhu L, Ming H, Iyyappan R, Chen Q, Susor A, Zhou T, **Jiang Z#**. High-resolution ribosome profiling reveals translational selectivity during bovine preimplantation embryo development. *54th Annual conference of Society for the Study of Reproduction (SSR)*, 2021.
 4. Zhu L, Ming H, Liu S, Iyyappan R, Liano ED, Dvoran M, Chen Q, Susor A, Zhou T, and **Jiang Z#**. High-resolution ribosome profiling reveals translational selectivity in the mammalian blastocyst. *Reprod, Fertil. Dev.* 3 December 2020. (Oral)
 5. Mor A, Gatenby L, Dzekunskas E, Zhu L, Bondioli KR, **Jiang Z#**, and Seli E#. Enhancing cell injection systems by real time confirmation of cytoplasmic penetration. *Fertility Sterility.* 2020, 0-174. (Oral)
 6. Goheen B, Rajput S, Logsdon DM, Yuan Y, **Jiang Z#**, Schoolcraft WB, and Krisher RL. A reduced nutrient culture environment improves bovine blastocyst development and alters mitochondrial metabolism as elucidated by single cell RNA sequencing. *Fertility Sterility.* 2020, P-566.



Interactions of bell pepper endornavirus with the host and plant pathogens

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Little is known about the interactions endornaviruses have with their plant hosts and plant pathogens. This project addresses research on the effects of bell pepper endornavirus to their plant host. Furthermore, it investigate potential interactions between bell pepper endornavirus and selected plant pathogens.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

The transcriptome of two near-isogenic lines (NILs) of bell pepper cv. Marengo, one infected with bell pepper endornavirus (BPEV) and the other BPEV-free was characterized before and after inoculation with the acute virus pepper mild mottle virus (PMMoV). Genes involved in plant defense response to external biotic and abiotic stimulus and interspecies interactions between organisms were differentially expressed between the two NILs. Using these two NILs, some biological and molecular interactions between BPEV and the acute viruses, PMMoV and tobacco mild green mosaic virus (TMGMV) were evaluated. BPEV was associated with systemic symptom reduction in pepper plants infected with single and mixed infections of PMMoV and TMGMV. Furthermore, biological, and molecular interaction(s) between BPEV and a fungus (*Colletotrichum* sp.), a bacterium (*Pseudomonas* sp.) and a nematode (*Meloidogyne incognita*) were also evaluated. Results indicate that titers of BPEV increased after infections with either *Colletotrichum* sp. or *Pseudomonas* sp. The nematode did not affect the BPEV titers. These results fulfill objective 2 and 3 stated in the non-technical summary.

Briefly describe how your target audience benefited from your project's activities.

The overall results of this investigation suggest that endornaviruses are in a mutualistic interaction with plants providing beneficial effects that include fitness advantage in the form of protection or tolerance to diseases caused by acute plant viruses. The target audience (plant virologists, plant pathologists, plant breeders, plant ecologists, microbiologists, agronomists, and graduate students) benefited by acquiring new knowledge on the interaction of endornaviruses with plants and plant pathogens. With the knowledge provided by data from this investigation, members of the target audience can design research to determine if endornaviruses can be used in novel crop protection approaches.

Briefly describe how the broader public benefited from your project's activities.

The results of these investigation suggest that the continuous infection of a plant by an endornavirus triggers the plant immune response. This information may lead to future research on using endornaviruses to alleviate some viral diseases in economically important crops.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

The project provided training in laboratory and computational techniques to two graduate students. Results were disseminated in the form of a Ph.D. dissertation of a graduate student.

Closing Out (end date 09/07/2023)

Project Director
Subramaniam Sathivel
Organization
Louisiana State University and A&M College
Accession Number
1014966

★ **Application of Steam-Venting Packaging Technology for Development of High Quality, Safe, Convenient, Frozen Seafood Products for the Frozen Ready-Meal Market Segment**

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

There are several ways seafood has the potential to be contaminated with pathogens, including through the presence of fecal matter and cross-contamination through handling and processing. The proposed research will develop a process to produce safe, convenient, and high-quality seafood food products. The products will be frozen and packed in a microwavable package to create steam (high moisture environment) during the microwaving process.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

PI's lab has designed and developed a process for seafood products that eliminates foodborne pathogens and thus reduces the incidence of foodborne illnesses, resulting in a convenient, high-quality product. Our preliminary studies demonstrated that microporous film (MF) packages could prevent cold spots in shrimp caused by the non-uniform temperature distribution and reduced the inactivation time of *L. innocua* during microwave heating. In this study, we inoculated shrimp with nonpathogenic surrogates *E. coli* ATCC 25922 and *L. innocua* NRRLB-33016, and they were frozen to -20 degrees with liquid nitrogen. The packages were then microwaved. The reduction of *E. coli* ATCC 25922 and *L. innocua* NRRLB-33016 were evaluated during microwave heating. Steam produced in shrimp packed with MF reached 90 °C in the headspace during the microwave process, which led to inactivation or reduction of the inoculated *L. innocua* and *E. coli* ATCC 25922.

Briefly describe how your target audience benefited from your project's activities.

We are continuously conducting preliminary studies for the HATCH project. The HATCH project has already resulted in several refereed publications and the recruitment of five Ph.D. and four M.S. graduate students to the PI's research lab. Three refereed articles and three abstracts were published from the PI's research lab. In addition, the preliminary findings from the Hatch have been presented at national and international meetings. For example, four papers were presented at the Institute of Food Technologists (IFT) annual meeting from the PI's research lab. The IFT meeting provided the PI with opportunities to share experiences, views, and ideas generated from his Hatch project with key government officials, industry representatives, and international experts from major seafood industries and academia. The meeting further allowed the PI to keep up with current events and trends in food industries on a global scale, which aided his understanding of how such trends influence food businesses in the USA. Thus, the results of work conducted under the Hatch project are being broadly disseminated amongst both scientific and food industry communities.

Briefly describe how the broader public benefited from your project's activities.

Nine graduate students have **been** trained about the intervention of seafood safety practices and increased their food safety skills and knowledge. We presented the findings at the graduate student seminars of the LSU School of Nutrition and Food Sciences. Thirty students in the class had opportunities to learn about the intervention of seafood safety practices.

PI teaches NSF 4075 (Food Preservation) and NFS 4005 (Food Engineering Systems) courses at Louisiana State University. The diversity of these classes' (undergraduate and graduate students) backgrounds has increased substantially during the past eight years. PI has re-designed these courses to provide a well-thought-out balance of food preservation and practical aspects of food engineering and food processing and reflect the Hatch project concepts for graduate and undergraduate students.

PI also assisted Bocage, Crawley, LA, to develop a crawfish minced meat processing line and assisted Blue Runner Foods, Inc., Burnside Ave, Gonzales, LA, to place a freezing line for producing frozen products. This processing line was developed based on the concept of the Hatch project.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

We had expected to complete the project by December 2021, but the COVID19 situation limited our performance on the project. It was the main reason we did not meet the proposed study as planned.

Refereed Scientific Articles:

Calumba, K.F., Reyes, V., Bonilla, F., Villasmil, E., and **Sathivel, S.** 2021. Ale beer containing free and immobilized *Lactobacillus brevis*, a potential delivery system for probiotics. Food Production, Processing and Nutrition. 3: 8.

<https://doi.org/10.1186/s43014-021-00051-3>

Sribounoy, U., Pirarat, N., Solval, K.M., Sathivel, S., and Chotiko, A. 2021. Development of pelleted feed containing probiotic *Lactobacillus rhamnosus* GG and Jerusalem artichoke for Nile Tilapia and its biocompatibility studies. 3 Biotech.11: 279.

<https://doi.org/10.1007/s13205-021-02829-1>

Bueno, F., Chouljenko, A., and **Sathivel, S.** 2021. Development of coffee kombucha containing *Lactobacillus rhamnosus* and *Lactobacillus casei*: Gastrointestinal simulations and DNA microbial analysis. LWT-Food Sci. & Technol. 142. 110980.

10.1016/j.lwt.2021.110980.

Kyereh, E. and **Sathivel, S.** 2021. Viability of *Lactobacillus Plantarum* NCIM 8826 immobilized in a cereal-legume complimentary food “weanimix” with simulated gastrointestinal conditions. Food Biosciences. 40: 100848.

<https://doi.org/10.1016/j.fbio.2020.100848>.

Mis Solval, K., Chouljenko, A., Theegala, C., and **Sathivel, S.** 2021. Physicochemical Properties of Purified Biodiesel Based on Oil Recovered from Catfish (*Ictalurus punctatus*) Viscera. J. Am. Oil. Chem Soc. 98: 581-591.

[Integrated approach to understand and manage major rice diseases](#)

Project Director

Jong-Hyun Ham

Organization

Louisiana State University and A&M College

Accession Number

1015305



Integrated approach to understand and manage major rice diseases

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Bacterial panicle blight and sheath blight are major chronic rice diseases in the southeastern United States. Currently, there are several challenges in management of these diseases, including no effective chemical measures for bacterial panicle blight and emergence of fungicide-resistant populations of the sheath blight pathogen. The main goal of this project is to find a better solution for disease management of bacterial panicle blight and sheath blight through comprehensive molecular genetics and genomics studies on the rice disease resistance to the diseases and the virulence system of the bacterial panicle blight pathogen.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

In the study of *Burkholderia glumae*, the major pathogen of bacterial panicle blight, we discovered key regulatory elements for proper expression of virulence factors, which is essential for causing disease in rice. Better understanding of those regulatory elements will lead us to develop new materials that manage bacterial panicle blight through interference of them.

In our genetics and genomics studies of rice disease resistance, we identified genetic locations and candidate genes in the rice genome that contribute to the disease resistance to bacterial panicle blight and sheath blight. On the basis of this information, we also could develop molecular markers that can be used for breeding disease resistant rice lines. For development of new disease resistant rice lines, we tested a variety of rice lines having different genetic background and identified several promising ones. These resistant lines were crossed with elite commercial varieties to generate breeding population, which can be used for developing new disease resistant lines having commercial values. In addition, we establish the technical system for a new pathogen detection technology, called RPA (recombinase polymerase amplification), which will allow us to perform disease diagnosis in more rapid and easier ways.

Briefly describe how your target audience benefited from your project's activities.

Our research on the pathogen of bacterial panicle blight discovered key biological components that determine the virulence of the pathogen. On the basis of their molecular structures, we can design or identify chemical compounds that can interfere with the pathogenesis-related functions of those bacterial components. With this information, new chemical products or practices can be developed for effective management of bacterial panicle blight, which have not been available so far. The genetic information of rice disease resistance to bacterial panicle blight and sheath blight, which was obtained from our genetics and genomics studies, can be used to develop useful molecular markers for breeding of disease resistant rice lines. The disease resistant rice lines identified and generated in this project are excellent genetic resources for the development of new disease-resistant rice lines or varieties. In addition, we set up the isothermal DNA amplification technique (i.e. RPA) for the bacterial panicle blight pathogen, which enables to conduct rapid diagnosis and pathogen detection for the disease.

Briefly describe how the broader public benefited from your project's activities.

This project expands our general knowledge of bacterial pathogens, particularly in the regulatory mechanisms of virulence. The information obtained from our study can be applied to related bacterial species that are pathogenic to animals and humans, so contribute to the field of microbiology in general, as well as phytobacteriology. Our study on rice disease resistance and development of disease resistant rice lines contributes to food security because bacterial panicle blight and sheath blight significantly hamper stable production of rice, which is one of the most important staple food for the human population.

ENHANCE SOYBEAN AND CORN RESISTANCE TO IMPORTANT FUNGAL DISEASES IN LOUISIANA

Project Director

Zhiyuan Chen

Organization

Louisiana State University and A&M College

Accession Number

1012674



Enhance aflatoxin resistance in transgenic corn through host induced gene silencing

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Corn (*Zea mays* L.) is one of the major agricultural crops not just in Louisiana, but also in the U.S. and many developing countries. However, the global corn production is under constant threat of various diseases. One of them is the infection by *Aspergillus flavus* and subsequent contamination with aflatoxins, the most potent naturally occurring toxic secondary metabolites that are known to cause liver cancer in humans and are associated with hepatocellular carcinoma. Aflatoxin contamination of corn is a common problem worldwide and a frequent occurrence in the southern U.S. (such as Louisiana and Texas), which significantly reduces the value of grain both as an animal feed and as an export commodity due to strict regulations established by many countries, such as the U.S. (20 ppb or 20 ng/g) or EU members (6 ng/g). The major reasons for this high frequency of aflatoxin contamination in the southern U.S. are a lack of resistance in commercial varieties and the fact that these fungi thrive under hot and dry environmental conditions. Aflatoxin resistance is a quantitative multi-gene trait and the breeding process to transfer resistant traits from known aflatoxin-resistant corn lines to commercial lines has proved to be difficult due to the lack of markers consistently associated with resistance. Therefore, the objective of our research was to develop novel approaches to reduce aflatoxin contamination in corn.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

We employed the RNA interference (RNAi) based natural plant defence mechanism, called Host Induced Gene Silencing (HIGS), to reduce *Aspergillus flavus* infection and aflatoxin contamination in corn. This approach uses toxic information (gene sequence information) to achieve disease control instead of the traditional disease control using toxic chemicals. This approach is very specific to the targeted pathogen and non-toxic to non-targeted organisms and very environmental-friendly. Four genes from *A. flavus*, two involved in the hydrolysis of protein and pectin and the other two in the biosynthesis of aflatoxins, were selected and cloned into a special RNAi vector and transformed into corn through collaboration with Iowa State University in 2012 and 2013. Transgenic seeds from each of these lines were received in 2012/2013. These seeds were increased in the field through self-pollination since 2015 with APHIS permits. Consistent suppression of aflatoxin production in the corn lines that are homozygous for the transgene were observed in the repeated field studies conducted since 2015. This enhanced aflatoxin resistance is correlated with the presence of the transgene in the transgenic lines and the significantly high levels of gene specific small RNA detected in the leaf and kernel tissues, demonstrating that HIGS through suppressing the expression of these fungal genes is effective in reducing aflatoxin contamination under natural infection and artificial inoculations. In addition, these constructs have also been introduced into peanuts through collaboration with ICRISAT and have also enhanced aflatoxin resistance in the transgenic peanut lines. These transgenic corn lines have been tested at multiple locations in the southern U.S. to confirm their stable resistance to *A. flavus* infection and/or aflatoxin contamination since 2021. We are currently introducing the transgene into elite commercial corn lines through crossing and backcrossing with the goal of developing aflatoxin resistant commercial corn lines.

Briefly describe how your target audience benefited from your project's activities.

The target audience of our research activities are the researcher in similar fields as well as corn producers in the U.S. The benefits that our research activities provided include: (1) demonstration of the feasibility of using HIGS in reducing aflatoxin contamination in corn and in peanut. Similar approaches can be used to manage other fungal diseases; (2) production of transgenic corn lines with enhanced the aflatoxin resistance can reduce our farmers' reliance on fungicides to manage fungal diseases, reducing the production cost; (3) developing elite corn lines with high yielding potential, good agronomic traits and with enhanced aflatoxin resistance can provide our growers a more effective and sustainable way to produce corn.

Briefly describe how the broader public benefited from your project's activities.

The broader impacts of our research activities include: (1) reducing the economical losses associated aflatoxin contamination in corn production through the use of transgenic corn lines with enhanced aflatoxin resistance; (2) enhancing food and feed safety and reducing the health concerns associated with consumption of aflatoxin contaminated grains; and (3) increasing the sustainability of corn production in the U.S. and reducing the environmental pollution caused by the use of toxic fungicides.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

N/A

Critical Issue

Natural Resources & Environmental Sustainability

[Development and evaluation of biochar products for agronomic and environmental applications](#)

Project Director

Jim Wang

Organization

Louisiana State University and A&M College

Accession Number

7000857



In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Biochar, produced from biomass pyrolysis under the partial or total absence of oxygen, has been recently proposed as a soil amendment to enhance soil carbon (C) sequestration and reduce greenhouse gas (GHG) emissions as well as to improve soil fertility and quality for agronomic production. In addition, pristine biochar has been modified to improve its functionality for environmental application. This project addresses development and characterization of functionalized biochars for specific applications such as removal and recovery of nutrients from waste and surface waters as well as removing various inorganic and organic pollutants from aqueous and soil systems. Specific objectives are 1) to develop biochars for enhancing phosphate and other oxyanion adsorptions and potential nutrient recovery from surface and waste water treatments, 2) to characterize ecotoxicity of biochars made from different feedstocks and potential field applications, and 3) to evaluate the properties of commercially available biochars for improving soil fertility and crop production.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Several experiments were carried out in 2021. This includes laboratory experiments conducted to examine metal-impregnated biochar catalysts for oxidation removal of recalcitrant organic pollutants found in the environment besides removing phosphates for achieving Objective 1. In doing so, methylene blue was used as an indicator of recalcitrant pollutant to test the functionality of iron-impregnated biochar, and the removal effectiveness of methylene blue was examined over a wider pH range. It was found that even after four consecutive runs, iron-impregnated biochar maintained above 95% methylene blue removal rate within 3 min of treatment with low Fe release, indicating strong stability and reusability. The removal velocity of methylene blue showed two rate steps: a fast first stage followed by a slow stage with rate. Overall, the developed iron-impregnated biochar is more economical with strong stability and recyclability for treating recalcitrant pollutants. In addition, a commercially produced biochar from sugarcane bagasse was examined for its application effects on agronomic and environmental impacts in a second-year sugarcane field trial to accomplish Objective 3. The results showed that sugarcane residue biochar treatment produced 20% and 14% higher yields than the control in light- and heavy textured Mississippi River alluvial soils, respectively, that grow sugarcane. Biochar also increased soil carbon content by 15%. In addition, the biochar treatment significantly reduced cumulative runoff volumes, which led to the load reduction of nitrate, phosphate, biological oxygen demand, total organic carbon and total suspended solids from sugarcane fields. Overall, these results suggest significant benefits when pristine biochar and functionalized/modified biochar are used in environmental and agronomic applications.

Briefly describe how your target audience benefited from your project's activities.

Agricultural and environmental professionals as well as waste management professionals and small biochar producers and farmers are targeted audience. These project activities help farmers/producers with use of crop waste such as sugarcane and rice harvest residue for producing value-added biochar products for additional application with improved revenue. By returning biochar to agricultural lands, farmers will enhance soil health for sustainable production. Environmental professionals will benefit from additional knowledge of using potential biochar application to increase carbon and reduce nutrient runoff as well as for more specific wastewater treatments

Briefly describe how the broader public benefited from your project's activities.

Results and activities of this project promote using harvest crop residue to make biochar and reducing open-field burn of sugarcane harvest residue. This should benefit public by improving air quality in southern Louisiana. In addition, the project helps the development of agricultural conservation practice that will should benefit our overall wellbeing of our society besides farmers and producers.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

The project was extended for one year due to Covid 19 effect. The planned work has been carried out. Additional data has been analyzed. The final report will be prepared for the project. Through the activities accomplished, Two graduate students were trained in the knowledge and analytical skills in the area related to this project.

The results have been disseminated through publications in peer-reviewed journals.

Integrated PEst Management of Sugarcane Insects

Project Director

Blake Wilson

Organization

Louisiana State University and A&M College

Accession Number

1024658



2021 Progress Report

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

This project aims enhance sustainability of Louisiana sugarcane production through development of integrated management strategies for key insect pests.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Numerous field trials were conducted which identified insect resistant sugarcane varieties and optimized chemical control strategies. On-going research activities are assessing yield loss relationships among poorly-understood pest guilds.

Briefly describe how your target audience benefited from your project's activities.

Results have reduced unnecessary insecticide use, thereby improving farm profitability. Identification of insect resistant varieties will preserve efficacy of chemical controls, by mitigating development of insecticide resistance among key pest populations.

Briefly describe how the broader public benefited from your project's activities.

Research activities that enhance farm revenues will improve the economies of rural communities which are heavily invested in rice production. Reduced reliance on insecticides will also help ensure preservation of ecosystem services by eliminating environmental detriments that can results from inappropriate pesticide applications.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.


Several graduate and undergraduate students were trained with all or partial involvement in this project. Results were disseminated at grower-oriented extension meetings, farm visits, and extension publications. Multiple peer-reviewed journal articles were published.

Evaluation of soybean varieties, planting practices, and fertilizer inputs to maximize yield and profitability in Louisiana soybean production systems.

Project Director

David Moseley

Organization

 **Evaluation of soybean varieties, planting practices, and fertilizer inputs to maximize yield and profitability in Louisiana soybean production systems**

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

It is important to continue evaluating the best management practices of soybean production for producers to remain profitable and sustainable. The best management practices that are addressed in this proposal are evaluating the performance and stability of soybean varieties, planting practices, and phosphorus applications.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Objective 1: Maximize soybean yield and profitability in Louisiana by evaluating the performance and stability of commercial and experimental soybean varieties.

1. An LSU AgCenter publication, “2022 Soybean Variety Yields and Production Practices”, was published online and in print to provide producers data on soybean variety performance and stability.
 1. In 2021, 125 soybean varieties were submitted by 12 private seed companies and two University breeding programs to be evaluated in replicated small plots on seven research stations across Louisiana. The varieties were evaluated for yield, plant height, lodging, and maturity.
 2. In 2021, A total of 25 soybean varieties were submitted by six private seed companies and 1 University breeding program to be evaluated in strip trials across 20 demonstrations and 12 Louisiana parishes. The varieties were submitted in appropriate maturity group sections (3.7-4.4, 4.5-4.9, 5.0 – 6.0). The varieties were evaluated for yield, and protein and oil content.
 3. In 2021, four soybean varieties were submitted by three private seed companies to be evaluated in strip trials at two locations across two Louisiana parishes to be evaluated for nematode resistance.

Objective 2: Evaluate soybean planting practices to maximize yield across regions and planting dates.

1. In 2021, a planting date trial was conducted at three research stations (Dean Lee Research Station, Rice Research Station, and Macon Ridge Research Station). The trial consisted of 12 varieties split evenly across three maturity group sections (MG 3.7-4.4, 4.5-4.9, and 5.0-5.6). Yield, plant height, growth rate, and protein and oil were collected.

Objective 3: Evaluate methods and timings of phosphorus applications in Louisiana soybean production to maximize profitability and sustainability.

1. In 2021, a phosphorus application method and timing trial was conducted at two locations (Dean Lee Research Station and Macon Ridge Research Station). Yield and phosphorus content were collected.

Briefly describe how your target audience benefited from your project's activities.

Objective 1: The yield, nematode resistance, and plant characteristics were published online and in print. Yield differences were presented at meetings. An example of possible yield differentiation between varieties could be seen in the MG 4.5-4.9 core-block demonstration. Across all locations, the highest yielding variety had an overall average of 63 bushels per acre where the lowest average yield was 55 bushels per acre. In addition, five out of 11 varieties had an overall average that was higher than the combined variety average. Selecting varieties with the highest yield potential can help producers be profitable and sustainable.

Objectives 1, 2, and 3: The data from the planting date trial and the phosphorus application method and timing trial was presented at eight meetings. The meeting audiences included the Louisiana Soybean and Grain Promotion Board, producers, consultants, and agents. Besides variety testing results, data from the optimum planting date and maturity group trial and the results of the phosphorus application methods and timing trial was reported at meetings. An earlier planting date window compared to the published recommendation; and a possible yield benefit of a phosphorus application after the onset of flowering were presented.

Briefly describe how the broader public benefited from your project's activities.

Objective 1: Two articles discussing variety testing were published in the Louisiana Agriculture Magazine in 2021. In addition, short articles were published by commodity websites and radio interviews on variety testing were conducted. These efforts helped the broader public understand the efforts the soybean industry takes to be profitable and sustainable.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

An online variety selection tool is going to be developed to assist in evaluating varieties across multiple variable such as yield, stress resistance, and plant characteristics. In addition, the variety screening efforts will be expanded to included weathering resistance data.

Evaluating the use of activated aluminum as an amendment to reduce phosphorus loading from turfgrass during establishment.

Project Director

Jeffrey Beasley

Organization

Louisiana State University and A&M College

Accession Number

1025897



Evaluating the use of activated aluminum as an amendment to reduce phosphorus loading from turfgrass during establishment

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Offsite movement of phosphorus from turfgrass systems through leaching or surface runoff can limit turfgrass growth as well as contribute to water impairment. Activated aluminum has high specificity for adsorbing phosphorus and other anions. Therefore, adding activated aluminum as an amendment should limit phosphorus movement.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Research to address phosphorus leaching during bermudagrass establishment in a sand and peat soil was evaluated. Columns were filled with 90:10 sand:peat amended with activated aluminum at 0, 1, 2.5, and 5% (v/v) with sand volume percentages declining accordingly. Columns were seeded with bermudagrass, irrigated daily, and fertilized weekly using a complete fertilizer. Once per week the column was leached with leachate volume measured and nutrient analyses performed.

The addition of activated aluminum had no deleterious effect on bermudagrass establishment but did reduce phosphorus leaching compared to controls. Activated aluminum resulted in >80% reduction among treatments in total phosphorus leached compared to controls for a five-week establishment period. This indicates activated aluminum may be a suitable amendment capable of reducing phosphorus leaching during establishment to prevent phosphorus movement offsite.

Briefly describe how your target audience benefited from your project's activities.

The turfgrass industry installs and maintains turfgrass on sand-based golf greens and athletic fields for better drainage. Soil conditions of high percolation and poor nutrient retention lead to nutrients leaching beyond the rootzone. There is recognition in the industry that applied fertilizers can result in offsite movement of nutrients. This has led to increased development and refinement of best management practices to limit nutrient movement. Establishment is a period that is particularly prone to nutrient movement because of poor plant coverage and increased fertilizer and irrigation application. The use of activated aluminum appears to be an amendment that can reduce phosphorus movement during establishment.

Briefly describe how the broader public benefited from your project's activities.

Water impairment is an issue that goes beyond horticulture and agriculture. Developing and refining best management practices will provide strategies for turfgrass managers to reduce potential movement of nutrients offsite. Activated aluminum is a product that is routinely used to purify drinking water. Addition of activated aluminum was able to reduce phosphorus leaching losses in a sand-based turfgrass system such as the athletic fields used for recreation purposes. Reducing nutrient movement, specifically phosphorus that has been associated with eutrophication, can lower potential water impairment and strengthen environmentally turfgrass management practices.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

None at this time.

[Water Management and Quality for Specialty Crop Production and Health](#)

Project Director

Jeb Fields

Organization

Louisiana State University and A&M College

Accession Number

1025569



2021 Progress Report

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Water management is critical to the continued success of the specialty crop industry. As water becomes more limited, we require more efficient production practices for the industry.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

I served as vice-chair of the NC1186 multistate group in 2021, assisting with the annual meeting, report gathering, and planning practices. Further, My research and academic contribution to the group is through the focus of soilless substrate management. Particularly, assisting with adoption of soilless substrate practices for transitioning specialty crops and identification of alternative soilless substrate materials.

Through my lab's activities we wrapped up data collection on a national soilless substrate science needs assessment in 2021, where growers from across the US and the entire North American continent were polled and surveyed to indicate research needs associated with utilizing soilless culture. Further, we have begun working with sugarcane bagasse as a potential substrate component, that is showing promise in short-term specialty crop systems.

Briefly describe how your target audience benefited from your project's activities.

The specialty crop producers interested in transitioning to soilless culture were provided with information as to substrate selection and administration. Further, they were able to indicate their desired research focuses, which we are publishing to help guide and steer future research across the country. Further, with the potential inclusion of sugarcane bagasse as a

substrate amendment, growers may have the opportunity to lower substrate costs and reduce reliance of peatmoss for production purposes.

Briefly describe how the broader public benefited from your project's activities.

In-ground specialty crop production requires extensive use of agrichemicals, good arable land, and direct access to water. Soilless culture reduces or limits these needs entirely. The support of transitioning agriculture from in-ground production will reduce resource reliance, expand food production into food deserts, and bring a more local and regional based agricultural system.

The use of more sustainable and regional substrate components improves overall sustainability of specialty crop industry, which improves environmental sustainability for the broader public.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Hurricane Ida was declared a federal disaster in my area (Hammond, LA) reducing progress from August 2021. However, great strides were made prior to that event.

Associated publications in 2021:

Fields, J.S., J.S. Owen, Jr., A. Lamm, J. Altland, B. Jackson, Y. Zhen, L. Oki, K. Fontenot, J. Samtani, and B. Campbell. 2021. Soilless Substrate Science: A North American needs assessment to steer soilless substrate research into the future. Proc. Int. Symp. Growing Media, Soilless Cultivation and Compost Utilization in Hort. Acta Hort. 1317.313-318. Ghent, Belgium (oral presentation)

Fields, J.S. and N. Gruda. 2021. Development of substrates for soilless culture systems. In "Advances in Horticultural Soilless Culture" Nazim Gruda (ed). Burleigh Dodds Publishing, Cambridge, UK.

Fields, J.S. 2021. Supporting soilless culture through improved soilless substrate science. HortScience 59:S101 (oral presentation at annual Amer. Soc. Hort. Sci. Conf. Denver, CO.).

May, K., **J.S. Fields**, and A. Edwards. 2021. Fresh vs. aged sugarcane bagasse as a pine bark substrate amendment. HortScience, 56:S213 (poster presentation at annual Amer. Soc. Hort. Sci. Conf. Denver, CO).

Owen, Jr., J.S., **J.S. Fields**, J.E. Altland, A. Lamm, and B.E. Jackson. Soilless substrate science: Part 3 – A glimpse into the future of soilless substrates. GrowerTalks. May 2022, pg 52-53.

Jackson, B.E., **J.S. Fields**, J.S. Owen, Jr. and J.E. Altland. Soilless substrate science: Part 2 – Science for current and future growers. GrowerTalks. April 2022

Fields, J.S., J.S. Owen, Jr., J.E. Altland, B.E. Jackson, A. Lamm. Soilless substrate science: Part 1 – A collaborative effort to support our industry. GrowerTalks. March 2022

Fields, J.S. 2021. Meeting the changing needs of the specialty crop industry with soilless substrates. Louisiana Agriculture Magazine. Summer 2021. Vol. 64:3.

Fields, J.S. 2021. Soilless Substrate Science. Citrus Industry Magazine. January 2021.

Diversifying Louisiana Pastures for Multiple Uses and Enhanced Sustainability

Project Director

William Pitman

Organization

Louisiana State University and A&M College

Accession Number

1025048



In 2-3 sentences, briefly describe the issue or problem that your project addresses.

The extensive plantings of bermudagrass and bahiagrass as productive introduced pasture plants across Louisiana and the South present both production advantages and limitations. Productivity from these pastures depends on increasingly costly inputs of fertilizer and pesticides with the wide-spread use of these grasses limiting diversity within pastures and across pasture landscapes. Availability of reduced-input pasture species options could decrease vulnerability to volatile input costs and increase benefits from provision of multiple ecosystem services by pasture landscapes increasing sustainability of pasture-based enterprises.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

On-going evaluations of field plot and small pasture experiments continued to provide insights for use of new grass and legume varieties with potential to contribute diversity to Louisiana pastures. Some commercially available novel-endophyte tall fescue varieties have proven adapted to some bottomland sites in north Louisiana providing potential for extended periods of perennial grass pasture growth into the cool season. The native legume herbaceous mimosa has persisted under a range of grazing defoliation treatments and has increased nutritive value of warm-season grass pastures under low-input management. A new dallisgrass variety has been successfully managed with reduce-input levels to provide a warm-season pasture option for clay bottomland soils.

Briefly describe how your target audience benefited from your project's activities.

These pasture options have introduced Louisiana cattle producers to potential approaches for reduced-input management and non-traditional pasture species to diversify pastures for less-costly forage systems producing increased ecosystem benefits.

Briefly describe how the broader public benefited from your project's activities.

Overall contributions of these results to the general public will accrue from more diverse pasture landscapes and less dependence on inorganic inputs, which can reduce risk of off-site movement of fertilizers and pesticides along with providing enhanced habitat for wildlife and improved water quality from pasture landscapes.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Project publication:

Pitman, W.D. 2021. Changing ecological and agricultural expectations for US Coastal Plain managed grasslands. *Restoration Ecology* 29 (no. 7): e13436.

[Phenotypic testing and scoring of eastern oyster populations for use as broodstock for the northern Gulf of Mexico oyster aquaculture industry](#)

Project Director

Jerome La Peyre

Organization

Louisiana State University and A&M College

Accession Number

1025244



In 2-3 sentences, briefly describe the issue or problem that your project addresses.

The eastern oyster *Crassostrea virginica* is a foundation species that provides critical ecosystem services and supports an economically valuable fishery and aquaculture industry in the northern Gulf of Mexico. However declines in oyster populations have been driven by factors such as over-harvest and changing estuarine environmental quality. Altered salinity regimes from riverine and coastal management and climate change can significantly impact oysters.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Understanding the range of oyster population responses to changing environmental conditions provides insight into their ability to respond and adapt to climate change and will inform efforts to manage their long term sustainability.

Briefly describe how your target audience benefited from your project's activities.

Empirical results were published on the divergence in salinity and thermal tolerance of northern Gulf of Mexico oysters.

Briefly describe how the broader public benefited from your project's activities.

The negative impact of rising temperatures on eastern oysters' performance and health in northern Gulf of Mexico estuaries is likely to be significant and will be greatly exacerbated by extreme and fluctuating salinity conditions resulting from climate change.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Marshall et al (2021). Divergence in salinity tolerance of northern Gulf of Mexico eastern oysters under field and laboratory exposure. *Conservation Physiology* 9(1):coab065

Marshall et al (2021). Tolerance of northern Gulf of Mexico eastern oysters to chronic warming at extreme salinities. *Journal of Thermal Biology* 100:103072

[Engineering multi-functional substrates and identifying new substrate management practices for Louisiana's nursery industry](#)

Project Director

Jeb Fields

Organization

Louisiana State University and A&M College

Accession Number

1023629



2021 Progress Report

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Nursery production relies upon soilless substrates as a rooting media for containerized production. These substrates can be modified to create more efficient use of resources (water and fertilizer). The goal of this research is to identify new techniques and engineer new substrates to help increase economic and environmental sustainability of the nursery production industry.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Stratified substrates is the term we have coined for layering unique substrate materials within a single container. In 2021, this research was accelerated through the completion of a Master's student project on stratified substrates in the Fields Lab at the Hammond Research Station. Three individual research projects were developed and completed in 2021 associated with the

Master's thesis. These projects focused on water efficiency through pairing irrigation schedules (i.e. single vs cyclic) with stratified substrates. Further, we completed pragmatic stratification practices work, focused on grower oriented engineering of substrates.

Briefly describe how your target audience benefited from your project's activities.

Nursery growers have begun to implement stratified substrate trials on farm. The benefit comes from potential reduction in fertilizer costs due to more efficient nutrient distribution. Further, the stratified process allows for more efficient root growth and development. This increased rooting is being further investigated as it has the potential to reduce time to market for nursery growers and improve transplant success; however, this is being further investigated. Finally, a reduction of "soil" costs through utilizing cheaper substrate in layers may help further reduce production costs of growers.

Briefly describe how the broader public benefited from your project's activities.

With the implementation of more efficient production practices, the industry may be able to reduce use of fertilizer and water. Both water and fertilizer are becoming critical resources for the public as well as our direct stakeholders. Reducing consumption will lessen the demand and requirement for resource driven crop production.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

The major disaster Hurricane Ida directly affected research and implementation of research at the Hammond Research Station and surrounding areas. However, this work did continue to progress around the hurricane. Results from this work have been shared with academics (through research conferences like American Society of Horticulture Science) and industry stakeholders (through popular press articles and presentations at trade shows like Cultivate, and industry association webinars like International plant propagator's society).

Associated publications in 2021:

Criscione, K., **J.S. Fields**, J.S. Owen, Jr., L. Fultz, and E. Bush. 2021. Evaluation of stratified substrate effects on containerized crop growth under traditional and alternative irrigation protocols. HortScience. 57:400-413.

<https://doi.org/10.21273/HORTSCI16288-21>

Fields, J.S., J.S. Owen, Jr., and J.E. Altland. 2021. Substrate Stratification: Layering unique substrates within a container increases resource efficiency without impacting growth of shrub rose. Agron. J. Special Issue: Advances in soilless substrate science for modern plant production systems. 11:1454. doi: 10.3390/agronomy11081454

Criscione, K., **J.S. Fields**, and J.S. Owen. 2021. Exploring water movement through stratified substrates. Proc. Int. Plant Prop. Soc. Student paper competition, Mobile, AL.

Criscione, K., **J.S. Fields**, and J.S. Owen, Jr. 2021. Investigating substrate stratification water dynamics and subsequent water status between irrigation events. Soil Sci. Soc. Amer. Ann. Meeting. Salt Lake City, UT. (oral presentation by Criscione).

Fields, J.S., K. Criscione, and J.S. Owen, Jr. 2021. Water dynamics of stratified substrate systems under single and cyclic irrigation schedules. The Int. Symp. Growing Media, Composting and Substrate Analysis. Ghent, Belgium (poster presentation).

Criscione, K.S., **J.S. Fields**, J.S. Owen Jr., L. Fultz, and E. Bush. 2021. Stratified substrate systems for improved water resource management strategies in container grown nursery crops. HortScience 59:S101-S102. (oral presentation by Criscione at annual Amer. Soc. Hort. Sci. Conf. Denver, CO.).

Owen, Jr., J.S., **J.S. Fields**, J.E. Altland, S.C. Marble, T. Hoskins, and J. Brindley. 2021. Opportunities and challenges to implementing stratified substrates in soilless culture of economically significant crops. Int. Symp. Growing Media, Composting and Substrate Analysis. Ghent, Belgium

Owen, J.S. Jr., **J.S. Fields**, and J.E. Altland. Utilizing stratified growing media to invent the future. Nursery Management. March 2022.

Fields, J.S. and K. Criscione. 2021. Soilless substrate stratification: A new media management strategy for improved resource efficiency. Louisiana Nursery and Landscape Association Quarterly Magazine.

Additional associated workshops and presentations:

Fields, J.S. LSU AgCenter Horticulture Field Daye Hammond Research Station: Soilless substrate stratification research update. July 23, 2021. Hammond, LA

Fields, J.S. 2021. Engineering more profitable substrate systems: Developing techniques for enhanced water and fertilizer management. Cultivate '21, July 12, Columbus, OH. (invited speaker)

Next year:

We plan to continue to publish and present research associated with stratified substrates in 2022. Further, we plan to expand and investigate the use of stratified substrates in greenhouse floriculture production.

Closing Out (end date 09/07/2023)

Thermochemical Conversion of Lignocellulosic Materials Using Electromagnetic Technologies

Project Director

Dorin Boldor

Organization

Louisiana State University and A&M College

Accession Number

1021617



Thermochemical Conversion of Lignocellulosic Materials Using Electromagnetic Technologies

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

The project will convert biomass such as wood, agricultural residues, and bioenergy crops into solid, liquid, and gas products that can be used as fuels, feedstock for other chemical products, or specialty products. The conversion will take place at high temperature in the absence of oxygen or with only partial oxygen addition in the form of air or steam. The products will be characterized quantitatively and qualitatively. A secondary conversion process can be employed to improve the desirable characteristics of a certain product.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

The focus of research activities targeted the consolidation of efforts in the field of bioenergy and to promote research accomplishments. During the Spring 2021, the COVID19 pandemic continued to significantly affect the ability of the research group to undertake laboratory activities, due to restrictions in place until all personnel was vaccinated against COVID19. However, the research activities have continued to be maintained at both the national (with University of Kentucky sustained under the NSF \$4 million grant) and the international level (with Politehnica University of Bucharest). These two projects were concluded in Fall 2021. Multiple peer-review articles were submitted for publication, with 5 of them published (and virtually all of them being collaborative in nature). Due to COVID19 no presentations were made at national and international conferences. To fund the research using extramural and internal sources, 16 proposals (one of them as senior collaborator, the others as PI or coPI) were prepared during 2021, with 5 of them funded, 4 under current consideration, and the rest of them

declined or asked to be resubmitted. Two graduate students (one M.S., one PhD) were advised during the period, with two additional graduate students being recruited (1 MS, 1 PhD) and accepting to join with a start date of January 2022. A new research associate was interviewed and hired in collaboration with Chemistry, with a start date of early 2022. An international PhD student was mentored in research during 2021. In addition, 7 undergraduate students were guided in their research projects during 2021, with several of them presenting at the LSU Discover Day, one of them being accepted as an LSU Discover student for Summer 2021, and one accepted into the LSU MARC program. An LSU Honor Thesis student was advised (graduating in May 2022). Committee member for 5 additional PhD students at LSU, and for one undergraduate Honor Thesis. Mentoring was provided to several PhD students, postdocs, and junior faculty under the auspices of the grant funded by ACNSI – Romanian National Body for Research with Dr. Boldor as the PI. The results of the research are described in detail in the peer-reviewed publications as follows:

1. State, R. N.; Ionescu, G.; P?tra?cu, M.; Volceanov, A.; Boldor, D.; M?rculescu, C., Twin reactor catalytic assisted pyrolysis for food court waste conversion into high end chemicals. *J Anal Appl Pyrol* **2021**, *160*, 105351. doi.org/10.1016/j.jaap.2021.105351
2. Trost, D., Polcar, A., Boldor, D., Nde, D. B., Wolak, A., & Kumbár, V. (2021). Temperature Dependence of Density and Viscosity of Biobutanol-Gasoline Blends. *Applied Sciences*, *11*(7), 3172. doi:10.3390/app11073172
3. Ellison*, C.É., & **Boldor, D.** (2021). Mild upgrading of biomass pyrolysis vapors via ex-situ catalytic pyrolysis over an iron-montmorillonite catalyst. *Fuel*, *291*, 120226. [doi:https://doi.org/10.1016/j.fuel.2021.120226](https://doi.org/10.1016/j.fuel.2021.120226)
4. Nde, D. B., Barekati-Goudarzi, M., Muley, P. D., Khachatryan, L., & **Boldor, D.** (2021). Microwave-assisted lignin liquefaction in hydrazine and ethylene glycol: Reaction pathways via response surface methodology. *Sustainable Materials and Technologies*, *27*, e00245. doi:10.1016/j.susmat.2020.e00245
5. Nde, D. B., Muley, P. D., Sabliov, C. M., Nokes, S. E., & **Boldor, D.** (2021). Microwave assisted pyrolysis of Kraft lignin in single mode high-Q resonant cavities: Degradation kinetics, product chemical composition, and numerical modeling. *Energy Conversion and Management*, *230*, 113754. [doi:https://doi.org/10.1016/j.enconman.2020.113754](https://doi.org/10.1016/j.enconman.2020.113754)

Briefly describe how your target audience benefited from your project's activities.

Other researchers in plant sciences, biomedical, chemistry, and engineering; R & D personnel in all agricultural field (production, harvesting, logistics, processing) and food and biological engineering, microwave equipment manufacturers, other related industries are also included in the target audience for this project. Audience also includes the stakeholders in the Louisiana agriculture via popular magazine articles, and various state and federal governmental agencies and other policy makers, which can make scientific-based policy decisions using the outputs from this project. International stakeholders include foreign governments and non-governmental entities, especially from the developing world, interested in promoting production of biofuels from various waste and non-food resources.

Briefly describe how the broader public benefited from your project's activities.

Outcomes of this project have impacts that will further the knowledge base required for successful development and implementation of low-cost technologies for biofuel and bioproducts production from a variety of feedstock. It is expected that this project will have both short- and long-term impacts on biofuels derived from both food (i.e. various fruit seeds) and non-food (i.e. algae, lignocellulosic biomass) feedstock. Design of new equipment and processes using the data acquired and the numerical models developed will lead to an expanded and improved intellectual property portfolio, which can be further leveraged toward developing new businesses, improving rural economies, and generating a significant number of jobs in the agricultural sector in Louisiana and other rural area. New biomedical devices under investigation may lead to improve health outcomes.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to

communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Dissemination of the findings resulting from this work include multiple presentations of research results at local LSU conferences (due to COVID19 restrictions), and scientific papers published in peer-review journals. Multiple collaborations have been initiated and enhanced across multiple disciplines, including chemical engineering, civil and environmental engineering, plant sciences, agronomy, biological sciences, and many more. The results, published mostly in the scientific literature, indicated that various biomass resources are successfully converted into platform chemicals and fuels using electromagnetic-based heating (induction or microwave). Also, we demonstrated that various catalysts are very active under electromagnetic exposure, and these can be used for plastic depolymerization. Deliverables include values for parameters of importance in lignin processing, operating parameters for thermochemical conversion of biomass into bio-oil and drop-in fuels, parameters determining catalyst behavior under various electromagnetic stimulation conditions, and temperature and flow data using simulations in continuous-flow microwave pyrolysis. We also continued our efforts to establish standardized procedures for image analysis procedures for biomedical applications. A new medical device for delivery of neonatal tissue at injection sites is being developed as part of the senior design sequence, with disclosures being made to the LSU and LSU AgCenter IP offices.

Disease Management in Sweetpotato in Louisiana

Project Director

Christopher Clark

Organization

Louisiana State University and A&M College

Accession Number

1021402



Disease Management in Sweetpotato in Louisiana

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Sweetpotato production in the U.S. is affected by multiple diseases that affect profitability of sustainability. Included are diseases that occur in the field caused by soilborne pathogens, diseases that occur post-harvest, and diseases that result from accumulation of systemic pathogens such as viruses in the vegetative propagating materials used for planting. Very few programs exist to develop management practices for these diseases and the goal of this program is a comprehensive effort to develop resources to manage this spectrum of sweetpotato diseases.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Screening LSU AgCenter sweetpotato breeding lines identified multiple lines with sufficient resistance to *Streptomyces* soil rot, *Fusarium* wilt, root-knot nematodes, *Fusarium* root rot, and Java black rot to provide practical management of these diseases. Post-harvest studies indicated that prophylactic use of a synthetic fungicide provided control of *Rhizopus* soft rot whether disease pressure was artificially high or naturally low, while a biological gave adequate control consistently under naturally low disease pressure but was variable when disease pressure was artificially high. 'Seed' roots produced from virus-tested tissue culture plants produced seed roots after one year in the field that remained clean and produced a yield that 43% greater than that produced by older generation seed that had been re-infected with viruses.

Briefly describe how your target audience benefited from your project's activities.

Over recent years, many cultivars have been provided to the public from the LSU AgCenter that have multiple disease resistance, including Vermillion that was released in 2021. These cultivars are currently grown in Louisiana, California, Arkansas, Mississippi, Alabama, Florida, and North Carolina. They are provided to the seed systems in each state as virus-tested tissue cultures, and thus also provide an initially clean source of planting materials that help manage virus disease complexes. For the cost of the seed they purchase, growers have been able to successfully manage several diseases that once limited sweetpotato production.

Briefly describe how the broader public benefited from your project's activities.

Sweetpotato is one of the most nutritious crops produced in the U.S. and management of the most important diseases enables growers to produce the crop efficiently thus maintaining an abundant, relatively inexpensive supply of sweetpotatoes from consumers. It also provides valuable source of income and secondary effects on the rural economies where sweetpotato is grown.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Eighty-eight inches of rain were recorded at the primary location for field plot work for this project between Jan 1 and Sep 30, 2021 which caused severe problems with sweetpotato storage root production and storage. One graduate student is conducting PhD research on management of Rhizopus soft rot of sweetpotato under this project. Results were presented at a virtual field day in Aug, 2021 and at a statewide stakeholder meeting in Jan 2022. The PI for this project will retire in Aug, 2022 and a search is in progress for a successor who will determine future directions and activities for this project.

Closing Out (end date 09/07/2023)

Enhancing Bio-oils Production and Bio-Products Utilization from Forest Wastes of the Urban and Rural Interface in Louisiana

Project Director

Zhu Hua Ning

Organization

Southern University and A&M College

Accession Number

1021141



Enhancing Bio-oils Production and Bio-Products Utilization from Forest Wastes of the Urban and Rural Interface in Louisiana

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

This project addresses the challenges of the emerging biobased industry with potential solutions that would support research, development, and pre-commercialization activities. Biobased products utilization are expected to expand the role of agriculture and forestry.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

The team examined the effects of biochar as soil amendment on photosynthesis and shoot growth of Live Oaks (*Quercus virginiana*). Biochar was applied as soil amendment under the Live Oaks in a field experiment. A complete randomized block design was employed with four replications of the six biochar treatments - 0% biochar, 10%, 15%, 20%, 25%, and 30%. Data on net photosynthesis (Ps) were obtained using the LI-COR 6400 Portable Ps System. Shoot elongation was measured. Data were analyzed with SAS using a mixed analysis of variance model where treatment was the fixed effect and block was the random effect. Results showed that 20% and 25% biochar soil amendment increased Live Oak Ps rate significantly; the highest Ps rate was with 25% biochar treatment. Shoot growth was significantly increased after soil was treated by 15% to 30% biochar, with the highest at 25% biochar content. The result indicated that the optimal biochar application as soil amendment is 25%. The research contributes to promote wood waste recycling, biochar utilization, and soil nutrient management.

The team members have been conducting research to quantify biomass potential availability for bio-oil and bio-char production and utilization. The research extended to the biomass from agricultural crops in southern states such as Mississippi. Relative measures, time series graphs and descriptive statistics coupled with geographic information systems (GIS) mapping using ArcMap were employed to generate the outcome of this research. Statistical analysis indicated that corn and soybeans were the most produced crops in Agricultural Districts 10 and 40. These districts produced more bioenergy crops than the other districts. GIS mapping results also showed that the potential area for bioenergy crops is in zone 131 of the Mississippi Land Resource Area (MLRA). This zone has an absolute

advantage in the production of these crops which includes the diversity of biomass production such as corn, cotton, soybeans, wheat, rice, barley, grain sorghum, canola, camelina, algae, hardwoods, and softwood. The research team recommends a constant GIS mapping and land management system for each agricultural district in Mississippi to enable researchers and farmers to determine the factors which contribute towards the increasing and decreasing trends in the production of the bioenergy crops.

Briefly describe how your target audience benefited from your project's activities.

Two new research trainings have been initiated for students: "Quantifying forest waste potential availability for bio-oil and biochar production and utilization in urban and rural interface" and "Relationship among woody biomass, forest fire, biochar and bioenergy". The team faculty guided students to conduct literature reviews, explore research methodology, and develop doctoral research proposals.

The team faculty also trained students to conduct their master's degree research on "Bioenergy: Promoting Efficient Conversion of Agricultural Biomass into Sustainable Renewable Energy" and "Impacts of biochar application on soil processes, properties and activities". Their research aims to identify agricultural land cover uses for energy growing crops, determine the main agricultural biomass used for renewable energy production, and analyze the benefits and impact of agricultural biomass conversion into biofuels.

In collaboration with a Louisiana high school science teacher, a presentation was developed and delivered to high school students in EBR Readiness Superintendent Academy.

Briefly describe how the broader public benefited from your project's activities.

The project team of faculty and students published a peer reviewed journal article. The scientific presentation was made at the 2020 Society of American Foresters National Convention. The Biochar soil amendment initiative was implemented in Louisiana in collaboration with Exxon - a national company, and Baton Rouge Green- a nonprofit organization. Target audience includes scientists, extension agents, and practitioners in the fields of forestry, natural resources, and agriculture; public, private and industrial partners; college level students and high school students; professional state and national societies in forestry and natural resources, etc.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Publications

Twumasi, Y.A., Merem, E.C., Namwamba, J.B., Annan, J.B., Ayala-Silva, T., Asare-Ansah, A.B., Ning, Z.H., Opong, J., Loh, P.M., Frimpong, D.B., Owusu, F., Mjema, J.E., Okwemba, R., Mwakimi, O.S., Petja, B.M., Akinrinwoye, C.O., McClendon-Peralta, J. and Mosby, H.J. (2021) Land Resource Areas and Spatial Analysis of Potential Location of Bioenergy Crops Production in Mississippi. *Journal of Sustainable Bioenergy Systems*, 11, 187-214. <https://doi.org/10.4236/jsbs.2021.114013>.

Abdollahi K. 2021. Innovative Approaches in Urban Forestry to Enhance the Environmental and Community Health Around the World. *Journal of Forestry*, 119(2).

Changes/Problems: The former project director Dr. Kamran Abdollahi suddenly passed away on March 4, 2021, Resulted in the loss of a extremely valuable researcher and his expertise. The on-going COVID-19 pandemic continues to negatively impact the project.

Evaluation of carbon and nitrogen dynamics in agricultural ecosystems under different soil and water management

Project Director
Changyoon Jeong



Evaluation of carbon and nitrogen dynamics in agricultural ecosystems under different soil and water management

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Under different agricultural practices, the carbon (C) and nitrogen (N) dynamics are not fully understood. This project evaluated the movement, distribution, deposition, and dynamics of C and N in tailwater recovery systems, cover crop cultivation, and the decomposition of animal carcasses in soil.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

My primary activities to achieve the objectives were measuring nutrient concentrations from the tailwater recovery system consisting of two constructed wetlands in the Red River Research Station, LSU AgCenter, and measuring CO₂, CH₄, and N₂O gas emissions from winter cover crop cultivation and following the main crop fields, and poultry carcass burial sites under different burial methods. The processed-based model (DNDC model) simulated C and N leaching and movement with various scenarios.

The primary goals of the project are as follow:

1. Examine the dynamics of carbon and nitrogen removal in a tailwater recovery system.
2. Examine nitrogen leaching and CO₂, CH₄, and N₂O gas emissions from cover crop fields.
3. Examine the nitrogen leaching and CO₂, CH₄, and N₂O gas emissions in poultry carcass sites under different burial conditions.
4. Long-term simulation of the carbon and nitrogen dynamics from cover crop fields under different management systems.

The significant progress under these goals are as follow:

Objective 1: Examine the dynamics of carbon and nitrogen removal in a tailwater recovery system.

Carbon and nitrogen concentration were measured from the tailwater recovery system consisting of two constructed wetlands in the Red River Research Station, LSU AgCenter. The efficacy of the tailwater recovery system was evaluated with several water quality parameters such as Total Suspended Solids (TSS), Total Kjeldahl Nitrogen (TKN), NO₃-N, Total Phosphorus (TP), and Soluble Reactive Phosphorus (SRP). Additionally, the in-situ water quality parameters, temperature, Oxidation-Reduction Potential (ORP), Electrical Conductivity (EC), pH, and Dissolved Oxygen (DO) were measured. Regular water samples were collected twice a month, and rain event water samples were collected as appropriate. During the investigated period, the average DO level was 2.50 mg L⁻¹ in the shallow pond and 4.30 mg L⁻¹ in the deep pond. The DO Values were significantly influenced by surface runoff after rain events. The average pH was 7.51 at the deep pond compared with 6.98 at the shallow pond. The compared EC values between the shallow pond and deep pond showed that the average EC at the deep pond (252 μS/cm) was significantly lower than the value at the shallow pond (389 μS/cm). The measured average TKN, TP, SRP, and TSS values were 2.61, 2.36, 0.67, and 75 mg L⁻¹ at the deep pond and 3.78, 2.56, 0.78, and 108 mg L⁻¹ at the shallow pond, respectively, during the investigated period. The shallow pond functions as a filtering stage before it drains to the deep pond. Overall, this data suggests that constructed wetlands reduce excess nutrients before draining into the agricultural watershed.

Objective 2: Examine nitrogen leaching and CO₂, CH₄, and N₂O gas emissions from cover crop fields.

Biomass from hairy vetch (HV)-winter wheat (WW) mixed systems was significantly higher than the biomass from HV, Rapeseed (RS), WW, HV-RS mixed treatments. Biomass of HV in the treatments with a seeding rate of 15, 30, and 60 lbs/acre was 108.2, 235.78, and 401.18 lbs/acre, respectively. In the seeding rate of 0, 15, 30, and 60 lbs/acre, soybean yield was 36, 48, 93, and 96 bushels/acre, respectively

Soil moisture contents and soil salts (EC) were measured during the winter season with cover crop (HV) and following crop season. Results showed that soil moisture content was 15.3 % in the seeding rate of 60 lb/ac and 12.1 % in the 15 lb/ac seeding rate during the winter cover season. However, soil moisture content from the residue incorporated soybean field was not significantly different with seeding rates except the plot with a 30 lb/ac seeding rate during the crop season. Soil salt

contents (EC) were increased by increasing hairy vetch's seeding rate during the cover crop season. HV's recommended optimum seeding rate was between 30 and 60 lbs/acre for increasing crop yield and soil organic matter contents. We are recommending HV-WW mixed system to increase biomass and crop yields.

Cover crop residue either soil surface or incorporated in silty loam and sandy loam soils mitigated CO₂ and N₂O emissions compared to the control (no-cover crop), and CO₂ and N₂O emissions from the field incorporation fields were significantly reduced with the residue retained at the surface. Carbon dioxide and N₂O gas emissions were 58.0 mg m⁻² ha⁻¹ and 35 µg m⁻² ha⁻¹ from the incorporation of legume cover crop into the soil and 68.6 mg m⁻² ha⁻¹ and 39.2 µg m⁻² ha⁻¹ from the residue, retained at the soil surface. N₂O gas emissions were 38.1 µg m⁻² ha⁻¹ and 45.2 µg m⁻² ha⁻¹ from the legume cover crop and non-legume cover crop incorporated field.

Objective 3: Examine the nitrogen leaching and CO₂, CH₄, and N₂O gas emissions in poultry carcass sites under different burial conditions.

Different burial methods were shallow burial with wood chips layer and wood chips + bio-film layer, and clay layer. One hundred chickens were buried under each other burial conditions. Soil pore air concentration of CO₂, CH₄, and N₂O gas samples was collected through installed PVC pipes from the chicken burial sites using a septum installed cap between 09:00 and 11:00 am on every sampling day. The gas fluxes from the woodchip treated site ranged from 22.29 to 1,980 mg m⁻² hr⁻¹ in CO₂, from 0.25 to 25.35 mg m⁻² hr⁻¹ in CH₄, from 3.12 to 1,751 µg m⁻² hr⁻¹ in N₂O, respectively. The biofilm-treated gas fluxes ranged from 12.91 to 1,133 mg m⁻² hr⁻¹ in CO₂, from 0.17 to 7.39 mg m⁻² hr⁻¹ in CH₄, from 8.39 to 1,282 µg m⁻² hr⁻¹ in N₂O, respectively. The gas fluxes from the clay treated site ranged from 12.25 to 1,682 mg m⁻² hr⁻¹ in CO₂, from 0.12 to 79.08 mg m⁻² hr⁻¹ in CH₄, from 1.05 to 1,075 µg m⁻² hr⁻¹ in N₂O, respectively. The trendline of gas flux from the woodchip layer treatment showed a relatively higher flux compared to that of the biofilm and clay layer treatment. Gas fluxes under all treatments showed significant seasonal variations with climaxing during summer. Significant nitrate and soluble reactive phosphorus (SRP) leaching were observed along the slope from the burial site. However, the SRP movement was relatively slower compared to nitrate movement. We also observed that microbial activity was altered during composting at the burial sites due to the changes in soil nutrient levels, soil organic matter, and soil structure.

4. Long-term simulation of the carbon and nitrogen dynamics from cover crop fields under different management systems.

The process-based DeNitrification and DeComposition (DNDC) model was used for long-term simulation. Climate data was collected from the regional climate station of Shreveport-Bossier city (climate datasets available from the National Centers for Environmental Information: <https://www.ncdc.noaa.gov/>). Soil and farming information used as model input parameters were updated in this reporting period. The model input data were updated until the end of the project, and the prepared data were used for long-term simulations of carbon and nitrogen dynamics. The model predicted that plant transpiration was 28% improved under the cover crop applied field compared with the non-cover crop applied field. Leaching water volume from soybean fields was reduced by 4 % with cover crop incorporated soybean plots.

Briefly describe how your target audience benefited from your project's activities.

This study extended knowledge for local producers and government agents on sustainable agriculture, carbon sequestration, and mitigating greenhouse gas emissions from agricultural activities under different conditions and treatments. The findings were disseminated to producers via workshops at local and state level producer meetings and field days. In addition, the results were communicated to target audiences via peer-reviewed journals, magazines, and national conferences.

Shin, J-D., D-G Park, S-G Hong, C.Y. Jeong, and H. Kim. 2021. Influence of activated biochar pellet fertilizer application on greenhouse gas emissions and carbon sequestration in rice (*Oryza sativa* L.) production. *Environmental Pollution*. 285(15): 117457. <https://doi.org/10.1016/j.envpol.2021.117457>.

Calderon, R.B., C.Y. Jeong, H-H. Ku, L.M. Coghill, Y.J. Ju., N. Kim, and J.H. Ham. 2021. Changes in the Microbial Community in Soybean Plots Treated with Biochar and Poultry Litter. *MDPI Agronomy*. 11:1428. <https://doi.org/10.3390/agronomy11071428>.

Jeong, C.Y., J. Hendrix, J. Copes, and L. Fultz. 2020. Impact of cover crop residue management on nitrous oxide emission in Louisiana. *Louisiana Agriculture*, Winter 2020, Vol. 63 (4), p 30 – 31.

Jeong, C.Y., K. Ro, H.H. Ku, M. Lee. 2021. Evaluation of pyrochar and hydrochar amendments on greenhouse gas emission and water quality in tomato cultivation. 2021 ASA-CSSA-SSSA International Annual Meetings, Nov. 7-10, Salt Lake City, UT (Conference Abstract).

Calderon, R., C.Y. Jeong, J.D. Shin, J.H. Ham. 2021. Development of soil amendments enriching the soil microbial community for sustainable soybean cultivation. 2021 ASA-CSSA-SSSA International Annual Meetings, Nov. 7-10, Salt Lake City, UT (Conference Abstract).

Jeong, C.Y., S. Jeon, M. Blazer. 2021. Developing an Arduino-Maple Mini-based datalogger to measure real-time CO₂ gas flux in soil systems. 2021 ASA-CSSA-SSSA International Annual Meetings, Nov. 7-10, Salt Lake City, UT (Conference Abstract).

Briefly describe how the broader public benefited from your project's activities.

The science based-knowledge on the dynamics of suspended solids, nitrogen, and phosphorus from the constructed wetlands and carbon and nitrogen cycles from the winter cover crop fields and poultry burial sites were delivered to audiences via the virtual local meetings and national/international conferences.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

The current research objectives were conducted by one post-doctoral research scientist, three undergraduate students, and two transients workers. The post-doctoral scientist was hired as a tenure track assistant professor at one of the national universities in Seoul, Korea, with two years of research experience from the Red River Research Station, LSU AgCenter.

The project goals for the next reporting period:

1. Examine the dynamics of carbon and nitrogen removal in a tailwater recovery system.
2. Examine nitrogen leaching and CO₂, CH₄, and N₂O gas emissions from cover crop fields.
3. Evaluate nitrogen leaching and CO₂, CH₄, and N₂O gas emissions under biochar and hydrochar amendment in tomato production.
4. Long-term simulation of the carbon and nitrogen dynamics from cover crop fields under different management systems.

Closing Out (end date 09/07/2023)

[The Biology and Control of Aquatic Animal Diseases](#)

Project Director

Ronald Thune

Organization

Louisiana State University and A&M College

Accession Number

1018515



In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Edwardsiella ictaluri is a Gram-negative bacterium that causes disease in channel catfish using a Type three secretion system to inject a variety of effector proteins into host cells that bind to various host cell target proteins and manipulate their activity to favor the progression of disease.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

FLAG tagged constructs of five leucine-rich repeat (LRR) effectors, as well as the non-LRR effectors EseI and EseO were PCR-amplified, cloned into the complementation vector pBBR1, and transferred to wild-type *E. ictaluri* by conjugation. Each tagged effector strain was confirmed to maintain virulence in an immersion challenge of 5-8-inch catfish fingerlings. Each individual FLAG tagged effector was then confirmed to be specifically recognized in a mix of all other effectors using Western blotting and immunofluorescence. Putative target proteins for each effector were identified by co-immunoprecipitation of a macrophage whole cell lysate, identification of isolated proteins by polyacrylamide-gel-electrophoresis, and mass spectrometry of the separated bands. Results of this analysis:

Effector Putative host-cell target protein(s)

EseG - Ras-associated and pleckstrin homology domains; Teashirt3; BK Channel

EseI - F-box; Calcium-transporting ATPase

EseO - Ras/Rap GTPase-activating protein

EseH - ATP synthase subunit alpha; ATP synthase subunit beta

EseJ - Heat shock protein 90

EseK - CD74

EseL - Collectin-12; Myocardin isoform X6; Tight junction protein ZO-2; Teashirt3

EseM - Collectin-12; Teashirt3; Trafficking protein subunit 9; inactive serine protease PAMR1

Briefly describe how your target audience benefited from your project's activities.

Understanding how *E. ictaluri* manipulates the catfish immune response and physiology will provide information that will allow manipulation of the bacterial activity and potentially prevent progression of the disease.

Briefly describe how the broader public benefited from your project's activities.

Ultimately, knowledge of what turned out to be a very complicated disease process will provide avenues for preventative or treatment procedures that will reduce the loss of catfish to this bacterial pathogen.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

The results presented above apply to joint funding of this project that provided Hatch funding for the work on EseL and EseM and a USDA Foundational Grant, No. 2019-67015-29839 provided funding to support the work on the other six effector proteins. This funding arrangement was approved by the National Program leader for Animal Health and Well Being at USDA-NIFA. This resulted from a reduction in the USDA funding request when the grant was awarded by the USDA. These results will be presented at the 9th International Symposium on Aquatic Animal Health on September 4-8, 2022.



An integrative framework for understanding social behavior and invasion biology of the Formosan subterranean termite

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

The Formosan subterranean termite is an economically devastating invasive pest, which poses challenges to control due to its complex social behavior and cryptic habitat. Integrated management of this termite relies on mechanistic understanding of its social behavior and invasive biology, which this project aims to address.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

During the reporting period, we have (1) characterized the morphology of the chemosensory structures in the Formosan subterranean termite, which provides baseline information for investigating the regulation of social behavior, (2) obtained preliminary data on the chemosensory gene profiles in different castes, and the results will facilitate mechanistic studies of important genes that govern termite social behavior, and (3) investigated an environmental factor (food availability) and a social factor (social proportion) for their effects on foraging behavior of termites.

Briefly describe how your target audience benefited from your project's activities.

The audience of this research includes both the scientific community and stakeholders, such as the Louisiana Department of Agriculture and Forestry (LDAF) and Louisiana Pest management Association (LPMA). The research results have been published both as scientific articles and magazine articles. The findings are presented at the 2021 Annual Meeting of the Entomological Society of America, which attracts audience primarily from academia. They have been also presented at the LSU/LPMA pest control winter institute, with audience primarily from the industry and regulatory agency.

Briefly describe how the broader public benefited from your project's activities.

To promote public awareness of the invasive Formosan subterranean termite, findings from this project have been disseminated as an article on Louisiana Agriculture Magazine, which is publicly accessible. In addition, the research results have been published in an open access journal *Insects*.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

As noted in the last report (2020), one major change involves the focus of behavioral study in Objective 3, which has been directed to foraging instead of aggression proposed previously. This change has been made because foraging is a fundamental behavior for colony survival, which has broader implications for pest management. We have developed several protocols to examine the social regulation and molecular mechanisms of foraging activities in the Formosan subterranean termite, and will report the process and results in the subsequent reporting periods.

BACTERIOPHAGES FOR TERMITE CONTROL AND BIODIVERSITY OF INVERTEBRATES AS BIOINDICATORS OF MARSH HEALTH

**In 2-3 sentences, briefly describe the issue or problem that your project addresses.**

The Formosan subterranean termite, *Coptotermes formosanus* is one of the most devastating urban pests in the U.S. Both *C. formosanus* and, its close relative *C. gestroi*, are invasive species originating from China. Colonies of wood feeding subterranean termites depend on symbionts (protozoa, bacteria and archaea) in the guts of their workers. Several bacteria are known to be ecto- and endosymbionts of the protozoa. Although there have been several studies to decipher the taxonomic and functional diversity of bacterial communities in the guts of termites, their bacteriophages remain unstudied. With its high bacteria diversity we expect the subterranean termite gut to be a hotspot for bacteriophages, i.e. viruses that infect bacteria. As the first step towards developing successful phage therapy for termite control (eg. killing the vital endosymbiotic bacteria of the cellulose-digesting protozoa via phages) we needed to gather information about the biodiversity of phages and the existence of a core community of bacteriophages. The metavirome study showed the presence of a diverse phage population in the termite gut. Diversity and distribution of virus-related sequences suggests the presence of a colony specific as well as a core virome in the termite gut. We intend to develop termites as a model system to study the four-fold relationship of phages, bacteria, protozoa and host.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Subterranean termites depend nutritionally on their gut microbiota, which includes protozoa as well as taxonomically and functionally diverse bacteria. Our previous metavirome study revealed a high diversity and novel families of bacteriophages in the guts of *Coptotermes formosanus* workers from New Orleans, Louisiana, USA. Two assembled bacteriophage genomes (Phages 04 and 06, family Podoviridae) existed in all colonies and showed similarity to a prophage (ProJPt-Bp1) previously sequenced from a bacterial endosymbiont (*Candidatus Azobacteroides pseudotrichonymphae*, CAP) of protozoa in the gut of a termite species of the genus *Prorhinotermes* from Taiwan. In this study the genomes of Phage 04 and 06 were subjected to detailed functional annotation. Both phage genomes contained conserved genes for DNA packaging, head and tail morphogenesis, and phage replication. Approximately 30% of the amino acid sequences derived from genes in both genomes matched to those of ProJPt-Bp1 phage or other phages from the crAss-like phage group. No integrase was identified; the lack of a lysogeny module is a characteristic of crAss-like phages. Primers were designed to sequence conserved genes of the two phages and their putative host bacterium (CAP) to detect their presence in different termite species from native and introduced distribution ranges. Related strains of the host bacterium were found across different termite genera and geographic regions. Different termite species had separate CAP strains, but intraspecific geographical variation was low. These results together with the fact that CAP is an important intracellular symbiont of obligate cellulose-digesting protozoa, suggests that CAP is a core gut bacterium and co-evolved across several subterranean termite species. Variants of both crAss-like phages were detected in different *Coptotermes* species from the native and introduced range, but they did not differentiate by species or geographic region.

Briefly describe how your target audience benefited from your project's activities.

Since similar phages were detected in different termite species, we propose the existence of a core virome associated with core bacterial endosymbionts of protozoa in the guts of subterranean termites. This work provides a strong basis for further study of the relationship of termites, protozoa, bacteria, and bacteriophages and how disruptions of this balance would lead to termite control.

Results were communicated to scientists and stakeholders, which include industries developing pest management strategies, via publications and presentations at professional and other clientele targeted conferences.

Briefly describe how the broader public benefited from your project's activities.

Biological (chemical-free) termite control by disrupting the termite colonies' ability to digest wood might offer homeowners more choices for environmentally friendly pest management.

Research results were communicated to the broader public via Extension publications (e.g., Louisiana Agriculture Magazine), mass media, podcasts, outreach websites and social media.



In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Under the Louisiana Coastal Master Plan, freshwater diversions have been planned for certain sites in South Louisiana in order to restore sediment input to rebuild marsh habitats, which are currently under threat. These proposed diversions will undoubtedly have additional effects beyond the intended sediment input, one of which will be salinity regime change.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Salinity is a major controlling factor in the distribution of marsh organisms, including meiofauna (organisms between <500 μm and >45 μm). Pre-diversion distributions of marsh soil meiofauna from three salinity zones in tidal marshes of Barataria Bay in Plaquemines Parish and Caillou Bay in Terrebonne Parish (Low [\sim 3 ppt], Mid [\sim 8 ppt], and High [\sim 16 ppt], according to a 4-year average) were examined using 18S rRNA gene metabarcoding with Illumina next-generation sequencing. Prior to DNA extraction and sequencing, seventy-two marsh soil samples were sieved to only include meiofauna, and then the organic portion of that matter was separated using Ludox. Groups of samples from the different salinity zones were distinct based on the differentiation of their metazoan meiofauna composition (Adonis test) with samples from the Mid zone falling in between the High and Low zone (NMDS ordination). A large group of meiofauna Operational Taxonomic Units (OTUs) were present across all zones, but distinct groups of meiofauna OTUs were detected from each salinity zone. The group of OTUs that were detected in all zones most likely represents species that are tolerant to a wide range of salinities. Several commonly detected collembola OTUs were unique to the Low salinity zone, while kinorhynch OTUs were commonly detected only in the Mid and High salinity zones. Several major groups of commonly detected OTUs, including annelids, nematodes, and platyhelminthes, had representatives present in all salinity zones, but the specific OTUs were different in the Low zone compared to the Mid and High salinity zone. It is likely that, when the freshwater diversions are completed, the species unique to higher salinity zone will be outcompeted by the Low salinity zone species, causing species turnover and range expansion/contraction, while the species present in all zones will be largely unaffected.

Briefly describe how your target audience benefited from your project's activities.

Tidally influenced coastal marshes provide numerous important ecosystem services, but these habitats are experiencing extreme habitat loss. Louisiana's coastal marshes in particular are vulnerable to land loss resulting from both anthropogenic and natural causes, but especially to subsidence and relative sea-level rise. In response, the Louisiana Coastal Restoration and Protection Authority has outlined and is currently implementing the largest ever attempt at habitat restoration. A major component of this habitat restoration attempt is the use of freshwater and sediment diversions to increase the input of low salinity water, sediment, and nutrients needed to slow marsh loss and build land. Coastal marsh plant communities are primarily stratified by salinity and their distributions and salt tolerances are relatively well understood. However, the insect communities that are associated with these plant communities are not well known. Few inventories of Louisiana's coastal insects have been made, and those that exist did not adequately sample the breadth of the tidally influenced marsh vegetation types. We conducted the first insect and sediment meiofauna inventory across salinity zones in the marsh as baseline to monitor future changes in response to coastal restoration and environmental stresses.

Briefly describe how the broader public benefited from your project's activities.

This research guides assessment of damage, recovery and restoration of salt marshes.

Enhancing sustainability of beef cattle systems in the US southeast region

Project Director

Organization

Louisiana State University and A&M College

Accession Number

1021351



In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Different cultivars have different characteristics including, forage mass production and nutritive value. Differences in annual cultivars may affect the stocker performance (average daily gains). Identifying the most adapted, reliable, and productive cultivar would ensure greater profitability for stocker operations.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Weaned crossbred and Brangus steers (10-12 months of age; 575 pounds of BW) grazed 3 replicates of 4 annual ryegrass cultivars: Nelson, Marshall, Prine, and Jumbo. Cattle grazed from early January to early April. Similar gains were observed for steers grazing all cultivars. Forage mass was impacted negatively due to lack of control of excessive forage mass of bermudagrass at the time of planting the annual ryegrass.

Briefly describe how your target audience benefited from your project's activities.

Understanding differences between cultivars is essential for producers to make the correct decision at the time of planning their grazing season. The consideration of management of summer stands and the appropriate planting time are two benefits that were presented by the present project.

Briefly describe how the broader public benefited from your project's activities.

Efficient use of resources will make of the cattle enterprise a more solid industry through enhancing its productive and economic sustainability.



Evaluation of source of ionophores on heifer development

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Ionophores may increase the average daily gains of replacement heifers grazing high nutritive value forages (i.e. annual ryegrass). This experiment evaluate the use of monensin and lasalocid sodium as part of a loose mix or in blocks on replacement heifers grazing 'Nelson' annual ryegrass. Impact of the ionophores is also evaluated at the time of breeding (artificial insemination, then bulls).

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Ionophores modify ruminal microbial fermentation and activity allowing the animal to utilize dietary energy and protein more efficiently. They are a tool available to beef cattle producers to increase the efficiency of use of resources. Increasing the performance (average daily gains) of replacement heifers may increase the percent of them cycling at the beginning of the breeding season, thus increasing the number of heifers with early pregnancies. This in turn, will let them calve early and increase the time to recover for the next breeding season as first calf heifer.

Briefly describe how your target audience benefited from your project's activities.

Data show to be useful for cow-calf producers trying to better manage their resources and improve the profitability of their ranches.

Briefly describe how the broader public benefited from your project's activities.

A more efficient beef production production system will make the beef cattle industry a more reliable industry producing a better end-product at a lower cost possible.



Fetal Programming

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Appropriate nutrition in different stages of pregnancy may affect the performance of off-spring, as well as the final product produced. Changes in blood metabolites, hormones, colostrum quality, and calf performance by affecting maternal nutrition through supplementation on the second and third stage of pregnancy,

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Nutrition is the main issue affecting cow's performance (body condition score, fertility, milk production, etc.). Through supplementation of the basal diet during different stages of pregnancy, nutrients (protein and energy) are not limiting for the correct development of the off-spring. It will also positively impact body condition score and milk production of the dam which should impact calf development. All these factors are in line with the improvement of the cow-calf production systems in the Southeast.

Briefly describe how your target audience benefited from your project's activities.

Understanding the positive impact of nutrition on the dam and calf's health was a major issue for beef cattle producers.

Briefly describe how the broader public benefited from your project's activities.

Better animal performance and sustainable systems will ensure a more resilient beef cattle industry.



Mitigation of heat stress

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Impact of heat stress is a major negative factor in the beef cattle industry. Despite the fact of having the possibility of using thermotolerant beef cattle breeds there is still a negative impact on the reproduction physiology through effects on nutrition.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Results of this objective may give answers to negative production statistics in the beef cattle herd due to excess heat and humidity.

Briefly describe how your target audience benefited from your project's activities.

Should give answers to reductions in animal performance and fertility observed during the summer months.

Briefly describe how the broader public benefited from your project's activities.

This project should improve animal welfare, which is a major concern for the general public.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

It was not possible to develop this objective due to lack of appropriate facility.

[Change Strategies to Mitigate Health Disparities](#)

Project Director

Bailey Houghtaling

Organization

Louisiana State University and A&M College

Accession Number

1024670



Hatch Project Report

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

This project focuses on key settings and populations experiencing health disparities to inform contextually-appropriate policy, systems, and environmental (PSE) changes for healthy eating and active living that have the capacity for adoption, implementation, and sustainability in hard-to-reach, vulnerable settings in the US. Given many dietary and physical activity inequities stem from the built environment, this approach informs opportunities for public health impact through up-stream changes.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

In 2021, the major project activities allowed for the collection of data about upstream or policy, systems, and environmental factors that pose a barrier to healthy eating and active living. This data was collected and interpreted using a research-to-practice partnership approach, so actionable changes could be used by Louisiana Cooperative Extension Services to inform program development, implementation, and sustainability.

Briefly describe how your target audience benefited from your project's activities.

Key research outcomes informed Louisiana Cooperative Extension Services policy, systems, and environmental change programming for healthy eating at store settings and also helped to identify structural barriers among populations experiencing health disparities in the U.S. to inform meaningful intervention points.

Briefly describe how the broader public benefited from your project's activities.

Key research outcomes added novel findings to the broader scientific community/discourse that can be used to advance regional and federal nutrition and physical activity policy, systems, and environmental change strategies to reduce health inequities.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

The ongoing COVID-19 pandemic prevented the collection of data at times; although, project goals were shifted slightly to meet project aims using virtual and remote data collection opportunities.

Related publications for reporting year 2021 are listed:

Houghtaling B, Cater M, Bryant D, Brooks A, Holston D. What is the availability, affordability, and quality of foods and beverages aligned with dietary guidance in Louisiana Supplemental Nutrition Assistance Program (SNAP) authorized stores? *Preventative Medicine Reports*; 2021;24:101578. doi: <https://doi.org/10.1016/j.pmedr.2021.101578>.

Houghtaling B, Holston D, Szocs C, Penn J, Qi D, Hedrick V. A rapid review of stocking and marketing practices used to sell sugar-sweetened beverages in United States food stores. *Obesity Reviews*. 2021;22(4):e13179. doi: <https://doi.org/10.1111/obr.13179>.

Project Director

Fatemeh Malekian

Organization

Southern University and A&M College

Accession Number

1021122



Combating Obesity and Related Diseases through Innovative Food, Nutrition and Wellness Programs

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

A scientific consensus on the relationship between diet and obesity related diseases such as diabetes, heart disease, stroke, and some forms of cancers have been documented. In the United States, Louisiana is one of the most obese states in the nation. Food insecurity in the United States especially in Louisiana and Mississippi could have been a contributing factor to these States being number 50 and 49, respectively in the health ranking. Food deserts may not directly cause food insecurity, but they do provide good indicators of areas where food insecurity is more likely to take place. The areas around Southern University campus lack access to healthy food because these areas are considered as low-food access. The majority of the population in these communities are African American children and elderly.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

The proposed project is focused on development of healthy food products utilizing agricultural commodities such as whey protein, resistant starch, sweet potatoes, hibiscus etc. in the areas that have been identified as a food desert.

Major activities to accomplish our goals and objectives were to: 1.) conduct nutrition education intervention to increase in knowledge and adoption of healthy eating patterns as recommended by the US Dietary Guidelines for Americans 2020, 2.) Increase the connection among Southern University personnel, students, community members and farmers by having a number of meetings, 3.) Establish a Community Food Access and Health Advisory Committee (CFAHAC) to be more effective in implementing the objectives of the project, 4.) Bring more fruits and vegetables through development of new healthy food products, a farmer's market or a community garden etc., 5.) Work closely with community members and apply them as change agents to educate others about healthy life style, and 6.) Reduce food insecurity and health related issues by bringing all the entities together. The identification of food insecure populations and enhancing access to healthy foods by having sustainable access to fresh produce is the primary goal of this project.

Briefly describe how your target audience benefited from your project's activities.

The SUAREC goal is to enhance a research, teaching and extension infrastructure where innovative research on human health related to food and nutrition can be conducted not only for the wellbeing of citizens of Louisiana, but for the region, nation and world. Therefore, the goal of this project which has been to develop healthy foods using whey protein/resistant starch and other agricultural products such as sweet potatoes, after assessing the nutritional needs of the communities surrounding Southern University campus. The anticipated outcome/impact of this project are as follows: community needs are identified, new food products are developed based on the community member's needs, community leaders are being identified, establishing the CFAHAC is moving forward slowly, Southern University's students, faculty and staff have been involved with community members and the health and wellbeing improvement of these venerable neighborhoods. The participants have learned and changed behaviors that will lead to reduced visits to the physicians and less prescription drugs.

Briefly describe how the broader public benefited from your project's activities.

The new products will be introduced to the market and branded as such that can provide revenue for SUAREC over time. Also educational materials such as brochures, handouts, fact sheets, etc. have been developed. Extension professionals and paraprofessionals in different parishes throughout the state have been using these educational materials to educate their clientele about the health benefits of new healthy food products through field days, workshops and other events. As a result, the broader population will benefit from the results of this project and consequently, there will be a reduction in medical cost related to food insecurity and related diseases. With the implementation of this project participants have learned, changed behaviors, and experienced less health issues. Hopefully, they will reduce visits to the physicians, take less prescription drugs, which can reduce health care costs and reduce government and tax payers' burden.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

COVID-19 pandemic, moving laboratory from one location to another location in SU campus and the research associate retiring have created challenges beyond our control. It was anticipated to collect survey samples in different events such as health days, field days etc. but because of the pandemic and mandatory staying home condition, the collection of surveys did not happen. The surveys have been converted to an on-line format and we are in the process of collecting them but unfortunately the majority of the participants that we want to reach do not have access to computer.

Investigating the Effect of Retirement Financial Planning on Changes in Nutrient Intake: A Quest for Enhancing Louisiana Young Seniors' Wellness

Project Director

ONYUMBE LUKONGO

Organization

Southern University and A&M College

Accession Number

1021333



Investigating the Effect of Retirement Financial Planning on Changes in Nutrient Intake: A Quest for Enhancing Louisiana Young Seniors' Wellness

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

The project addresses the decrease in nutrient intake during retirement among young seniors. This is due to inadequate savings for retirement, poor dietary choices, lack of physical activity, limited accessibility to healthy food, and financial illiteracy. The proportion of young seniors is increasing at a higher rate [16 % now and 22% of the total population by 2048 based on U.S. Census estimates] as many baby boomers are retiring and are becoming more diverse. .

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

The project implements one of the central pieces of the 2018-2022 USDA Strategic Plan, namely, strategic goal seven, that is, *Provide All Americans Access to a Safe, Nutritious, and Secure Food Supply*. It leverages the National Institute of Food and Agriculture (NIFA, thereafter) programs in the Economics and Community Development National Emphasis Area, which promote increased prosperity and economic security for individuals and families, farmers and ranchers, entrepreneurs, and consumers. This project nurtures the 2018-2022 USDA's objective 7.3, "Support and Encourage Healthy Dietary Choices Through Data-Driven, Flexible, Customer-Focused Approaches". Science has established clear linkages between proper diet, adequate physical activity, children's ability to learn, and good health. Overwhelming evidence from existing academic literature and administrative reports indicates devastating health conditions emanating from lack of physical activity, poor dietary choices, limited availability and limited accessibility. This dire situation is spread across the United States but with differing intensity. Furthermore, the 2016 U.S. Federal Reserve Board's Survey of Consumer Finances reports a huge gap of 57 percent in financial literacy and in the understanding of basic principles of economics needed to operate in this advanced economy. Enlightened by issues faced by most of Americans including young seniors, the project harmoniously combines the field of Nutrition and Economics to investigate one of the core challenges--nutrition-economics nexus. The project pursues six objectives: (1) to conduct surveys and focus group discussions to measure financial literacy gaps among young seniors; (2) to conduct surveys and focus group discussions to identify deficiencies in nutrient intake using food diary; (3) to organize forums to present survey results and receive feedback from relevant stakeholders; (4) to provide nutrition education and financial literacy education; (5) to conduct surveys to identify deficiencies in nutrient intake using food diary and financial literacy post nutrition and financial education, and (6) to assess further research needs in nutrition and economics in collaboration with relevant stakeholders in rural and urban settings. The research team carefully selected to deliver this project has the required experiences to successfully complete this project to boost healthy eating and living and to nurture sound financial planning among young seniors and the Citizenry of Louisiana.

Briefly describe how your target audience benefited from your project's activities.

The activities of this project will boost healthy eating following the concept of MyPlate, improve physical activity, and nurture sound financial planning among young seniors and the citizenry of Louisiana.

Briefly describe how the broader public benefited from your project's activities.

Lessons learned from this project will be disseminated to the general public using the network of extension agents and the diverse media outlets embedded in social media platforms. As part of the university-community engagement for a better and more rewarding life, individuals, the research team, nutrition specialists, healthcare professionals, community leaders, and other relevant stakeholders will participate in the discussion and analyses of results from this proposed project. The method selected for this project is a model of co-learning, policy change, and advocacy, which is considered to be central to a community-based participatory (CBPR) approach (Israel et al., 1998). It is informed by the local knowledge embedded in young seniors, community leaders, which facilitates capacity building as a mechanism that nurtures the reciprocal transfer of knowledge and skills formation as well as empowerment of individuals in nutrition and financial literacy.

[Effects of dietary resistant starch on serum levels of trimethylamine-oxide and gut health of robust or low fermenting rat models consuming a high fat diet](#)

Project Director

Michael Keenan

Organization

Louisiana State University and A&M College

Accession Number

1018927



Effects of dietary resistant starch on serum levels of trimethylamine-oxide and gut health of robust or low fermenting rat models consuming a high fat diet

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

A human study was published in 2017, which indicated that including a resistant starch type 2 (RS) in a high fat diet resulted in increased amounts of serum trimethylamine N-oxide (TMAO). Increased amounts of serum TMAO are associated with increased cardiovascular disease. The implication is that greater amounts of fermentation of RS and other fermentable fibers in the GI tract increase bacteria that produce trimethylamine (TMA) that is absorbed and converted to TMAO in the liver of the host organism.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Our lab has conducted two studies with male Sprague Dawley rats. The first study using Envigo Company rats demonstrated that consumption of resistant starch type 2 (RS) in either a high fat or a moderate fat diet resulted in significantly greater amounts of serum trimethylamine N-oxide (TMAO) compared to controls. However, there was no effect of high fat; and there was a high amount of variation and no correlation with fermentation of RS. This study was published as an abstract, and it will soon be submitted as a manuscript to a refereed journal. A second study using Charles River rats with RS only in a moderate fat diet resulted in higher serum TMAO for both control and RS groups but again with a high amount of variation. Our lab does not know if this reflects an error at some point with sample identity with shipping to The Cleveland Clinic or if both studies indicate a high variation in the rats' ability to produce trimethylamine (TMA) in their GI tract that is then converted to TMAO in the host liver.

Briefly describe how your target audience benefited from your project's activities.

Our abstract for the study with Envigo male Sprague Dawley rats was published in 2020 in *Current Developments in Nutrition* journal that is accessible to members of the American Societies of Nutrition immediately after publication and other scientists after an embargo period.

Briefly describe how the broader public benefited from your project's activities.

It appears that fermentation of resistant starch type 2 does not promote high serum trimethylamine N-oxide (TMAO). Some other factor(s) appear to be the cause of the increased serum TMAO other than fermentation in the GI tract. Consumption of fermentable fiber is associated with greater health of the GI tract. However, our lab needs to do further research to determine why we have observed high variation in male Sprague Dawley rats from two different companies.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Our lab expected more straightforward results than we observed. We have submitted grant proposals to a competitive USDA-NIFA nutrition and health program but were not funded. The plan is to resubmit for September 2022 to gain a larger source of funding to be able to determine the reason for the high variation in serum trimethylamine N-oxide we have observed in male Sprague Dawley rats from two different companies. Several scientists have been involved in conducting the two studies, and this included two graduate students. We have published an abstract with results from our first study and are in the process of writing a manuscript for submission to a refereed journal.

Fit Issues in Ready-to-Wear Clothing: The Influence of Obesity Indices Combined with Body Shapes on Clothing Benefits Sought

Project Director

Jung-Im Seo

Organization

Southern University and A&M College

Accession Number

1016007



Fit Issues in Ready-to-Wear Clothing: The Influence of Obesity Indices Combined with Body Shapes on Clothing Benefits Sought

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

When consumers make clothing purchase decisions, they always face problems such as garment fit issues in ready-to wear (RTW) clothing unless they are willing to get custom made clothing at extra expense and time. In order to solve clothing fit issues in RTW clothing, we need to study several critical factors which have great influences on clothing fit and furthermore, mutual relationship of those factors. This research proposal uses the 3D body scanner to identify the body mass location within body volume index (BVI).

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

The PD is recruiting the baby boomer, generation X and Y to collect the actual body measurement and the survey data in Baton Rouge, LA with 3D body scanner, digital scale, and questionnaire. The part of collecting data has been analyzed and presented and is being reviewed for publication as follows:

The PD presented the research results at the *2021 American Collegiate Retailing Association (ACRA)/ American Marketing Association (AMA) Virtual Triennial Conference* (March 25 & 26, 2021). The title of the presentation was "Psychological Impact of Body Shape on Ready-to- Wear Clothing Fit Preference." The PD has submitted a research manuscript to the peer-reviewed journal, *Fashion Practice*, and this manuscript is being revised for publication. The title of research manuscript is "The Influence of Body Mass Index on Ready-To-Wear Clothing Preferences of Young African-American Female Consumers."

The PD is preparing another manuscript to be submitted to the *Fashion and Textiles*, which is the peer-reviewed journal. The tentative title of this manuscript is "Ready-to-wear (RTW) clothing Satisfaction based on Body Image (Body Shapes)."

The PD's Evans Allen grant has conducted research on fit issues in Ready-to-Wear (RTW) clothing. Her research on this topic suggests that obesity control programs could provide more satisfaction with clothing fit in RTW. As one of the promising obesity control programs, we can begin with how and where the fresh and healthy grocery food items can be purchased. For this reason, the PD is developing the research on RTW clothing fit issues to study online grocery shopping behavior with her

undergraduate student. As a part of efforts, their research was presented at the *79th Annual Professional Agricultural Workers Conference (PAWC)* on December 5-7, 2021 and won 2nd place with the prize money (\$200.00) in the undergraduate students' oral competition. The topic was "Online Grocery Shopping Behaviors of Different Generations."

Briefly describe how your target audience benefited from your project's activities.

This project allows a great opportunity to provide consumer, producer, or sellers with information of apparel consuming behaviors related to Clothing Benefits Sought classified by each generation's body shapes and obesity indices (body mass index (BMI), body shape index (BSI), and body volume index (BVI)).

Briefly describe how the broader public benefited from your project's activities.

These results of this project could make it possible for apparel companies and manufacturers to produce and meet demands for satisfaction clothes for the target audiences. The results of this project may be used as a step to develop an expert system to correlate body measurement and fit problems for each generation.

Fashion designers will pay attention to target consumers' body shapes and ready-to-wear (RTW) clothing fit preferences when they design the clothing. Fashion marketers can create different shopping applications for their potential customers to search for clothing items.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Due to the pandemic, the completion of collecting data for this research project is delayed. Some target audiences skipped their visits to the Department of Family Consumer Sciences for the measurement of their body scan.

Critical Issue

Youth Development

Closing Out (end date 09/07/2023)

[An Evaluation of the Effectiveness of Research-Based Curriculum Teaching Methods in Early Childhood Environments](#)

Project Director

Kenyetta Nelson-Smith

Organization

Southern University and A&M College

Accession Number

1015884



"An Evaluation of the Effectiveness of Research-Based Curriculum Teaching Methods in Early Childhood Environments"

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

University laboratories tend to have higher tuition and fees than traditional and nontraditional child care centers. The expectations are that those children who are in university laboratories will participate in research-based curriculum which will better prepare them for further educational attainment. This research will determine the effectiveness of research-based curriculum as administered at university child care laboratories and findings can be used to implement child care policy as it relates to academic decisions and early learners, child care providers, and future research.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Southern University Child Development Lab was open, we hired a director and full staff, and had over 20 students enrolled prior to the pandemic. The research-based curriculum was purchased and all staff trained on implementation and assessment. The control-groups were selected and versed on the purpose of the research. The lab opened right before the COVID-19 pandemic, after over a year of being closed, the SU CHDV Lab is now re-open and at maximum capacity. With the delay, we lost all students eligible to participate in this study, thus the study had to be revamped to retest all age appropriate students newly enrolled. Also, selected child care centers who originally agreed to participate were still not willing to participate under their COVID guidelines. Thus, the researchers had to work diligently to locate other willing child care centers. Significant progress has moved the grant forward and moving towards final data collection and analysis.

Briefly describe how your target audience benefited from your project's activities.

The target audience are students and families enrolled in a variety of child care learning centers. This includes the SU CHDV Lab and center's surrounding this community. The age of participants targeted are ages 3-4 years of age. Though they may enter the lab/centers at younger ages, they cannot complete the curriculum and assessments until they have reached a higher-level cognitive ability to which they can be assessed.

Briefly describe how the broader public benefited from your project's activities.

Now that the project is moving forward, more community families have grown to learn and understand the vital importance of childcare laboratories. University officials, SU Board of Supervisors members, and faculty/staff parents (and non-parents) have also learned about the purpose and existence of the laboratory. The SU CHDV Lab has built multiple partnerships and collaborations across the Southern University Baton Rouge campus. Child Development students have gained an interest in research and furthering their education in graduate studies through assisting with the objectives of this grant.

Type

Projects/ Programs

Projects / Programs without a Critical Issue

14

[Conversion of Sugar Crops and By-Products to Chemicals with Applications in the Sugar, Food, Pharmaceutical, and Nutraceutical Industries.](#)

Project Director

Giovanna Aita

Organization

Louisiana State University and A&M College

Accession Number

1019950



Conversion of Sugar Crops and By-Products to Chemicals with Applications in the Sugar, Food, Pharmaceutical, and Nutraceutical Industries

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

The cane sugar industry can be subjected to abrupt changes in sugar prices which are mostly driven by surpluses in global production. Sugarcane factories are aware of these changes and the possible ramifications and are working towards diversifying their product portfolio beyond their traditional options of sugar, ethanol, electricity, and biomass (briquettes, pellets) from their various processing streams and by-products (e.g., blackstrap molasses, bagasse). This project addresses the use of renewable resources (e.g., lignocellulosic biomass, woody biomass, agricultural residues/byproducts) for the production of green fuels and chemicals with potential use in the sugar, nutraceutical, food, pharmaceutical, and textile industries.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Co-Products

Lignocellulosic Biomass as a Source of Protein and Fatty Acids: Global food demand continues to rise with major shifts most likely to happen in diets favoring protein and lipid-rich foods. Therefore, there is an urgent need to replace conventional animal feed ingredients (e.g., fishmeal, cornmeal, soybean meal) with ones that are both sustainable and economically

beneficial. Such nutritional alternatives can be provided by black soldier fly (*Hermetia illucens*) larvae which are capable of converting many organic waste materials into proteins and lipids. The present work explored, the possibility of using blackstrap molasses and bagasse as diet ingredients for BSF larvae with and without the addition of cricket feed (a cornmeal and soybean meal-based, high-protein-based reference substrate). Our findings indicate that sugarcane processing by-products (blackstrap molasses and bagasse) could serve as added nutritional ingredients in the formulation of BSF larvae diets to deliver a nutritious (e.g. protein, lipids) insect value meal with potential for being incorporated in animal feeds. Biomass weight, protein and fat contents of BSF prepupae appear to be dependent on the rearing substrate and the diet's protein to carbohydrate ratio. The high crude fat content seen in prepupae reared on blackstrap molasses (only) could find additional use as a source for bio-oil and biodiesel. The findings from this study could be the basis for future studies dealing with the combined effect of sugarcane by-products (e.g., molasses, bagasse, vinese) and organic wastes (e.g., vegetable waste, fruit waste) as mixed diets on the nutritional composition of BSF prepupae meal, and the incorporation of BSF meal in pet food, livestock and aquaculture feed formulations.

Prebiotics from Lignocellulosic Material: Xylooligosaccharides (XOS) is a group of emerging prebiotics that selectively stimulate the growth of advantageous gastrointestinal bacteria benefitting the host's gut health and functionality. XOS can achieve positive biological effects at low daily doses and low caloric content, properties that are the same or more desirable than the already established prebiotics. XOS are present in plants in very low amounts so there is a great opportunity to isolate XOS with varying degrees of polymerization from the hemicellulose (xylan) fraction of lignocellulosic materials (e.g., bagasse), a source that offers both economic and environmental advantages. In this study, XOS were successfully recovered by the combined use of activated carbon adsorption, water washing and ethanol desorption from diluted acid pretreated energy cane bagasse hydrolysates. XOS from bagasse crude sample exhibited prebiotic properties by stimulating the growth of *B. adolescentis* ATCC 15703 and by producing lactic acid. These results were comparable to those observed with commercial prebiotics from corn cobs.

Production of the Antimicrobial Lactosporin from Sugarcane Molasses: Antimicrobial proteins that are naturally produced by bacteria are currently receiving well-deserved attention due to the rapidly-growing microbial resistance to conventional antibiotics, and the health problems associated with the use of chemical antimicrobials in foods and personal care products. Production of antimicrobial substances by several spore-forming species within the *Bacillus* genus has been recently reported. A very promising antimicrobial is lactosporin which is produced by *Bacillus coagulans*. *B. coagulans* spores can also serve as a probiotic dietary supplement with added health benefits that involve improving the immune system, prevention of respiratory infections and intestinal ailments. This study was successful in optimizing the growth conditions of *B. coagulans* and increase lactosporin (antimicrobial protein) production by using final molasses as the main source of carbohydrates and minerals during fermentation. Results have shown that the production of this antimicrobial (protein) at optimum conditions also depends on the length of the fermentation. This protein has been successfully recovered from the fermentation broth having a molecular weight of 27KDa. The antimicrobial protein has been tested against the pathogen *Listeria monocytogenes* resulting in up to 2 mm inhibition zones as determined by antimicrobial susceptibility disc and well diffusion methods.

Identification of Fructan-Producing Organisms from Cane Juice: Sucrose deterioration can be attributed to physical, chemical, enzymatic, and microbial deterioration. During microbial deterioration of sugarcane, a variety of extracellular polysaccharides (EPS, e.g., dextran, fructan) and other impurities (e.g., organic acids, sugar alcohols, alcohols) are produced. The microbial-derived EPS dextran (a polymer of glucose) has generally been considered the main problem in sugarcane processing, with its main production source being attributed to the bacterium *Leuconostoc mesenteroides*. Technical problems associated with the presence of dextran at the sugar factory can affect every step of sugar processing (e.g., clarification, evaporation, crystallization) resulting in high viscosities, reduced efficiencies, elongation of sugar crystals, and the loss of sucrose to molasses. In recent years, fructan (a polymer of fructose) concentrations have been increasingly reported in both cane juice and molasses at Louisiana sugar factories. With the limited information that exists on the microbial origin of fructan at the sugar factories and its possible impact on Louisiana sugarcane processing, this research study aimed at identifying the microbial populations present in high numbers in the crusher juice, and determining the effect of cultivation conditions on their ability to produce EPS (dextran and/or fructan). This study indicated that *Lactobacillus*, *Lactococcus*, *Leuconostoc*, *Pantoea*, *Pseudomonas*, and *Saccharomyces* were the microbial genera present in high cell numbers in Louisiana's crusher juice and that all isolates were capable of producing dextran and/or fructan. *Leuconostoc* had the most diverse number of species, and were identified as *Leuconostoc mesenteroides*, *Leuconostoc citreum*, *Leuconostoc pseudomesenteroides*, and *Leuconostoc suionicum*. A single isolate of *L. suionicum* A14 was identified and produced only fructan from sucrose. This is the first study to report on a fructan-only producing *Leuconostoc* isolate from sugarcane. EPS production was affected by temperature, sucrose concentrations, and medium pH.

Antimicrobial, Antioxidant Properties of Agricultural Residual Extracts and the Synthesis of Metal Nanoparticles: Recent studies have revealed that wood residuals are present in large quantities, and are an abundant and currently underutilized natural resource. These residuals possess important properties for new applications, which are related to the presence of natural phytochemicals or bioactive compounds. These bioactive compounds include terpenes, tannins, glycosides, lignans,

flavonoids, alkaloids (to name a few), and are known to have antimicrobial, antioxidant, anticancer, anti-inflammatory properties. This important and green source of bioactive molecules can be used in the formulation of bio-sourced products. Green nanotechnology is a field in which these bioactive compounds can be of great use, particularly in the synthesis of metal nanoparticles. Metal nanoparticles have gathered attention because of their novel physico-chemical properties and potential biological applications (e.g., biocides, fungicides, pesticides, targeted drug and gene delivery, biosensing, dietary supplements, medical implants, plant biostimulants). Among metal nanoparticles, gold, silver, iron, and copper nanoparticles are of particular interest as they can be easy to operate and are cost effective, biocompatible, and their stability can be enhanced by surface modifications. In this study, extracts from sawdust and chips from four softwood materials showed antioxidant activities (ORAC, DPPH methods) and antimicrobial activities against a wide range of microorganisms (bacteria, fungi). To further enhance these biological activities, silver nanoparticles were synthesized. Optimization for the high yield synthesis of stable silver nanoparticles has been conducted where various parameters (pH, salt concentration, temperature, reaction time, extract concentration) were evaluated.

Briefly describe how your target audience benefited from your project's activities.

Target audiences for the results of this project included personnel in the biofuels, bioenergy and biochemicals industries as well as the sugar industry sector interested in expanding their products beyond sugar and molasses. Other target audiences included researchers in the fields of food science, biotechnology, biochemistry, engineering, and medicine, and the domestic sugar industry to include managers of all sugar factories in Florida, Louisiana, and Texas, and the commodity groups in these states. The above mentioned target audiences benefited from my project efforts by sharing research findings (presentations, peer-reviewed publications, short-courses, meetings), by training students, visiting scholars, industry personnel; and by mentoring students (high school, undergraduate, graduate) expand their knowledge and be the next leaders in the bioeconomy.

Briefly describe how the broader public benefited from your project's activities.

This project focuses on the bioconversion of renewable biomass to bioproducts which has wide applications in the sugar, food, nutraceutical, and pharmaceutical industries. This work provides the above mentioned industries with technologies on how to expand their current product portfolio by utilizing/reducing their agricultural waste/byproducts and by generating "green" products that help increase their profits and safe the environment. All research findings have been published and can be accessed by the public, academic and industry sectors.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

No major changes or problems were encountered during the reporting period.

Training/Professional Development Provided: Mentored high school, undergraduate, and graduate students with their science projects. Served as judge in numerous scientific events (Louisiana Junior Science and Humanities Symposium, Louisiana Science and Engineering Fairs, Junior Science and Humanities Symposia, LA-STEM Selection Committee). Mentored students about the bioeconomy through the Consortium for Advanced Bioeconomy Leadership Education (CABLE). CABLE is a nationwide organization of 20 colleges and universities led by OBIC, the Bioproducts Innovation Center at The Ohio State University and supported by the United States Department of Agriculture, National Institute of Food and Agriculture (USDA NIFA). Hosted visiting scholars from South Korea for six months to conduct work on nanoparticles. Continued to acquire several grants (state/private sector) to support my research program at the LSU AgCenter. Continued to serve as leader within LSU and my community: Co-Product Commissioner for the International Society for Sugar Cane Technologists; Scientific Proposal/Project Reviewer Committees; Guest Editor to Scientific Journals; Member of the Council for Diversity, Inclusion, Equity, and Change; Interim Head of Audubon Sugar Institute; Mentor/Leader to Students.

Dissemination of Findings: Dissemination of the findings resulting from this work included presentations and meetings conducted at national level, regional level, and the private sector; and several peer-reviewed publications and book chapters. Served as technical support to all sugar factories in the state with topics on how to expand their current product portfolio.

Next Reporting Period: Continue the work on co-product development from renewable resources with positive impact on the sugar, food, nutraceutical, and pharmaceutical industries; mentoring and guiding students and professionals; national and international outreach through publications, presentations and teaching; secure research funding (state, federal, private).

Development of Cotton and Soybean Weed Control Programs for Northeast Louisiana

Project Director

Donnie Miller

Organization

Louisiana State University and A&M College

Accession Number

1018864



Development of Cotton and Soybean Weed Control Programs for Northeast Louisiana

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Weeds are a major limiting factor to maximizing yield and profit in cotton and soybean production systems in Northeast Louisiana. Weed resistance to commonly used herbicides like glyphosate also pose a great risk to current production systems in both crops. It is essential that effective and economical weed management strategies be identified that mitigate weed competition and interference as well as resistant populations on soils and in climatic conditions common to Northeast Louisiana cotton and soybean producers.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Greater than 25 field trials were implemented and completed that identified effective preplant and in season weed management programs in cotton and soybean production systems. Programs identified included soil residual and postemergence herbicides both prior to planting and in-season. In addition effective programs applied in fall were identified to mitigate emergence and competition/interference from glyphosate-resistant Italian ryegrass.

Briefly describe how your target audience benefited from your project's activities.

Results from research trials were published in scientific journals to add to the scientific body of knowledge in the field of weed science and also incorporated into the LSU AgCenter Weed Control Recommendation Guide publication that is utilized by producers and independent crop consultants throughout the state on a daily basis to make informed weed management decisions in cotton and soybean production systems.

Briefly describe how the broader public benefited from your project's activities.

Results from this research ensure that correct herbicide programs are utilized at proper rates to ensure effective weed management and not over used at unnecessary rates that may lead to soil and water contamination. Preplant trials identified effective ways to limit tillage which can result in soil runoff and water body contamination.

Development of New Methods for Testing Aerial Application Equipment

Project Director

Randy Price

Organization

Louisiana State University and A&M College

Accession Number

1020170



Development of a New Method to Detect Applications on Pattern Test Strings

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Agricultural spray planes are a very large part of American agriculture applying products to more than 28% of the farmland in the U.S. Still, because of the various application heights and speed of these aircraft, the swath width and spray pattern cannot be predicted by nozzle placement alone and empirical testing is needed to determine these parameters. This project creates better methods, equipment, and sensors to measure spray plane application widths and patterns.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Several pieces of equipment were designed and improved to aid in the pattern and swath width testing of agricultural aircraft.

Briefly describe how your target audience benefited from your project's activities.

University, government, and public testing companies will benefit from alternate and better methods to test aerial aircraft. This equipment will be less-expensive, smaller, and more robust than traditional equipment, and newer methods and technologies will be identified that work for this purpose.

Briefly describe how the broader public benefited from your project's activities.

The broader public will receive better crop applications with less skips and over application of products, leading to cleaner, more environmentally friendly applications.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

A real-time pattern testing system was desired, but all systems currently investigated and developed have only been able to achieve "near-real time" (needing a processing step before the pattern results are delivered). Next year I will concentrate on a system that can produce output pattern as the string is collected in real-time.

Presentations were given on the newer pattern testing equipment at the NAAA (National Agricultural Aviation Association) meeting, the LAAA (Louisiana Agricultural Aviation Association) meeting, and the Minnesota aerial applicators recertification webinar.

[Economic Analysis of Sugarcane Production](#)

Project Director

Michael Deliberto

Organization

Louisiana State University and A&M College

Accession Number

1018731



Economic Analysis of Sugarcane Production

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

This research project addresses farm management issues facing Louisiana sugarcane producers including: developing enterprise cost and returns budgets for various sugarcane production activities, examining the economic impact of important agronomic factors and alternative sugarcane production practices and new production technologies on the production of sugarcane within a single enterprise context.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

The major goals of this project are to: (1) identify current and relevant sugarcane production and farm management issues and problems facing the Louisiana sugarcane industry; (2) develop and publish a representative set of annual projected costs and returns estimates for the production of sugarcane as a commodity enterprise in Louisiana; (3) evaluate the economic impact of important and relevant agronomic factors, alternative sugarcane production practices and new production technologies on the production of sugarcane within a single commodity enterprise context; and (4) evaluate the economic impact of various factors which affect farm-level decision making, resource allocation, and resulting economic performance of sugarcane farming operations within a whole farm context.

In addition to providing cost of annualized production estimates for sugarcane, several issues were addressed relating to the economic cost of alternative weed control programs, mechanical planting methods, row spacing, allocation of planting costs over alternative crop cycle length, evaluating optimal crop rotation length, evaluating field performance and machinery cost estimates associated with sugarcane production, and evaluating risk management strategies.

Briefly describe how your target audience benefited from your project's activities.

Research activities were disseminated through communication with state sugarcane producer groups such as the Louisiana Farm Bureau Federation Sugar Advisory Committee and the American Sugar Cane League, as well as by communication with LSU AgCenter extension personnel, experiment station scientists with sugarcane research responsibilities, and other individuals in the sugar industry.

Briefly describe how the broader public benefited from your project's activities.

Supplemental to the estimation of annual sugarcane farm production cost and returns, this project includes economic research in several areas of sugarcane production. A majority of research activities conducted in this endeavor are concerned with the economics of farm-level production and management decisions, some research activities also investigate economic issues related to domestic farm policy and international trade policy that affect sugar.

Closing Out (end date 09/07/2023)

Estimation of the Impact of Participation in Federal Programs that Promote Soil and Water Conservation

Project Director

Naveen Adusumilli

Organization

Louisiana State University and A&M College

Accession Number

1020001



Estimation of the Impact of Participation in Federal Programs that Promote Soil and Water Conservation

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

To understand whether government assistance received through participation in conservation programs is resulting in greater adoption of practices compared to implementation without any government assistance.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

We were able to understand the impact of conservation programs in Louisiana concerning adoption intensity. Farmers rely on incentive payments to increase the number of practices on their farms. Incentive payments play a significant role in continued adoption. Lack of funding in the program significantly affected adoption. Years with a greater number of extreme weather events resulted in increased interest and continued implementation. Years with higher farm income produced a small decrease in implementation compared to years with lower farm income.

Briefly describe how your target audience benefited from your project's activities.

Staff reports and journal articles were produced and published. Extension meetings were conducted for disseminating the results to local agencies and commodity groups. The audience was able to understand the impact of the program at the state level and the factors that influenced farmers from staying and not staying in the program.

- a. Impact of the Federal Conservation Program Participation on Conservation Practice Adoption Intensity in Louisiana, USA. Published in Environmental Management.
- b. Additionality in Agricultural Conservation Programs and Extension Services. Published in Journal of Natural Resources Policy Research.
- c. Staff reports - Louisiana Conservation updates. January through October 2021. 10 reports.
- d. Staff report Compliance of Conservation Contracts in Louisiana. 2021.

Briefly describe how the broader public benefited from your project's activities.

Conservation programs are implemented at the national level. Understanding the program impact at the state and regional level is crucial for addressing the resource concerns and advocacy for continued funding for these programs. Agencies can benefit from understanding success within certain programs to direct more technical and financial support to address the challenges.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

The project has provided opportunities to train a graduate student and mentor a post-doctoral researcher. The graduate student presented this work at academic conferences in 2021.

Conservation contracts data is considered confidential. The analysis is limited to the county (parish level). Open access to such data can provide crucial answers to some of the long-standing questions of individual farmer-level decision-making.

[Evaluating methods of estimating reference evapotranspiration for scheduling irrigation](#)

Project Director

Stacia Conger

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Louisiana State University and A&M College

Accession Number

1019444



Updates to estimating reference evapotranspiration used for scheduling irrigation

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Achieving efficient irrigation through irrigation scheduling can be accomplished using a soil water balance, which relies on accurate estimations of reference evapotranspiration (ET_o) and rainfall using weather data collected from weather stations. Even though weather station equipment continues to become more economical with advancements in technology, station networks require significant upfront investment with on-going maintenance costs that may include product upgrades, frequent calibrations, travel fees, and dedicated labor and time commitments. Thus, investments in reliable, high quality data can be more difficult to obtain in environments with less water scarcity such as Louisiana despite the need for managing applications around rainfall events. Though alternatives to research-grade weather networks exist, they have yet to be evaluated for use in Louisiana's unique climate conditions.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Over the last year, major activities included collecting hourly weather data from all eight functioning weather stations in the Louisiana Agrilclimatic Information System (LAIS), collecting available weather data from public sources such as National Centers for Environmental Information Climate Data Online, and conducting a replicated trial to evaluate the use of atmometers (i.e. ET gauges) as a substitute for ETo calculated from weather station data.

The LAIS weather data was pulled from the server every six months and quality checked using the methods described in the Standardized Reference Evapotranspiration Equation reference manual. If the data passed quality control, the hourly data was used to calculate daily ETo and rainfall totals. A majority of data was determined to be of acceptable quality.

Aside from the LAIS network, it was found that only temperatures and rainfall amounts were available from publicly accessible weather stations in Louisiana. It is impossible to use the standardized ETo equation without the other variables that affect ETo such as wind speed, relative humidity, and solar radiation. Instead, focus was placed on utilizing historical rainfall totals to determine spatial patterns through a statistical regionalization technique.

Replicated trials were conducted at the Red River Research Station in Bossier City, LA and the Dean Lee Research Station in Alexandria, LA. Each location received three atmometers, one rain gauge, and one datalogger. These products were installed within the fetch distance of the weather station, thus utilizing the same reference crop for estimating ETo.

Briefly describe how your target audience benefited from your project's activities.

Based on the target audience of agricultural irrigators, the primary benefit of this year's activities was associated with the process of regionalizing historical rainfall patterns. It was determined that Louisiana has two distinct regions for rainfall based on the results of the statistical model using both seasonal rainfall totals and frequency of events greater than 5 mm, 12.7 mm, and 25.4 mm. In all cases, only the summer months of June, July, and August contributed to the two separate rainfall patterns with North Louisiana considered drier than South Louisiana. The distinction cuts the state across the middle, falling just below Alexandria, LA. These different patterns were used to estimate both crop water requirements and irrigation requirements under two possible planting dates representing early and late plantings to help irrigators plan water budgets and estimate irrigation applications based on their circumstances (i.e. location/region, planting date, crop type, normal weather patterns).

Briefly describe how the broader public benefited from your project's activities.

As irrigators better understand their crop water requirements and irrigation need, they will adapt and make changes to improve irrigation water use efficiency. In turn, increases in on-farm water use efficiency can maximize yield while reducing tailwater runoff. This result broadly affects the public through improvements to water quality in local waterways by reducing nutrient loads and sediment transport. These waterways serve the public as drinking water sources, food sources (i.e. fishing), wildlife habitat, and have many recreational uses that can be impacted by lack of practicing good irrigation strategies.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

There were a few setbacks related to this project in 2021.

1. The LAIS weather network is not fully operational from an end-user standpoint. Irrigators can pull certain weather variables for a variety of date ranges, but ETo is not being reported on the public facing website. The standardized equation is cumbersome and is not meant for the end-user. As a result, server access was required to obtain large quantities of weather data from the LAIS system. Still, more information for some of the variables is needed to calculate ETo correctly such as the latitude of the weather station and station height above mean sea level. These values were collected manually from the two stations being used for the atmometer trial. In 2022, time will be dedicated to locating each weather station and manually collecting this information for the remaining stations.

2. The atmometers located at the Dean Lee Research Station were not removed for the winter months by the collaborator and were damaged by an unseasonable freeze event in February 2021. Repair parts were ordered and used to fix the devices, but supply chain issues resulted in delays that led to no usable data for the 2021 crop season at that location. The wiring for the atmometers located at the Red River Research Station was damaged by farm staff while maintaining the grassy area surrounding the devices. Only half of the crop season produced viable data. All repaired devices will be reinstalled and increased coordination with the farm manager about maintenance will occur in 2022.

[Evaluation of Weed Management Strategies in Louisiana Red River Valley Corn and Soybean](#)

Project Director

Daniel Stephenson

Organization

Louisiana State University and A&M College

Accession Number

1016167



Weed management strategies in corn and soybean

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Louisiana corn and soybean producers must plan to manage at least six weedy species, some of which are resistant to herbicides. This broad spectrum of weedy pest requires detailed weed management strategies to lessen the influence of weeds on crop yield.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Strategies involving multiple techniques including herbicides, herbicide-tolerant crops, and non-herbicidal means were evaluated to determine their level weed management and feasibility of implementation to provide season-long weed management. Progress was made in determining strategies in corn and soybean that are beneficial for Louisiana producers.

Briefly describe how your target audience benefited from your project's activities.

Target audience was provided with information to assist them in determining the best strategy for their farm.

Briefly describe how the broader public benefited from your project's activities.

The advantage that the evaluated weed management programs provide to the broader public is that they help improve crop yields so that the potential impact of food shortages may be lessened.

[Evaluation of the agronomic value of warm-season pasture overseeded with functionally diverse winter annuals](#)

Project Director

Kun Jun Han

Organization

Louisiana State University and A&M College

Accession Number

1015635



Evaluation of the agronomic value of warm-season pasture overseeded with functionally diverse winter annuals

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Warm-season grass pasture has been the backbone of cow-calf operations in Louisiana and other Gulf Coast regions. However, due to the seasonal pasture availability, cattle feeding depends heavily on high input cost hay during the non-pasture growing season. Also, excessive soil nutrients may leach as nonpoint pollutants during the non-pasture growing season. Overseeding of diverse cool-season annuals on dormant warm-season pasture can extend pasture growing season and recycle the unused soil nutrients.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Project activities achieved the following objectives.

1. Quantify improved year-round forage production and nutrient value of diverse cool-season annual species overseeded pasture.
2. Compare the effectiveness of the overseeded cool-season species for seedling establishment, production consistency, and regrowth capability.
3. Develop biomass quality models for diverse species overseeded pasture using nondestructive analysis approaches.
4. Evaluate fertilizer options targeting a long-term nutrient release for year-round pasture production.

Briefly describe how your target audience benefited from your project's activities.

Drill planted diverse cool-season species [annual ryegrass (*Lolium multiflorum*), small grains, legumes, and brassicas] on dormant warm-season grass pasture can relieve the dependency on hay during the non-warm season pasture growing season. The diverse species application also reduces potential risk in winter pasture utilization from the current single species, annual ryegrass overseeding strategy. The two or more of the annual type cool-season species combinations produced equivalent biomass and nitrogen uptake to those of annual ryegrass overseeded pasture. The diverse species overseeding did not affect the following warm-season grass pasture production. The overseeded legumes and small grains are more consistent than brassicas. For the prepared seedbed, the establishment of brassica seedlings was also successful as hairy vetch. Among the tested slow-release fertilizer options targeting overseeded pasture, poultry litter application realized the most significant net gain in biomass production. Although coated slow-release fertilizer outperformed other fertilizer options in production, the high price of the fertilizer undermined the net revenue.

Briefly describe how the broader public benefited from your project's activities.

Legumes and other diverse species provide sustainability to the conventional monoculture pasture system through improved resistance to environmental stress. Cultivating functionally diverse species such as nitrogen-fixing legumes and other beneficial chemicals releasing brassicas can promote soil health. This application is advantageous for recycling excessive soil nutrients into high-quality pasture production and enhancing carbon sequestration. Diverse species application reduced nutrient leaching from agricultural soil by accumulating biomass during the non-pasture growing season. Compared with non-overseeded pasture, grass species overseeded pasture improved nitrogen uptake by more than 120%. The biomass capturing excessive soil nutrients can increase soil organic matter and become a source for slow-release nutrients for following crop growth. Considering the unique characteristics of the diverse species applied pasture conditions, the project developed a localized non-destructive analysis model using near-infrared spectroscopy. This application reduces hazardous chemical use in analyzing biomass by more than 80%.

[Integrated Pest Management of Rice Insects in Louisiana](#)

Project Director

Blake Wilson

Organization

Louisiana State University and A&M College

Accession Number

1015726



Annual Progress Report

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

This projects aims to enhance sustainability of U.S. rice production through diversification of insect management strategies.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Numerous research trials were conducted to optimize chemical control strategies and reduce reliance on insecticides. Insect resistant rice varieties were identified. Economic returns on insecticidal inputs were determined. Emerging insect pests of rice were identified and monitored.

Briefly describe how your target audience benefited from your project's activities.

Rice farmers realized enhanced profitability through elimination of unnecessary input costs. Diversification of pest management tactics is expected to delay development of insecticide resistance and preserve efficacy of key rice technology.

Briefly describe how the broader public benefited from your project's activities.

Research activities aim to improve the economies in rural rice production regions through enhanced farm revenue. Findings will also help preserve ecosystem services by reducing environmental detriments from inappropriate use of pesticides.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Several graduate and undergraduate students were trained during research activities. Two PhD students and one Master student completed their degrees in 2021 with all or partial involvement with this project.

Results were disseminated through presentations at grower oriented extension meetings, farm visits, and extension publications.

Closing Out (end date 09/07/2023)

Management Systems to Improve the Economic and Environmental Sustainability of Dairy Enterprises.

Project Director

Cathleen Williams

Organization

Louisiana State University and A&M College

Accession Number

1019319



Assessment of insulin sensitivity from glucose responses to insulin infusion in neonatal dairy calves.

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Feeding and management of dairy calves is important to their future performance as lactating cows. One aspect of growth and development is efficient energy metabolism, as glucose is the principle source of energy for life processes of mammalian cells. Gaining a greater understanding of developmental changes in glucose metabolism and insulin sensitivity will allow nutritionists to make recommendations for feeding dairy calves as they transition from non-functional to fully functional ruminants.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

On-farm testing to determine insulin sensitivity in dairy calves before and after weaning is useful for assessing developmental changes in energy metabolism. The project results gave us a better understanding of how insulin sensitivity decreases as calves are weaned from milk replacer and rely strictly upon solid feeds such as grain and forages.

Briefly describe how your target audience benefited from your project's activities.

Researchers and dairy nutritionists benefit from results of projects such as this because the basic science studied in this project has applications in making recommendations for feeding management of dairy calves. Furthermore, we identified areas that may need further investigation such as application in the beef industry.

Briefly describe how the broader public benefited from your project's activities.

Dairy producers gain a greater understanding of how feeding management of calves from birth through weaning affects their overall growth and development. This will carry over into the future milk producing ability of the heifer once she enters the milking herd later in her life.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

The project allowed undergraduate students the opportunity to participate in a research project. The project was part of one student's independent study program, and he presented the results at a national meeting of the American Dairy Science Association. The problems encountered during the project have led to another study currently in progress. The calves were stressed due to handling and repeated blood sampling during the insulin challenges. Therefore, a follow-up project is in progress to determine if acepromazine, as a chemical restraint, will affect insulin sensitivity and glucose tolerance in young dairy calves.

Closing Out (end date 09/07/2023)

[Methods for assessing a role for prolactin and kisspeptin in ovarian function, and development of protocols for inducing early cyclicity in seasonally anovulatory mares](#)

Project Director

Erin Oberhaus

Organization

Louisiana State University and A&M College

Accession Number

1015724

★ [Methods for assessing a role for prolactin and kisspeptin in ovarian function, and development of protocols for inducing early cyclicity in seasonally anovulatory mares](#)

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Many horse owners, especially those who plan a racing career for their horse, desire an early foaling date, usually mid-January to early February, to gain a developmental advantage over foals born later in the year. Unfortunately, many horses are not reproductively active at the desired time of breeding, necessitating a method to advance the onset of the breeding season. Use of dopamine antagonists appears to be a reliable method for inducing early ovulation in mares; however, further studies focusing on a simple and effective treatment for breeders are warranted.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Two projects were carried out to 1) determine if oocytes (eggs) obtained from horse mares induced to cycle with dopamine antagonists were developmentally competent and able to be fertilized; and 2) determine the interaction between kisspeptin, prolactin, and growth hormone in horses. These projects both made progress towards the understanding and application of hormonal therapy as a means to induce early breeding in horses.

Briefly describe how your target audience benefited from your project's activities.

The opportunity to apply the current treatment in a commercial embryo transfer program has allowed for the delivery of some of the first foals born to mares that were induced to cycle using the current treatment. A simple (one injection) and effective treatment to induce early cyclicity has attracted considerable attention from equine veterinarians and breeders.

Briefly describe how the broader public benefited from your project's activities.

The current research continues to support the use of dopamine antagonists as a method to advance the onset of the breeding season. Those desiring early foals benefit greatly from the current research.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Many opportunities for technical and lab training were provided by the trials described. Graduate students were trained in ultrasound examination of the reproductive tract as well as in performing analyses of blood plasma samples in the physiology lab. Undergraduates involved in research received training in large animal safe handling skills and blood sampling.

Three abstracts were accepted for presentation at equine and reproduction society meetings.

1. Vetter, M., C. Pinto, V. Bailey, B. Gilbert, E. Oberhaus*. 2021. Meiotic competence of oocytes obtained from seasonally anovulatory mares treated with estradiol and sulpiride. *Reprod. Fertil. Dev.* 34: 311-2.
2. Looman J, J. Pipkin, E. Oberhaus, G. Veneklasen, J. Richeson, L. Baker, V. Bailey, C. Camp, V. Smalley. 2021. Induction of cyclicity in seasonally anestrous recipient mares. *J. Equine Vet. Sci.* 100:103567.
3. Bailey, V.N., C.M. Camp, E.L. Oberhaus.* 2021. Interaction of kisspeptin and the lactotropic and somatotrophic axes in mares and geldings. *J. Equine Vet. Sci.* 100:103482.

Closing Out (end date 09/07/2023)

Plant Genetic Resources Conservation and Utilization

Project Director

Don LaBonte

Organization

Louisiana State University and A&M College

Accession Number

1019329



Plant Genetic Resources Conservation and Utilization

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

This multistate project is between state and federal entities which use plant germplasm. The S-9 repository in Griffin, GA maintains collections of commercial species. Each state has a representative and they advise curators on appropriate collection acquisition and maintenance activities.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

The state and federal representatives met to discuss current activities at the repository and operations of the federal germplasm system in general.

Briefly describe how your target audience benefited from your project's activities.

Plant breeders are the main recipient of the activities of the S-9 repository. Targeted germplasm acquisitions help growers meet evolving trends for growers.

Briefly describe how the broader public benefited from your project's activities.

Improved varieties with higher yields keep growers profitable and help keep lower cost of production keeping prices stable for consumers.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

none

Closing Out (end date 09/07/2023)

U.S. Agricultural Trade and Policy in a Dynamic Global Market Environment

Project Director

Philip Kennedy

Organization

Louisiana State University and A&M College

Accession Number

1018921



U.S. Agricultural Trade and Policy in a Dynamic Global Market Environment

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

International Trade and Agricultural Policy affects the adoption of new technologies and cultural practices. Analyses were conducted in collaboration with researchers at LSU AgCenter and the University of Florida, to examine the impact of the adoption of new technologies and cultural practices on yields in the rice and sugarcane industries.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

We show how changes in cultural practices and varietal development have increased yields in the rice and sugarcane industries. Our work also highlights the importance of the Louisiana Agricultural Experiment Station in the creation and identification of Best Management Practices and the implications for Food Security.

Briefly describe how your target audience benefited from your project's activities.

Agricultural producers, policy-makers, and researchers benefit from this research in gaining a clear understanding of how the Louisiana Agricultural Experiment Station provides productivity enhancing research that will increase their competitive position in the market and allow them to better provide a secure food supply.

Briefly describe how the broader public benefited from your project's activities.

The broader public benefits from this research as an understanding of the role of Agricultural Experiment Stations in providing for a secure food supply will lead to continued public support of these research activities which contribute to the public welfare through increasingly efficient food production.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Results from these analyses have been presented at academic conferences and published in refereed journals.

Project Director

Mark Schafer

Organization

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Accession Number

1016396



Understanding Connections

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Three projects contributed to understanding connections between schools, families, and communities: (1) a coastal roots study showed how introducing students to tree-ring science can enhance their understanding and interest in science; (2) a "peer effects" study explored how friends and extracurricular activity engagement can shape students performance in school; and (3) an examination of family structures and migration can influence children's schooling in rural Nepal.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

During fiscal year 2021, collecting data was challenging so this project primarily involved analyzing secondary data, with enhanced attention to the relationships between families, communities, and schools.

Briefly describe how your target audience benefited from your project's activities.

My target audience is primarily scholars, students, and educators interested in the connections between families, schools, and communities. Our work contributed by focusing school's efforts to engage students and their parents in a coastal science project, how children's social networks can influence their academic performance, and how family strategies for enhancing incomes can influence children's schooling.

Briefly describe how the broader public benefited from your project's activities.

The broader public can benefit from understanding the relationships between middle and high school students friendships and activities and their educational trajectories. The broader public also benefits from more Louisiana students gaining through practical experience a deeper understanding of environmental science. Finally, the broader public also benefits from a general understanding of how migration experiences influence children left behind.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Fujiyama, Hideki, Yoshinori Kamo, and Mark Schafer. 2021. "Peer Effects of Friend and Extracurricular Activity Networks on Students' Academic Performance." *Social Science Research* 97.

Tucker, Clay S. Jill C. Trepanier, Pamela B. Blanchard, Ed Bush, James W. Jordan, Mark J. Schafer, and John Andrew Nyman. "Using Tree-Ring Research to Introduce Students to Geoscience Fieldwork." *Bulletin of the American Meteorological Society*.