Research Proposals Funded for Fiscal Year 2018 (July 2017-June 2018)

The farmer-leaders of the Kentucky Soybean Board met on March 16, and among their top priorities was deciding which research project proposals to invest Kentucky's soybean checkoff dollars in. The following proposals were approved.

Blue Water Farms: Edge-of-Field Monitoring in Kentucky Soils

University of Kentucky, Dr. Brad D. Lee

The objective of this project is to facilitate the establishment of a network of edge-of-field (EoF) water quality monitoring demonstration sites in Kentucky collectively known as Blue Water Farms. This work will establish partnerships between the USDA NRCS and USDA NRCS Environmental Quality Incentives Program (EQIP) eligible producers who wish to take advantage of and participate in the EoF Water Quality Monitoring Standard Practice 201 and 202. The University of Kentucky will serve in the role of water quality monitoring partner and in this capacity we will establish the water quality monitoring network, collect and analyze water samples, and assemble the data into reports required by the USDA NRCS for participating EQIP producers. Dissemination of results to Stakeholders will be conducted through the activities of the Cooperative Extension Service. This work will benefit producers by evaluating yield and nutrient and sediment losses under current practices as well as the Kentucky USDA NRCS Conservation Practice Standard for Nutrient Management, which utilizes University of Kentucky CES Bulletins AGR-1, AGR-16 and AGR-92.

Support for Technician Position with the Kentucky Soybean Variety Performance Program- Fiscal Year 2018

University of Kentucky – Dr. Claire Venard

The Kentucky Soybean Variety Performance Tests are conducted to provide an unbiased and objective estimate of the relative yield performance of soybean varieties grown in Kentucky. Over 200 soybean varieties in the maturity groups II, III, IV, and V are expected to be entered in the 2017 tests by soybean growers, commercial companies and federal institutions. Tests are conducted at 8 locations in the major soybean producing areas of Kentucky. The technician will provide strong support with all steps of soybean production and data collection: planting, stand count, pest and disease control over the course of the growing season, and preparing for harvest and collecting samples for seed composition analysis. This will likely result in the timely release of the "2017 Soybean Variety Performance Tests" report by early December.

Comprehensive Soybean Guide Publication Costs

University of Kentucky – Dr. Carrie Knott

The University of Kentucky Soybean Research Group has spent the last 2 years compiling a Comprehensive Soybean Management Guide, much like ID-125 A Comprehensive Guide to Wheat Management in Kentucky (http://www2.ca.uky.edu/agcomm/pubs/id/id125/id125.pdf). We request funds to publish 2,500 copies to distribute throughout the state. Ideally we would like to include the Kentucky Soybean Board logo on all printed documents to clearly publicize the board's contribution for printing. Our goal is to have a completed copy by the end of March so that there is time to print and distribute newly printed copies at our Corn and Soybean Field Day July 27, 2017.

Quantifying the potential of 100 bu ac-1 yield in soybean and its profitability for environmental conditions in Kentucky

University of Kentucky – Dr. Monserrat Salmeron Cortasa

Yields from soybean contests can offer an estimate of the yield potential of current cultivars in a region. Since record soybean yields were obtained by a farmer in Missouri (139 to 161 bu ac-1 in 2006, 2007, and 2010), several other states in the U.S. have crossed the 100 bu ac-1 threshold. In Kentucky, maximum contest yields have increased on average since 2002, but the highest yield reported is still below 100 bu ac-1 (98.4 bu ac-1 in 2015). Understanding what are the main limiting factors for soybean production in KY, and quantifying the environmental potential of current soybean cultivars, is critical for developing management recommendations that can increase both maximum and average yields in the state.

Intensive Management: An option to increase Double-Crop Soybean Yields?

University of Kentucky – Dr. Carrie Knott

The goal of this research is to identify intensive management practices of the double crop wheat and soybeans system of Kentucky, that will increase yield and profitability for Kentucky farmers. We will specifically examine the effect of planting date, seeding rate, seed inoculant, fungicides (on seed and foliar), and insecticides (on seed and foliar) on double-crop soybean yield and profitability.

Management of stink bugs in soybean: Does one strategy fit all species?

University of Kentucky – Dr. Raul Villanueva

In soybean fields of Kentucky there are two recurrent stink bug species that require control; the green stink bug (GSB), and the brown stink bug (BSB). However, there are two invasive species; the brown marmorated stink bug (BMSB), and the redbanded stink bug (RBSB). BMSB and RBSB may cause problems because they are expanding their geographically range. Moreover, studies on these two invasive species have shown that they persist when insecticides used to control the GSB and BSB are applied. In this project we will complete an educational comprehensive study for management strategies against stink bugs affecting soybeans in Kentucky. We will accomplish this with the following more specific objectives: (1) develop a program to train a future professional on agricultural entomology, (2) compare current management strategies against stink bugs utilized by KY soybean growers, (3) conduct replicate insecticide efficacy field tests for the management of stink bugs, (4) evaluate the effects of these compounds on stink bugs and natural enemies in laboratory studies, and (5) transfer all information generated in this study to end users through the use of digital, printed and extension conferences.

Quantifying White-tailed Deer Damage to Soybean Yields in Kentucky.

University of Kentucky – Dr. Matthew Springer

Wildlife is believed to cause significant losses to yields for grain farmers within the state of Kentucky. Currently, no research has attempted to quantify yield losses directly attributed to white-tailed deer within Kentucky. Previous research on deer damage to grain crops in other regions of the United States have found contradicting results, with some research showing significantly decreased yields while others showing little to no effect on yields. Within Kentucky overall the last several decades deer populations have drastically increased in many areas. Increasing deer densities have been shown to alter impacts on several ecosystems however no previous agricultural damage studies have not attempted to link deer densities to impacts on yield. With the advancements in technology and decrease in costs, we are now able to estimate deer densities at a relatively accurate level in a localized setting such as a farm or park. Pairing damage estimates to deer densities may provide more of an insight into the impacts of high density deer populations. If a correlations between deer density and yield loss exists, managers and farmers could estimate potential losses by simply estimating deer densities on their properties

Managing frogeye leaf spot of soybean with foliar fungicides and resistant varieties

University of Kentucky – Dr. Carl Bradley

This will be the second year of a project that was conducted in 2016, and an additional year of this research is important to confirm the results found in 2016. This research will be conducted across eight locations in Kentucky (in collaboration with the UK Soybean Variety Performance Tests). Varieties that differ in their susceptibility to frogeye leaf spot (susceptible, mod-resistant, and resistant) will be planted. A strobilurin fungicide product and a triazole + strobilurin fungicide product will be evaluated and compared to a non-treated control. At each location, this research will be conducted on: MG III varieties; MG IV varieties; and MG V varieties. Disease severity and yield data will be collected from each plot, and profitability (yield response*marketing price – product and application cost) will be calculated. The presence of strobilurin fungicide-resistant isolates of the frogeye leaf spot pathogen will be determined at each location by evaluating the disease-control effectiveness of the strobilurin fungicide relative to the non-treated control and the triazole + strobilurin fungicide product. This research will begin the development of a fungicide response database, and will be drawn upon for extension presentations and newsletter articles.

Race survey of Phytophthora sojae, causal agent of Phytophthora root rot of soybean, in Kentucky

University of Kentucky – Dr. Carl Bradley

Phytophthora root rot (caused by Phytophthora sojae) can be a destructive disease of soybean in years in which rainfall and wet soils are abundant. Management of this disease is accomplished primarily through the use of resistant varieties that utilize either single resistant genes (known as Rps genes) or partial resistance (sometimes referred to as “field resistance” or “tolerance”). The use of Rps genes over time has allowed for the selection of races of P. sojae that can overcome specific Rps genes, rendering these resistant genes ineffective. Understanding the diversity of P. sojae races in Kentucky can help soybean farmers make better choices when selecting varieties, and can help soybean breeding programs make better choices when determining which Rps genes to utilize when developing new varieties for Kentucky farmers. The last P. sojae race survey conducted in Kentucky was in 1994. In that survey, race 1 was the predominant race present in Kentucky soils. Race 1 is able to overcome the Rps7 gene, which is rarely present in modern soybean varieties grown in the state. The objective of this proposed research is to determine the predominant races of P. sojae that occur in Kentucky soybean fields.

Use of plant growth-promoting microbes for improved soybean yield and stress tolerance

University of Kentucky – Dr. Prahdeep Kachroo

The overall goal of this research project is to increase profitability of soybean production by simultaneously enhancing yield as well as tolerance against biotic and abiotic stresses. Plant growth promoting microbes not only stimulate plant growth but can also confer resistance to microbes that cause plant diseases. The PI’s group is characterizing strains of the naturally occurring, nonpathogenic soil fungi Trichoderma spp. that serve as biocontrol agents to confer enhanced resistance against pathogens in many plant species, including soybean, tomato and tobacco. The Trichoderma spp. also improve plant growth and development, suggesting that these microbes induce root to shoot signaling resulting in induced resistance. The proposed work will characterize the efficacy of Trichoderma spp. in protecting soybean plants against bacterial, fungal, viral, and oomycete diseases and abiotic stresses. This proposal will also characterize the effect of Trichoderma spp. on soybean plant vigor and yield. The molecular events resulting in the establishment of induced resistance in soybean plants will also be characterized. Understanding these mechanisms is crucial for maximizing the application of biocontrol agents in crop improvement. Benefit to producers: a) Increased plant growth and yield b) Improved tolerance against abiotic stress c) Improved tolerance against microbial diseases

Investigation of Multiple Herbicide Resistant Palmer Amaranth and Waterhemp

University of Kentucky – Dr. JD Green

A field site in west Kentucky with a mixed population of Palmer amaranth and waterhemp has exhibited resistance to postemergence applications of both glyphosate (an EPSP enzyme inhibitor herbicide) and fomesafen (a PPO inhibitor type herbicide). Another site with Palmer amaranth located in central Kentucky has also been identified and requires further investigation to determine if this population also displays resistance to multiple sites of action. The objectives of this project is to conduct field studies at both locations to investigate various soil-applied and postemergence herbicide options which can be effective for developing best management strategies for control of these complex weed populations. Greenhouse and laboratory studies will be conducted to investigate and characterize these two populations relative to the level of herbicide resistance and the heritability of the mechanisms for resistance to multiple sites of action. This research will improve our understanding of these pigweed populations and how significant of a threat these weeds are to soybean production. The ultimate goal is to enable soybean producers and crop consultants to make better decisions when employing weed control programs for managing these and other herbicide resistant weeds.

Comparing the Xtend Soybean System to the Roundup Ready System

University of Kentucky – Dr. Chad Lee

Federal and international approvals for the Roundup Ready 2 Xtend (Xtend) soybean have allowed in numerous companies to begin selling these varieties this season. Farmers are interested in how these varieties compare with Roundup Ready and/or Roundup Ready 2 Yield soybeans. We intend to investigate the overall system to assess the agronomic performance of the systems. In addition, we will try to assess the genetic effect on relative yield. The objective of this project is to evaluate relative yield of RR soybean and Xtend soybean in their respective weed management systems.

Integrating cover crops and herbicides for marestail management prior to soybean

University of Kentucky – Dr. Erin Haramoto

Marestail has become a major weed for soybean producers in Kentucky and throughout a broader geographic range. Its small seed size make this weed particularly troublesome for no-till soybean growers; its prolific, wind-blown seed can disperse far between fields and adjacent natural areas; and its extended emergence period complicates management efforts. In addition to all of these traits, glyphosate resistant biotypes are now widespread throughout the state. Thus, management tactics that integrate other chemical options with cultural practices like the use of cover crops are desirable for this species. This project examines the integration of fall- and spring-applied herbicides with fall-planted winter rye as a cover crop to improve management of marestail prior to soybeans. We are utilizing a site with a heavy infestation of fall-emerged marestail that has historically had spring emergence as well. Results from this project will allow us to make recommendations about best management practices for this species in a winter rye cover crop system, and also elucidate areas for further research to better integrate herbicide applications with cover crops—examples include application timing (i.e. when should soil residual products be applied if cover crops are used?), and species by product combinations (i.e. what herbicides can be applied before or after planting cereal rye and cover crop mixtures without damaging the plants?). A master's student under the supervision of Dr. Haramoto will utilize this project for his thesis research, and we also plan to utilize data collected for this project to leverage federal grant funding with collaborators from throughout the Midsouth and Midwestern regions.

Understanding the Components and Mechanisms Responsible for High Yielding Soybeans

University of Kentucky – Dr. Edwin Ritchey

Once the 100 bu/A soybean yield barrier was broken in yield contests, many others have attempted to repeat this feat. We are not proposing to break 100 bu/A soybean yield with this proposal, but rather to provide a better understanding of new or novel management practices that have the potential to substantially increase soybean yield. We plan to examine practices that are novel, counter to traditional thinking, or have shown promise in the lab or greenhouse but are not yet proven in the field at production scale. Approach We plan to apply nutrients to both sides of the soybean row by subsurface injection later in the season, on soils that have a soil test nutrient status such that a yield improvement would not be expected. These nutrients will be nitrogen, phosphorus, potassium, and combinations thereof. We also propose to inject a commercially available humic substance or biological stimulant product in the same manner. This work will be conducted in 30-inch soybean rows to determine if this mechanism has the potential to increase field-grown soybean yield. We hope to identify novel approaches to increased soybean yield in this research such that the information gained can be used to advance our understanding of the limitations other than water stress to increased soybean yield potential in Kentucky.

Publication on Fragipans

University of Kentucky – Dr. Jim Martin

The Kentucky Soybean Board has funded multiple years of research on fragipan, fragipan remediation, and the use of poultry litter to break up the fragipan. This publication will convey to farmers the information learned in these projects.

Boosting Aquaculture Sustainability and Profitability by Enhancing Soybean Meal Utilization in Aquafeeds: An Assessment of Nutritive Value and Optimization of Soybean Meal-Based Diets for Hybrid Catfish and Largemouth Bass

Kentucky State University – Dr. Vikas Kumar

Quality of dietary protein ingredients plays an important role in feed utilization and performance of farmed fish. High protein content, balanced amino acid profile and high digestibility ensure fishmeal (FM) as the most suitable protein ingredient for aquafeeds. However, the high cost of FM (currently $900-1100 per ton) and its increased demand and uncertain availability, make it necessary for the aquafeed industry to substitute FM with alternative protein sources, which can possibly decrease diet costs and aid sustainability to the whole aquaculture industry. In this context, plant proteins due to their highly availability, worldwide production and lower-cost are gradually emerging to be the only economic and sustainable protein alternatives to FM. In this scenario, the soybean meal (SBM) is a high-quality and widely available plant protein source extensively utilized in aquafeeds as partial substitute for FM. Despite overwhelming research on the potential use of SBM, there is still paucity on the use of conventional and new SBMs in the diet of carnivorous fish like the largemouth bass (LMB) or of promising crosses like the hybrid catfish (HCF), both commercially important in the US. There is either no consensus or unresolved issues concerning the maximum possible replacement of FM by SBM in fish without affecting the growth and nutrient utilization. Therefore, there is an urgent need to optimize SBM-based diets procure from several commercial feed companies and to maximize nutrient utilization through exogenous supplementation of additives/enzymes. This proposal also aims at investigating the overall performance of the HCF and LMB under different feeding conditions by integrating the response observed across various biological processes extending from molecular to organismal level. Furthermore, to bridge the gap between the outcomes of indoor experiments and farm levels, within this framework we also aim to conduct pond-based feeding trails to simulate culture-realistic conditions.