**USB Proposal**

**Sub/Contractor Information**

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| USB # | Title  | USB Target Area | USB Action Team | Sub/Contractor | Current Approved Budget (If applicable)  | Proposed Budget Change (if applicable) | Proposed or Revised Budget | Completion Date | Proposed or Revised Date (if applicable) |
|  | Effects of the Introduction of Feed Grains into Mid-South Soybean Production Systems | Sustainability | Supply | Mississippi State University-Delta Research and Extension Center |  |  | 51,050 | 9/30/18 |   |

**Proposal Information**

**Primary Contractor:** SmithBucklin

**Manager’s Name:** Rich Joost

**Start Date:** 10/1/17

**Other Cooperators/Funding Sources:** $\_\_221,969\_\_\_\_

The Mid-South Soybean Board is providing $158,969 per year. This includes contributions from the QSSB’s from Arkansas, Louisiana, Mississippi, Missouri, and Texas. The United Sorghum Checkoff Program has committed to provide $63,000. Additionally, seed companies throughout the Mid-South have been approached and will generously donate seed for the project with an estimated value of>$4,000 per year.

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| **Program Goal:** | Sustainable Production |
| **Road Map:** | Sustainable Production Practices - Advancing sustainability by developing and promoting advanced production practices and facilitating adoption of digital farming technology. |
| **Track:** | Technical Solution (Creating competitive advantage for U.S. soy growers by differentiating soy offerings throughout the value chain, leveraging the latest technological advancements and innovations) |
| **Milestone(s):** | Public researchers identify key production practices that can improve on-farm profitability and sustainability when incorporated into soybean production systems. |
| **Audience:** | Public Researchers |
| **Objective:** | Objective A: Public researchers will collaborate with the checkoff to identify BMPs that enhance the overall sustainability of the U.S. soy crop and avoid potential increased regulations. |
| **Stage:** | Technical Solution Stage 2 - Investigation Stage - Explore important problems, opportunities & potential solutions for feasibility |
| **Innovativeness:** | Moderate (New but familiar market or solution) |
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| **Proposal Summary:** |
| Identification of those practices that improve soil health and conserve and protect water resources is critical to improving the sustainability of U.S. soybean production and will assist in defining metrics for monitoring soybean production system sustainability. Over the past decade acreage of feed grains (corn, grain sorghum, wheat) have increased in the Mid-South. Soybean producers in this region have limited information on the effects of incorporating feed grains into their rotations. This project will identify optimal rotational partners for soybean production under Mid-South management and environmental conditions to maximize producer profitability and sustainability.  |

**Proposal Description:**

Soybean farmers make important production and economic decisions based upon information supplied by Extension personnel, seed companies, local seed dealers, etc. Public researchers evaluate and disseminate production information derived from studies designed to determine best management practices related to soybean production systems. Often the information is limited, inconsistent and not applicable to the geographic area that is being considered by the producer or the crop advisor in the Mid-South. Farmers cannot make effective soybean production system management decisions without access to unbiased evaluations by public researchers. Unfortunately, the significance of crop rotation of soybean with feed grains cultivated in southern latitudes impact upon overall soybean production is not well understood. This study is designed to allow public researchers to evaluate the impacts of various crop rotation systems on the production of soybeans and the rotational crops such as corn and grain sorghum. Crop rotation is known to reduce pest pressure by breaking pest biological cycles, improve nutrient cycling and improve system profitability by spreading risks and maximizing returns.

The Midwestern US has used a corn/soybean rotation to enhance production of the two crops. However, there is no general agreement on the specific reasons for this enhancement. Nitrogen availability is usually identified as being responsible for increased corn yields following soybeans, but other factors such as decreased weed, disease, and insect pressures may also be important for both crops in this rotation. However, long-term corn-soybean rotation research has largely been confined to the Midwest. Results from numerous long-term studies conducted in the Midwest show that yield of corn grown in a 1:1 rotation with soybeans produces greater yields than corn grown following corn. For example, researchers in Wisconsin found that soybean in a corn/soybean rotations yielded 10% greater than continuous soybean. Similarly, a study in Minnesota observed an 8% yield increase for soybean following corn.

It is unreasonable to assume that the above Midwestern results will directly transfer to the Mid-South for the following reasons: 1) Mid-South soil properties present a much different environment for off-season maintenance of soil nitrogen levels (higher soil temperatures, frequent long-term soil saturation resulting in anaerobic soil conditions, etc.) that can result in greater losses of soil nitrogen during the winter months; 2) greater soil temperatures in the Mid-South during the winter months will result in greater decomposition of crop residues between harvest and next season’s planting. Both of these factors will affect residual soil nitrogen levels and 3) Lower non-irrigated crop yields in the Mid-South will presumably result in different nitrogen use patterns by corn and less crop residues. The magnitude of these differences is not known.

There is anecdotal evidence that corn yields will be greater following soybeans in the Midsouthern US, and this naturally leads to the assumption that rotation of the two crops will change the dynamics of their production. However, there is a lack of long-term research that documents just how a corn/soybean rotation will perform in the Mid-South. Moreover, incorporation of grain sorghum on non-irrigated acres and the double-cropping of winter wheat with soybean has often been considered advantageous when comparing Midwestern soybean production to Mid-Southern soybean production systems. Two things are certain regarding efforts to ascertain the potential benefits of rotating the Mid-South’s soybean and grain crops: 1) The recent surge in commodity prices and costs for fuel, fertilizer, genetically modified seed, and other inputs make it imperative that agronomic findings be supplemented by economic analyses to determine the monetary ramifications of rotations and 2) Previous research in this area in the Mid-South is probably obsolete because of the recent changes in commodity prices, input costs, and technology shifting the crop production landscape to a more grain rather than fiber based region.

A uniform replicated randomized complete block design with a spilt-plot arrangement of treatments will be used at multiple locations in this multi-state and multi-year research protocol. Twelve base rotations involving soybean, corn, grain sorghum, and winter wheat will be established as the whole plots. Each whole plot will be split by altering the residue management technique (Full residue vs. burning residue). Both irrigated and non-irrigated treatments exist within the whole plot fraction to determine the yield sustainability of specific rotations as result of irrigation management.

This project should produce data that can be used to validate the sustainability and benefits of soybean rotation with feed grains in southern latitudes. Economic analysis through input tracking should yield data that would allow producers to pick the most profitable rotation with soybean to help sustain or perhaps increase current soybean monoculture yields. The study will also provide the opportunity for measurement of the effects of differing Mid-South micro environments on soil nematode population and residue decomposition and its importance with yield sustainability.

The research proposed will contribute to a much improved sustainable Mid-South soybean industry. The target audience for this research is soybean producers in the Mid-South (Tennessee, Missouri, Mississippi, Arkansas, Louisiana, Texas) as well their advisors (ie. consultants, Extension agents). Producers (and those who advise them) will have information in readily available formats to use to make decisions regarding the economic and yield benefit of choosing a rotation partner for soybean, instead of making decisions based on the market or Midwestern data. The trial will lend much needed valuable information on feed grains residue management impact on the succeeding soybean crop. Furthermore the study could provide viable information on fluctuating pest pressures (weed, insect and disease, as well as nematode pests) with the shift from monoculture bean production to a feed grains rotation based system. The proposal will also allow for revision of current best management practices of feed grain systems when rotated with soybean for the Mid-South.

**Timeline:**

*List the anticipated timeline for key phases of the proposal. Focus on key milestones only and not day-to-day operations.*

Fall/Winter 2017

* Collate yield, post-harvest soil analysis and begin analysis
* Evaluate soil sample and nematode analysis.
* Present results at American Society of Agronomy meetings, as well as multiple producer meetings throughout the study
* Begin preparation for second publication and begin developing state-specific rotational guides.

Spring/Summer 2018

* Plant continuation of rotational treatments.
* Conduct research planning and discussion meetings with cooperators.
* Communicate findings to producers through field days and individual interactions.
* Develop short video presentations for posting on QSSB websites about rotational recommendations and implications of study.

Fall 2018

* Collate yield, post-harvest soil samples and send samples for nutrient and nematode analysis.
* Provide updated information to producers based on findings of year 4 of the study
* Begin data analysis and begin preparations for third publication.
* Finalize site specific production guides and sent to Osborne and Barr for proofing.

**Expected Outputs/Deliverables:**

*No long narrative is required here. List specific outputs and/or deliverables and describe them, i.e. number of things by X date, reports to be submitted, etc. These MUST include all deliverables listed in the Request for Proposal (RFP) as well as any additional deliverables the proposal will provide.*

1. One manuscript will be submitted on economic returns from various rotational systems for Mid-South soybean production systems.
2. State specific rotational guides will be prepared and readied for publications.
3. Soil test data will be examined to evaluate the effect of residue management and crop rotation of retention of soil nutrients.

**Key Performance Indicators:**

At least 30% of soybean growers in the Mid-South region adopt crop rotations and residue management practices identified in this study to increase soybean yield and profitability. Surveys on current rotational practices, as well as intentions about future rotations will be administered to soybean producers at major annual year-end meetings such as the Row Crop Short Course. Tracking rotational practices yearly over the course of the study will allow for assessment of changes in practices as a result of this research.

**Credentials:**

**John Orlowski**, PhD is an Assistant Extension/Research Professor in Agronomy at the Mississippi State University. Dr. Orlowski leads agronomic research and Extension activities for soybeans in the Mississippi Delta. Dr. Orlowski’s work is supported by the Mississippi Soybean Promotion Board, as well as the United Soybean Board, Mid-South Soybean Board, United Sorghum Checkoff Program, Mississippi Corn Promotion Board, as well as multiple agricultural companies.

Gurpreet Kaur, PhD is a Postdoctoral Research with Dr. Orlowski at Mississippi State University. Dr. Kaur has worked extensively on agronomic and soil issues in corn and soybean production. She has published extensively and has provided support for earlier versions of this project.

**Budget:**

*Attached.*