

Project Number:	1720-172-0124/1820-172-0124
Project Title:	Enhanced Pest Control Systems for Midsouth Soybean Production
Organization:	LSU AgCenter
Principal Investigator Name:	Trey Price
<p>Project Status - What key activities were undertaken and what were the key accomplishments during the life of this project? Please use this field to clearly and concisely report on project progress. The information included should reflect quantifiable results (expand upon the KPIs) that can be used to evaluate and measure project success. Technical reports, no longer than 4 pages, may be included in this section.</p> <p>Both breeding line and commercial cultivar data collected over 2016-2017 were analyzed. Breeding lines PI 548548 and PI 592756 (blight symptoms), and PI398982 and PI399022 (petiole symptoms) were found to be resistant to Cercospora Leaf Blight (CLB) both years across all locations that saw disease based on their individual disease parameters used. No commercial cultivars were found to be resistant by conventional standards in part because of high variability between locations. A publication should be produced soon that details the general resistances between varieties as well as meaningful state-wide resistances. It was determined that the original rating system introduced too much variability in the data set. A simplified scale was distributed to cooperators prior to rating commencement during 2018. During 2018, 16 locations were planned for the CLB variety (45 entries). Site visits to all locations across AL, AR, LA, MO, MS, TN, and TX were conducted by Dr. Brian Ward. Every location displayed CLB symptoms, and isolates were collected from all locations, resulting in a 1,000+ isolate collection. Stocks were created and catalogued for population studies and fungicide resistance screenings. Data is currently being compiled for the 2018 field trials to be added to the existing data. With strong data coming in, publications on both the PI and variety trial should be coming soon. Most of the trials were either recently harvested or remain in the field. More detailed reports of our findings will materialize for the winter meetings. Multiple quarterly and final reports that provide more project details are attached to this report as supplementary material.</p>	
<p>Did this project meet the intended Key Performance Indicators (KPIs)? List each KPI and describe progress made (or not made) toward addressing it, including metrics where appropriate.</p> <ul style="list-style-type: none"> • A regional variety trial will be conducted, using core commercial varieties, advanced breeding lines, and plant introductions, where natural disease reactions will be recorded and compiled in an annual publication for public researchers, extension personnel, and farmers that is made available for inclusion in each state's SVT publication or similar venue, that provides farmers with variety choices that are more resistant and thus more profitable. Regional variety trials with 45 entries were successfully conducted during 2018. Data has been compiled from the 30-entry trials during 2016 & 2017 and could be released in a publication, if we determine the information is valuable to stakeholders. • Consistency of disease reactions among locations will be compared and promising plant introductions, germplasm, or cultivars with stable resistance across environments will be identified for breeding stock and results shared with private and public soybean breeders to incorporate resistance into commercial varieties that benefit farmers. Four PIs, PI 548548 and PI 592756 (blight symptoms); and PI398982 and PI399022 (petiole symptoms), were identified with resistance to CLB across all locations and years. We cannot publish this information until we have results from the 2018 growing season. Since each location was a replication, statistically, the trials are invalid until we have more observations. Six PI locations were successful during 2018. • Release of high yielding lines with CLB and/or improved FLS resistance is expected in 2020, which can result in greater control of these diseases. Dr. Chen's group in Missouri had advanced yield trials during 2018 composed of 136 high yielding advanced breeding lines. These entries are being grown in 5 locations across three different soil types in Southeast Missouri. These lines are also being grown in Arkansas, Mississippi, and Louisiana for yield. These entries were monitored for symptoms of CLB and 	

other diseases such as SDS and FLS throughout the season. Based on current progress, the breeders seem to be on track for this KPI. No update has been received from Dr. Buckley for the entire 2018 season.

- By the end of 2018 growing season, soybean producers, breeders and consultants in the Mid-South should have begun using confirmation of QTL/markers for CLB and FLS resistance and regional evaluation of breeding lines for resistance and yield is expected in 2019 that can result in seed company offerings to farmers where this resistance is needed to avoid significant yield loss. Dr. Chen received 6 lines with resistance to stink bugs from Jeff Davis that were grown in our 2018 Crossing Block. 17 crosses with high yielding conventional, RR1 and R2Y lines for genetic mapping and breeding purposes. The F1 hybrids will be sent to a winter nursery in Puerto Rico for generation advancement.

- Top performing advanced soybean lines which have a significant level of resistance to stink bugs and are appropriate for each state's growing conditions are slated for development by 2022 which would represent a significant breakthrough in pest control i.e. a class of insects currently only partially controlled by insecticides. Dr. Chen and Dr. Davis appear to be making progress towards this KPI. At the time of this report, Dr. Davis had just harvested some trials two days prior and has not had time to analyze data as of yet.

Expected Outputs/Deliverables - List each deliverable identified in the project, indicate whether or not it was supplied and if not supplied, please provide an explanation as to why.

- Useful information concerning varietal resistance to multiple diseases will be generated for utilization by producers. An annual report detailing results from the regional uniform variety trial will be provided in a timely manner to stakeholders in each state through a variety of media to aid in planting decisions (extension bulletins, newsletters, email, blogs, professional meetings, field days, cross-referenced variety selection tool on individual states' websites, etc...). **Supplied. Please see first KPI.**

- In the short term, important disease resistance data will be generated for new plant introductions (breeding stock) and selections to serve as a guide for breeder selections and longer term goals. **Supplied.**

- Breeding efforts are expected to identify resistance to Cercospora leaf blight in the short term. Plant introductions (PIs) from GRIN and advanced breeding lines will be screened for CLB and resistant lines will be used a source for future research. A total of 580 PIs will be screened and used for association mapping for CLB and those PIs have 50K SNP chip data available. Interaction between CLB and purple seed stain (PSS) will be studied using advanced breeding lines as well as PIs. Identification of QTL/markers for CLB and FLS and the development and release of high yielding germplasm lines /cultivars resistant to CLB and FLS are expected in the long term. Breeders will work closely with plant pathologists to observe if reactions to CLB vary and observe possible isolate variations. **Supplied.**

- The key outcome will be high yielding, locally adapted soybean cultivars that are resistant to both stink bugs and diseases. In addition, a set of germplasm will be created to easily incorporate resistance into new cultivars. **Supplied.**

- Once resistance has been identified, our future approach will be to identify and map markers contributing to stink bug and disease resistance and to use marker assisted selection (MAS) to pyramid beneficial genes into current high-yielding adapted cultivars. By using MAS, it is possible to quickly screen large quantities of plant materials and remove progeny lacking the marker prior to testing for phenotypic response. Development of recombinant inbred lines (RIL) for mapping CLB and FLS resistance and selection within advanced breeding populations for resistance is expected by the end of 2017. Confirmation of QTL/markers for CLB and FLS resistance and regional evaluation of breeding lines for resistance and yield is expected in 2019. **Supplied. Breeding lines expected in 2019.**

- Increase seed of promising stinkbug resistant lines in winter nurseries for 2018. **Supplied.**

- Initiate mapping populations for stinkbug resistance. **Supplied.**

- Make crosses to develop an initial set of lines with elite material to improve agronomic characteristics. **Supplied.**
- By the end of the 2016 growing season, preliminary mechanisms of resistance to stink bugs were identified and shared with the target audience. By the end of the 2018 growing season, specific mechanisms of resistance to stink bugs will be identified. **Unknown. Dr. Davis has not had time to provide this information.**
- The benefits of using stink bug and disease resistant varieties will be promoted directly to growers during field days and on-farm demonstrations. Results and pertinent project updates will be reported to the entire mid-South soybean industry in appropriate participating statewide media. For example, in Louisiana it would be the Louisiana Agriculture Magazine, the official publication of the Louisiana State University AgCenter; the Louisiana Soybean & Feed Grain Review, and at commodity and professional meetings, e.g., Louisiana Soybean and Grain Research and Promotion Board Annual Meeting, and the annual branch and national meetings of the Entomological Society of America. **Supplied.**

Describe any unforeseen events or circumstances that may have affected project timeline, costs, or deliverables (if applicable.)

The timing of the project funding has made it difficult to set up contracts with other universities so they can begin billing in a timely manner. There is a major paperwork lag.
Several CO-PIs on the project have not expended their funding, and it is unclear if no-cost extensions are available. More flexibility in this matter would be welcomed.

What, if any, follow-up steps are required to capture benefits for all US soybean farmers?
Describe in a few sentences how the results of this project will be or should be used.

Traits developed from this project can be incorporated into commercial, high-yielding soybean varieties adapted to the Mid-South, where CLB and stink bug management are crucial for economically sustainability for producers.

Along with follow-up data analysis of incoming CLB data from the 2018 growing season, population and fungicide resistance studies will be conducted on the Cercospora isolate collection made during 2018. Results from these projects will give breeders resistant lines to CLB that they can incorporate for resistance in commercial cultivars, inform growers of commercial varieties that are particularly resistant or susceptible to CLB, give a map of pathogen population to aid in understanding of the disease, and alert experts to fungicide resistance across the mid-south to widely-used fungicide classes.

List any relevant performance metrics not captured in KPI's.

Dr. Brian Ward continues work on a method for screening for CLB resistance using a cercosporin assay. Further molecular and biological quantification work is being done analyzing factors that trigger symptoms in the late stages of soybean growth as compared to early vegetative and reproductive stages. Projects are being conducted analyzing soybean bacterial endophytes' effects on Cercospora pathogens, and if they could be used as a form of biological control.
Fungal pathogen viral testing is being conducted as another avenue for potential management strategies.