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| Please use this form to clearly and concisely report on project progress. The information included should reflect quantifiable results that can be used to evaluate and measure project success. Comments should be limited to the designated boxes. Technical reports, no longer than 4 pages, may be attached to this summary report. | |
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| Project Title: | Breeding Maturity Group 4 Soybean with Enhanced Resistance to Southern Root-knot Nematode by Reducing Galling and Nematode Reproduction |
| Organization: | University of Arkansas |
| Principal Investigator Name: | Caio Canella Vieira |
| Report Period: | June – September, 2025 |
| Project Status: | |
| **Objective 1 - Characterization of the mechanism of resistance (Faske, Nguyen)**  *Characterize the response of lines carrying different combinations of the resistance regions on chromosomes 10 and 13 as well as genetically diverse accessions for nematode reproduction and root galling.*  **Faske, University of Arkansas:**  One greenhouse experiment has been completed. All 16 recombinant lines were planted (4 reps) on June 30 and inoculated on July 10 with 4,000 eggs of *M. incognita* at the Lonoke Extension Center. The experiment was sampled in September and root gall ratings conducted and egg counts extracted and counted from Sep 3 to Sep 10. Data were entered but have yet to be analyzed. As a causal observation gall ratings ranged from 1 to 4 using a 0-5 scale and eggs were extracted from all entries. Some entries like MPB0551-1 died during the experiment and one did not germinate so there are only two data points per independent variable.  **Nguyen, University of Missouri:**  As reported in June, we identified sixteen contrasting recombinant inbred lines (RILs) derived from a cross between Magellan (susceptible to SRKN) and PI 438489B (resistant to SRKN). Materials were sent for yield and agronomic traits evaluation to Vieira’s group, and planted in Stuttgart, AR. Yield data from this trial will be correlated with phenotypic results to assess the effects of different QTL combinations on both SRKN resistance and overall soybean performance.  Selected RILs represent different QTL combinations: Chr. 10 + Chr. 13, Chr. 10 only, and Chr. 13. Chr. 10 QTL is known to have a major significant effect on phenotypic variation, while Chr. 13 contributes a smaller effect. Together, these RILs provide excellent genetic material to study the individual and combined impact of these loci on SRKN resistance. Seeds from each RIL have been shared with Dr. Faske’s group at the University of Arkansas for SRKN phenotyping for galling and reproduction index evaluations.  **Objective 2 – Development of SRKN-resistant breeding populations (Vieira, Lin)**  *Develop MG 4 breeding populations and varieties with SRKN resistance suitable for production in the Mid-South.*  **Vieira, University of Arkansas:**  **2025 Potential Release:** Progress continues as anticipated for soybean lines with resistance to SRKN. The pre-foundation seed increase of R19-45980 is advancing well at Kibler, Arkansas. The first round of flower color roguing activities has finished and will continue as materials progress for pod and pubescence color, as well as maturity. Line R21KB-05522 remains in testing through both the ARVT and USDA Southern Uniform Trials.  **2025 Pre-Commercial Stage:** In our advanced pre-commercial yield trials, lines continue to develop across five locations in Arkansas, as well as five additional testing sites in Mississippi, Louisiana, and Tennessee. Evaluation of the three SRKN-resistant lines in internal, USDA UP, and ARVT trials is also progressing as expected.  **2025 Preliminary Stage:** As previously noted, approximately 1,043 lines across 23 preliminary yield tests, representing maturity groups 3L through 5E, continue to develop normally at all testing locations. Tissue collection, DNA extraction, and genotyping with the BARCSoySNP6K chip were completed in collaboration with the USDA Soybean Genomics and Improvement Laboratory at the Beltsville Agricultural Research Center in Maryland. The resulting genomic data have been received and are currently undergoing quality control and data analysis. Once finalized, these data will be incorporated into genomic prediction models and combined with prior years’ datasets to improve model accuracy. The refined models will play a central role in the November selection meeting and will also support ongoing SRKN pedigree research.  For the proprietary disease and abiotic stress panel, seed samples were submitted, screened, and the results have been received. Notably, 43 lines carrying the SRKN-resistance trait were identified. Depending on yield performance, these lines will either advance to the 2026 final yield trials or, if performance is unsatisfactory, serve as parental material for crossing and trait transfer into elite, high-yielding backgrounds.  **2025 Progeny Rows:** A total of 18,938 progeny rows, representing 181 distinct populations, were established in Stuttgart, Arkansas. Over half of these populations included at least one parent with confirmed SRKN resistance, reflecting ongoing efforts to expand the deployment of this trait and advance toward broad resistance across all materials. Early evaluations indicate strong pod set and notable variation among families, both of which are key factors for breeders' selections.  **2025 Crossing Block:** Crossing activities were completed in the second week of August, involving 16 SRKN-resistant parental lines. Approximately 80 populations were developed using at least one parent resistant to SRKN. Materials are continuing to develop, and hand harvest will occur as they reach physiological maturity. Harvested seeds will be dried, inventoried, and sent to the winter nursery for generation advancement.  **2025 SRKN Yield Trials and Seed Increases:** The 16 recombinant inbred lines (RILs), together with nine key reference genotypes, have been successfully established in Stuttgart, AR, for both seed increase and yield evaluation. All lines are developing normally, and in the ongoing yield trials, important agronomic traits, including maturity, lodging resistance, and final plant height, will be carefully recorded. Grain yield and seed composition data will also be collected and summarized in the following report.  **Lin – University of Missouri:**  **2025 Screening for Resistance**: A total of 121 lines from the Advanced Yield Trials (AYT) were submitted for phenotypic screening to assess galling scores. These lines will also undergo molecular marker analysis for the major SRKN resistance gene located on chromosome 10. Results are pending.  **2025 Crossing Block:** The 2025 crossing season was successfully completed, with 80 crosses made incorporating SRKN-resistant parental lines. The harvested seeds will be sent to winter nursery for population advancement.  **2025 Breeding Population Advancement:** Crosses made during the 2024 season were advanced in winter nursery for generation advancement. The resulting materials are expected to be returned in April 2026, when they will be planted as progeny rows for evaluation of agronomic traits and yield potential.  **2025 Progeny Rows**: More than 160 progeny row populations were received from the winter nursery and were planted during the 2025 growing season. At least 30% of these populations include one parent with confirmed SRKN resistance. They are currently being evaluated for agronomic traits and yield potential, with harvest expected to begin in October.  **2025 Preliminary Yield Trials:** A total of 1,500 progeny rows were planted as part of the 2025 preliminary yield trials. These lines are being evaluated for agronomic performance and yield potential, with several derived from SRKN-resistant parents. The harvest will start in the following weeks.  **2025 Advanced Yield Trials**: A set of 121 lines from maturity groups 3L to 4L were selected for the 2025 AYT. These lines are being evaluated across multiple locations for yield potential. As noted above, they will also be assessed both phenotypically and genotypically for SRKN resistance. Harvest of the Advanced yield trials will begin in the second week of September.  **USDA Trials:** For the 2025 USDA Preliminary Uniform Trial, 12 lines from the 2024 AYT were selected based on strong SRKN resistance and high yield performance, with maturity groups ranging from 3L to 4L. Among these, two lines carry Enlist® herbicide technology. Additionally, two SRKN-resistant, high-yielding lines have been included in the USDA Uniform Trial (UT) and are under consideration for potential release in 2026. | |