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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. |
| Project Number: |  |
| Project Title:  | Screening soybean germplasm and breeding soybeans for flood tolerance |
| Organization:  | University of Missouri-Fisher Delta Research Center |
| Principal Investigator Name: | Shannon Grover, PhD |
| Other investigators: | Drs. Francia Ravelombola, Chengjun Wu, Caio Vieira, Tessie Wilkerson, and David Moseley |
| Report Period: | March 16, 2023 to June 15, 2023 |
| Project Status: On-going(What key activities were undertaken and what were the key accomplishments during this quarter? Please use this field to clearly and concisely report on project progress).  |
| **MISSOURI (Shannon)**Five lines, namely S19-17313, S19-17667, S19-17693, S17-1146, and S12-1362, consistently displayed flood tolerance at R1 stages across various years, and locations across states. To investigate their genetic traits associated with flood tolerance, these lines will be screened in Dr. Henry Nguyen's lab to determine if they carry flood tolerant markers previously identified from genetic mapping studies**1. Evaluation of breeding lines for flooding tolerance and yield to develop commercial varieties.****i) Advanced yield trials**: A total of 20 MG4, and 22 MG5 will were planted in 4-row plots in a heavy clay, zero grade field with 3 replications for exposure to flooding stress beginning at both the V2 (early) and R2 (reproductive) growth stages. The same set of lines will be evaluated under non-stress conditions in the same field at both the V2 (early) and R2 (reproductive) growth stages to determine lines with least yield reduction under flooding compared to popular commercial varieties of similar maturity. Those lines with least yield reduction from flooding will be classified as flood tolerant.**ii) Preliminary yield trial:** A set of 23 MG4 breeding lines, visually selected from progeny rows in 2022, were planted in 4-row plots with 2 replications. The soybean breeding lines were planted at the Lee Farm in Portageville, MO, and will be subjected both flooded conditions (V2 and R1 growth stages) and non-flooded conditions. The purpose is to evaluate the lines for flood damage score at V2 and R1 stages as well as to assess their seed yield at harvest. Seed yield among lines will be compared between flooded conditions at V2, flood conditions at R1, and non-flooded conditions.**2. Yield evaluation of selected tolerant and sensitive lines in flooded and non-flooded field:** A set of 9 tolerant and 9 sensitive lines for flood from MO, AR and NC, along with 2 commercial checks were planted in 4-row plots in 3 replications for flood tolerance and yield under flooded (R1/R2 stage) and non- flooded conditions at the Lee Farm, Portageville, MO. The same set were planted in Arkansas and North Carolina. The objective of this test is to evaluate effects of flooding stress on seed yield, seed composition (including protein and oil concentration) and seed quality across different states. **3. Screening of recently developed elite lines for flood tolerance (MSSB-FLD test):** A set of96 breeding lines, recently developed at the University of Missouri - FDREEC and at the University of Arkansas and six checks (5 commercial cultivars and one sensitive line) were included in the screening test. These lines were planted in 7’ single-row plots in 3 replications at the Lee Farm, Portageville, MO. The entries will be subjected to flooding stress at R1/R2 stage and then will be evaluated for flood tolerance. To evaluate the consistency of flood tolerance across different states, the same set of 96 breeding lines is being tested under identical conditions in Arkansas, Louisiana, and Mississippi. This additional testing aims to assess the flood tolerance of the lines and determine if their performance remains consistent across various geographical locations.**4. Missouri commercial variety testing for flood tolerance:** A total of 55 MG4 and MG5 commercial varieties developed by 13 different seed companies along with most advanced Missouri flood tolerant lines were planted in single 7-ft long row plots with 3 replications under flooding stress for at R1/R2 at the Lee Farm Portageville, MO. Lines will be waterlogged at R1/R2 stages and will be visually scored for flood tolerance. **5. Progeny rows:** About 400 new breeding lines derived from flood tolerant crosses will be grown in single progeny rows in the 2023 season. Seeds of each line will be planted in early June. **6. Breeding populations advancement:** Four flood tolerant breeding populations were developed in 2022. The F1 seeds of these crosses were sent to the off-season nursery where the populations will be advanced to F4 for testing in 2024.**7. New crosses:** About 4-5 new crosses between flood tolerant PIs/lines and elite breeding lines will be made with a view to develop new high-yielding flood tolerant varieties. **ARKANSAS (Vieira)****Arkansas (Vieira):****June 1, 2023 Season Update**: Preparation of soybean breeding lines and populations for planting is fully completed (cleaning, packaging, and boxing seeds). Yield and research trials have been planted in Marianna, Pine Tree, Rohwer, Stuttgart, DeWitt, and Fayetteville. Progeny rows have been planted in Kibler, AR, and all three dates of the crossing block have been planted in Fayetteville, AR.**2023 Germplasm Release:** The conventional MG5 line R16-45 has been released as a high-yielding and flood-tolerant germplasm. The manuscript for R16-45 registration was submitted to the Journal of Plant Registrations in March. The purified breeder seeds of R16-45 germplasm are being increased in Fayetteville, AR.**2023 Advanced Yield Trials:** A total of 19 advanced breeding lines (7 MG4 and 12 MG5) with flood-tolerant pedigrees are being evaluated for yield in two replicated trials in four Arkansas locations (Marianna, Pine Tree, Rohwer, and Stuttgart). The purified breeder seeds of these lines are being increased in Fayetteville, AR. Meanwhile, all 19 lines will be evaluated for flood tolerance under 8–10-day flooding conditions at R1 growth stage in Stuttgart, AR.**2023 Ongoing Population Development and Advancement:** A total of 136 progeny rows with flood tolerant pedigree (R16-45/R15-2422) are being evaluated in Kibler, AR. Selected rows will be moved into 2024 Preliminary Yield Trials. A total of 25 flood tolerant populations (14 EG2/11 EG3) are currently being advanced in the U.S. and off-season nurseries. Between 10 to 15 new crosses derived from flood tolerant and elite/value-added parental lines will be made in summer 2023. Value-added traits include high-yielding background, herbicide tolerance (Enlist E3), high protein and oil, and enhanced fatty acid profile (high oleic, low linolenic acids).**MISSISSIPI (Wilkerson)**One complete set of the Mississippi State University official variety trial was planted on June 1, 2023. Plots were planted 2 rows wide and 12 ft in length to allow for harvest. Plots will be flooded at v2/v3 growth stage for 72-96 hours to allow differences in natural flood tolerance to be observed. Once the flood is removed plots will be evaluated for flood incidence and severity (7 days prior to flood removal).Hill plots consisting of seed sent from both Arkansas and Missouri were also established (hand planted) on June 1, 2023 with 3 replications. Plots will be flooded at R1/R2 growth stage for 72-96 hours. Once the flood is removed plots will be rated for flood incidence and severity (7 days after flood removal).**LOUISIANA (Moseley)**1. **Flood tolerance evaluation of elite lines from AR and MO** A total of 100 lines including 90 developed by the University of Arkansas and the University of Missouri, and 10 commercial checks are packaged and scheduled to be planted in 5-feet single-row plots with 3 replications on June 13, 2023, at the Red River Research Station in Bossier City, LA. The plots will be flooded at the R1 growth stage.
2. **Evaluation of commercial varieties for flood tolerance** A total of 71 varieties from the 2023 Louisiana soybean OVT trial are packaged and scheduled to be planted in 5-feet single-row plots with 3 replications on June 13, 2023, at the Red River Research Station in Bossier City, LA. The plots will be flooded at the R1 growth stage.
3. **Yield evaluation of flood tolerant and sensitive lines:** Twenty flood tolerant and sensitive germplasm/lines developed from AR and MO are scheduled to be planted in two side-by-side, flooded and non-flooded tests, with three replications (two 20-foot rows per plot) at the Red River Research Station in Bossier City, LA. The flooded trial will be flooded at the R1 growth stage.
4. **Screening of recently developed elite lines for flood tolerance:** A set of80 lines are packaged and scheduled to be planted in 5-feet single-row plots with 3 replications on June 13, 2023, at the Red River Research Station in Bossier City, LA. There will be two identical sets. One set will be flooded at the V2 growth stage and the other set at the R1 growth stage.
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