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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: | Dr. Pengyin Chen |
| Other investigators: | Drs. M. Liakat Ali, Andrea A. Galindo, Tessie Wilkerson, David Moseley, and Blair Buckley  |
| Report Period: | March 15, 2022 to June 15, 2022 |
| 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:****1. Evaluation of breeding lines for flooding tolerance and yield to develop commercial varieties.**i**) Advanced yield trials**: A total of 36 breeding lines (18 MG4 and 18 MG5) will be evaluated for yield and flooding tolerance. These included selections from 2021 flood AYT, 2021 preliminary yield trials (PYT), and elite 2022 USDA Uniform Tests entries. One flood-tolerant and susceptible check and 4 commercial checks are also included in each MG test. Entries will be evaluated under flooding and non-stress conditions and will be planted in 4-row plots with 3 replications. The non-stress trial has already been planted in 2 locations. The flooding experiment will be planted as soon as the field moisture situation becomes suitable.**ii) Preliminary yield trial:** A total of 28 new breeding lines (F4:6) selected from 2021 progeny rows (6 bi-parental populations) will be evaluated for flooding tolerance and yield. The test also includes one flood-tolerant and susceptible check and 3 commercial checks. Entries will be planted in 4-row plots (7 ft. long) in 2 replications under flooding and non-stress conditions. The non-stress field has already been planted in one location, while the flooding trial will be done as soon as the field gets dry.**2. Yield evaluation of selected tolerant and sensitive lines in flooded and non-flooded field:** A set of 18 lines (roughly half tolerant, half susceptible) will be evaluated for flood tolerance and yield under flooding stress, and yield in non-stress conditions. Two commercial checks are included for yield comparisons. The entries will be planted in 4-row plots (12 ft. long) in 3 replications. The lines will be exposed to flooding stress during the R1/R2 stages (mid-season). The planting seed packets are ready and will be planted as soon as the field gets dry. These lines are also being grown in different states (AR, LA, MS, and NC) for the same purpose.**3. Screening of recently developed elite lines for flood tolerance:** A set of96 breeding lines recently developed at the University of Missouri-Fisher Delta Research Center and at the University of Arkansas and six checks (5 commercial cultivars and one sensitive line) have been included in the screening test. These lines will be planted in 7’ single-row plots in 3 replications. The test entries will be subjected to flooding stress for 8-10 days with 4-5 inches of water at R1/R2 stage. Planting seed packets are ready and planting will be done as soon as suitable field moisture situation is observed.**4. Missouri commercial variety testing for flood tolerance.** A set of 63 commercial varieties developed by 14 different seed companies will be evaluated for flooding tolerance in the field. The test entries will be planted as a single row plot (7 ft. long) with 3 replications. Varieties will be subjected to flooding stress during the R1/R2 stage. The planting packets are ready and will be planted as soon as the field soil moisture is appropriate.**5. Testing of new breeding lines in progeny testing** **nursery:** About 700 F4:5 progeny lines derived from 7 bi-parental populations will be tested in progeny rows (Table 1). The F4:5 seeds are being processed for planting in non-flooded conditions. Lines will be selected based on pod load, agronomic traits, and overall yield potential at maturity and will be advanced to 2023 PYT for yield assessment.Table 1. Summary of flood-tolerant bi-parental populations developed in 2020

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| Cross | Pedigree | Generation | Year of evaluation |
| S20-311 | S14-16267 (FT)x S12-1362 (FT) | F4:5 | 2022 |
| S20-312 | S12-1362 (FT) x R04-342 (FT) | F4:5 | 2022 |
| S20-313 | RIL 123 (FT) x R04-342 (FT) | F4:5 | 2022 |
| S20-314 | R11-6870 x S12-1362 (FT) | F4:5 | 2022 |
| S20-320 | S14-16267 (FT)x UA5814HP (High Protein) | F4:5 | 2022 |
| S20-321 | S12-1362 (FT) x Osage (Protein) | F4:5 | 2022 |
| S20-322 | RIL 123 (FT) x R11-7999 (Protein) | F4:5 | 2022 |

**6. Breeding populations under generation advance:** Three crosses were made in 2021 to develop new flood-tolerant, high-yielding soybean varieties (Table 2). These populations are currently being advanced in off-season nurseries and F4:5 seeds will return to Portageville, MO for evaluation and line selection in the 2023 growing season.Table 2. Summary of flood-tolerant bi-parental populations in generation advancement

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| --- | --- | --- | --- |
| Cross | Pedigree | Current Generation | Year of evaluation |
| S21-806 | S12-1362 x S18-3460 | F2:3 | 2023 |
| S21-807 | S18-3555 x S12-1362 | F2:3 | 2023 |
| S21-808 | S16-3739RY x S12-1362 | F2:3 | 2023 |

**7. New crossing plan in 2022 season:** Roughly 10-12 new crosses between flood-tolerant PIs/lines and elite breeding lines will be made to develop new high-yielding flood-tolerant breeding materials.**Mississippi:**A set of the Mississippi official state variety trial is being preparing for planting to determine natural flood resistance within commercial varieties. Trials will be arranged as 2 row plots, 3 replications. The field will be flooded at v2/v3 for 72-96 hours. Plots will be harvest at maturity to determine the yield effect, if any, of early stage flooding.**Louisiana:****Flood Yield Trial (FYT)*** On June 8, 20 entries were planted for two treatments (flood and Non-flood) with three reps. Herbicides were applied including Valor at 3 oz./A, Dual Magnum II at 1.5 pt./A, Liberty 1 qt./A and Induce(surfactant) at 1 pt./100 gals.
* Levees for flooding were built.
* The trial will be flooded at the R1 growth stage.

**GxE Study for USD-Flooding FY22*** Packaged 94 lines for two treatments (flood or waterlog at V2 and R1 stages) with three reps to be planted as soon as possible.

**Arkansas:****Flood yield and tolerance breeding:** Fifty-eight advance lines with high-yielding and flood-tolerant pedigrees are being evaluated yields in multiple Arkansas locations and flood tolerance at R1/R2 stage in Stuttgart, AR. Twenty-seven preliminary lines derived by flood-tolerant parents are being evaluated yields at three locations and flood tolerance at R1/R2 stage in Stuttgart, AR. In addition, the new progeny rows, breeding populations, and crossing combinations have been planted in Kibler and Fayetteville stations, AR.**Flood tolerance screening:** A set of 95 elite lines developed by Arkansas and Missouri Soybean Breeding Programs and five commercial checks are being evaluated flood tolerance at R1/R2 stage with 3-reps in Stuttgart, AR. **Commercial varieties evaluation for yield and flood tolerance:** In 2022, we are cooperating with Arkansas Variety Test Program to evaluate yield and flood tolerance performances of commercial varieties under flooding and non-flooding treatments (side by side). These tests are being conducted at three Arkansas locations with three replications. **Flood effect to yield and seed composition:** Four-teen flood tolerant/susceptible lines and two commercial checks are being evaluated yields and seed compositions under both short-term (4-day) flooding and non-flooding conditions at Stuttgart, AR. All breeding tests and experiments for yield and flooding screening were planted in May and June 2022 and seeds germinations are good. |