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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, Jeff Edwards, Daryl Chastain, Tessie Wilkerson and Blair Buckley |
| Report Period: | December 15, 2021 to March 15, 2022 |
| Project Status: Ongoing(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 38 breeding lines in two groups: MG-4 (19 lines) and MG-5 (19 lines) will be evaluated along with commercial checks for flooding tolerance and yield. The test lines include selections from 2021 flood advanced yield trials, 2021 preliminary yield trials and elite breeding lines that are included in the 2022 USDA soybean Uniform Test (UT). One flood sensitive check and 3 commercial varieties will also be included in each test. The tests will be planted in 4-row plots with 3 replications under both flooding stress and non-stress conditions. The lines will be exposed to flooding stress during R1/R2 (mid-season) for 8-10 days depending on stress injury signs on sensitive check.**ii) Preliminary yield trial:** A total 27 MG 5 breeding lines selected from 2021 progeny rows (derived from 8 crosses) will be evaluated for flooding tolerance and yield. The test entries will be planted in 7’ 4-row plots in 2 replications in flooded and non-flooded fields. Several commercial varieties and one sensitive line will also be included as checks in the trial.**2. Yield evaluation of selected tolerant and sensitive lines in flooded and non-flooded field:** A set of 14 lines, of which 8 are known to be tolerant and 6 are known to be sensitive, will be evaluated for flood tolerance and yield under flooding stress while under normal irrigation condition, only yield performance will be tested in 2022 season. The test entries will be planted in 12’ 4-row plots in 3 replications. The lines will be exposed to flooding stress during R1/R2 (mid-season) for 8-10 days depending on stress injury signs on sensitive check. The objective of this test is to evaluate effects of flooding stress on seed yield, seed composition and seed quality. These lines will also be grown in other locations (AR, MS, NC and LA).**3. Screening of recently developed elite lines for flood tolerance:** A set of95 breeding lines, recently developed at the University of Missouri-Delta Research Center and at the University of Arkansas and five checks (4 commercial cultivars and one sensitive line) will be 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 day with 4-5 inches of water at R1/R2 stage. **4. Missouri commercial variety testing for flood tolerance.** During 2022 season about 100 commercial varieties (the exact number is not yet known) developed by different seed companies will be evaluated for flooding tolerance. The test entries will be planted in 7-ft single row plots in 3 replications. The test entries will be subjected to flooding stress for 8-10 day with 4-5 inches of water at R1/R2 stage.**5. Testing of new breeding lines in progeny testing** **nursery:** About 700 F4:5 single plant progeny lines from 7 populations (the list of the crosses given in Table 1) are expected to be grown in progeny testing nursery during 2022 season. The F4:5 seeds are expected to arrive Portageville, MO in May 2022 from winter nurseries.Table 1. List of the crosses made in 2020 are in generation advance from F1 to F4 in winter nursery and the F4:5 progenies will be evaluated in progeny testing nursery in 2022.

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

**6. Breeding populations under generation advance:** Three crosses made in 2021 to develop new flood tolerant high yielding soybean varieties from tolerant PIs/lines and elite breeding lines are being advanced in winter nurseries in Costa Rica (CR) and Puerto Rica (PR), and these are expected to be in F3 generation by the end of 2022. The F4:5 seeds will return to home station for evaluation and lines selection in 2023 season. The list of the crosses is given in Table 2Table 2. List of the crosse made in 2021 season aiming at developing new flood tolerant cultivars.

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

**7. New crossing plan in 2022 season:** About 7-8 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:****1. Flood Tolerance Breeding:** In 2022, a total of 58 advance lines (45 MG4 and 13 MG5) with high-yielding and flood-tolerant pedigrees will be evaluated for flood tolerance at R1/R2 stage in Stuttgart, AR, and yield in multiple Arkansas locations. Similarly, twenty-seven preliminary lines derived from flood-tolerant parents will be yield evaluated under flood conditions at R1/R2 stage in Stuttgart, AR, and yield performance at three locations. Meanwhile, new progeny rows, single plants, populations, and crosses with flood-tolerant pedigrees will be developed, selected, and advanced during the 2022 season. **2. Flood Tolerance Screening:** A set of 95 elite lines developed by Arkansas and Missouri Soybean Breeding Programs and five commercial checks will be evaluated for flood tolerance at R1/R2 stage with 3-replications in Stuttgart, AR. These are high-yielding lines, with genetic diversity pedigree, disease resistance, drought tolerance, and high protein, oil, and oleic acid.**3. Evaluation of flood effect to yield and seed composition:** Four-teen flood-tolerant/susceptible lines and two commercial checks will be evaluated yields and seed compositions under both short-term (4-day) flooding and non-flooding conditions at Stuttgart, AR, in 2022. **4. Evaluation of Arkansas commercial varieties for yield and flood tolerance:** In collaboration with the Arkansas Variety Test Program, yield and flood tolerance performance of commercial varieties (MG4 and 5) provided from multiple companies will be evaluated under flooding and non-flooding treatments (side by side). Tests will be conducted at three Arkansas locations with three replications. Cleaning and packaging of these materials is ongoing for the 2022 planting season.**Mississippi:**The recently developed lines from this project and commercial varieties will be tested for flood tolerance. All the soybean varieties will be subjected to flooding stress for 8-10 days with 4-5 inches of water at R1/R2 stage. The lines included in the study will be rated for injury ratings with 0 being no damage and 9 being 90% dead to determine lines tolerant to flooding stress in this area.**Louisanna:** |
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