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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. Feng Lin |
| Other investigators: | Drs. Caio Vieira, Tessie Wilkerson, David Moseley, ChengjJun Wu, Francia Ravelombola |
| Report Period: | December 15, 2023 to March 15, 2024 |
| 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).  |
| **Research plan for 2024:** 1. Releasing conventional flood tolerant germplasm line
2. Converting high yield and flood tolerant lines into XtendFlex (XF) in Winter Nursery
3. Testing for flood tolerance at early vegetative and reproductive stages for advanced breeding lines from MO and AR and promising lines in the USDA Preliminary and Uniform Trials across 4 different states including AR, MO, LA, MS
4. Screening for flood tolerance at reproductive stage of different lines from different companies in MO, AR, LA, MS entered in the Variety Test
5. Developing new flood tolerant population to feed the flood breeding pipeline

**University of Missouri (Lin):** The 2024 Flood breeding pipeline at the University is summarized in Table 1.**Table 1**. 2024 Flood breeding summary in Missouri

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| Test/Line | Description | Entry |
| S12-1362 | Germplasm | 1 |
| S17-1146 | Germplasm | 1 |
| UT | USDA Regional Uniform trials | 1 |
| AYT-FLD | Flood advanced yield trials | 5 |
| PYT-FLD | Flood preliminary yield trails | 23 |
| MSSB\_FLD | Advanced breeding lines and promising lines | 130 |
| Progeny | Visual Selection | ~400 |
| Population | F1 to F4 generation | 4 |
| New Crosses | Population development | 6-7 |

**1. 2024 Conversion flood tolerant line into herbicide trait:** S18-6013 revealed a low flood damage score (FDS<2) at V2 during the 2023 screening and was released as a cultivar last year. Currently, S18-6013 is being transformed into XF in the winter nursery. BC1F1 plants have been planted, with BC2F1 expected to be harvested soon. In addition, S20-1492, identified as a potential flood-tolerant soybean line (FDS<2 at V2 and R1) will be entered during the 2024 UT, and has been sent to the winter nursery for conversion to XF. It will undergo three backcrosses to incorporate the herbicide trait.**2. 2024 Flood-tolerant germplasm potential release:** The high-yielding and flood-tolerant line S12-1362 (MG5) will soon be available as conventional germplasm. Its registration manuscript is currently undergoing processing and will be published in the Journal of Plant Registrations. This line has been shared with various soybean programs via a Material Transfer Agreement (MTA). Similarly, the line S17-1146 (MG4L), high yields and flood tolerance, will also be released as conventional germplasm. Its registration manuscript is also in progress and scheduled for publication in the Journal of Plant Registrations. Like S12-1362, this line has been exchanged with different soybean programs under an MTA.**3. 2024 Regional trials**: We will enter S20-1492, a potentially flood tolerant line in the USDA Southern Uniform Trials. S20-1492 exhibit a flood damage score FDS<2 at V2 and R1, with yield under flooded >20 bu/ac both at V2 and R1, and high yielding (70.1 bu/ac) that not significantly different from the commercial checks under non-flooded conditions.**4. 2024 Flood advanced yield trials**: A total of 10 MG4L, and 11 MG5E will be evaluated along for flooding tolerance and yield. The test lines include selections of lines with stable flood damage score and potential high yielding lines from 2023 flood advanced yield trials. One tolerant check and sensitive commercial varieties along with conventional checks have also been included. The tests will be planted in 4-row plots with 3 replications under both flooding stress (V2 and R1) and non-stress (non-flooded field) conditions.**5. 2024 Flood preliminary yield trials:** A total 28 MG4 breeding lines including one tolerant check (S17-1146) along with commercial checks (AG 40XF1, P42A84E, AG 43XF2, P47A64LX) will be evaluated for flooding tolerance and yield. The test entries will be planted in 4-row plots in 2 replications in flooded (V2 and R1) and non-flooded fields. Among those 28 lines, four lines showed high protein concentration ranging from 37.5 % to 38.8 % (% 13 moisture). **6. 2024 Flood Tolerant Progeny rows:** Approximately 400 F4 plant rows from 4 crosses will be planted at Portageville, MO as a single row at the Lee Farm, Portageville, MO. Individual F4 plants are in the process of being harvested in the off-season nursery and will be processed for planting this summer.**7. 2024 Breeding population advancement:** Four flood tolerant breeding populations were developed in 2023. The F1 seeds of these crosses were sent to the winter nurseries where the populations will be advanced to F4 for progeny row testing in 2025.**8. 2023 crosses for Flood tolerance:** We will attempt 6 to 7 new crosses for the season of 2024. **9. 2024 Missouri commercial variety testing for flood tolerance:** We will evaluate commercial varieties developed by different seed companies with 3 replications under flooding stress for at R1/R2 stage during and non-flooded treatment the summer of 2024 at the Lee Farm Portageville, MO (heavy clay soil). **10. 2024 MSSB Flood screening for flood tolerance**: We will enter 100 advanced breeding lines from the University of Missouri, and 27 promising lines from the University of Missouri for flood tolerance along advanced and promising breeding lines from the University of Arkansas. Those lines will be genotyped and screened for flood tolerance at V2 and R1 as 3 replications across different states including AR, MO, LA, and MS. **University of Arkansas (Vieira):** **1. 2024 Development of flood-tolerant germplasm:** In 2024, elite high-yielding and flood-tolerant pre-commercial lines R19C-1012, R19C-1035, R19C-1081, R21KB-05522, R21KB-05122, and R20-1429 will be further evaluated for yield and flood tolerance in regional USDA Preliminary Trial (UP5E) and AR Pre-commercial Test (PCM5E) in multiple locations. Lines will be selected for potential flood-tolerant germplasm release. R19C-1012, R19C-1035, R19C-1081, and R21KB-05522 are also being tested in the Official Arkansas Variety Testing and are undergoing introgression of herbicide resistance (Enlist-E3 and XtendFlex). In the same season, 14 preliminary lines with flood tolerance derived from soybean and soja pedigrees will be evaluated for yield and flood tolerance at V2 and R1 stages in Stuttgart, AR. Seeds are being packaged for planting. In addition, multiple breeding populations with flood-tolerant pedigrees are being advanced in winter nursery and elite parents with value-added traits are being selected for new crosses.**2. 2024 Flood tolerance screening for advanced and pre-commercial lines:** A total of 136 advanced lines (MG 3, 4, and 5) with economically important traits and diverse pedigrees were selected for 2024 advanced yield trials. In the same season, these AR lines together with 121 MO advanced lines will be evaluated for flood tolerance at both V2 and R1 growth stages in four states (AR, MO, MS, and LA). Visual and image data will be collected and used for breeding and genomic selection study. Additionally, 34 pre-commercial lines will be evaluated for flood tolerance in four states at V2 and R1 growth stages. Entry lists and seeds are being prepared and packaged for planting.**3. 2024 Yield and flood tolerance evaluation for commercial varieties and Arkansas lines**: In 2024 season, a total of 33 AR elite lines and commercial varieties (number TBD, MG4 and MG5) will be evaluated for yield and flood tolerance under 5-day flooded and non-flooded conditions (side-by-side tests) at early V2/V3 growth stages in Stuttgart, AR. The testing seeds are being prepared for planting.**Mississippi State University (Wilkerson)**The planning meeting for the flood trials has taken place (during our Zoom meeting last week). In Mississippi, we have pinpointed suitable field locations for the trials and are currently awaiting the arrival of seeds from breeders and the 2024 Mississippi State Official Soybean Variety. Once we receive the seeds, we will promptly initiate the organization and packaging process for planting.**Louisiana State University (Moseley)**We have discussed the experiment and field plans. We are awaiting the arrival of the seeds from the breeder and starting packaging. |