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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:  | Development of functional ultra-high stearic acid soybean germplasm |
| Organization:  | University of Missouri |
| Principal Investigator Name: | Pengyin Chen |
| Other investigators: | Caio Canella, Dongho Lee |
| Report Period: | March 15 to June 15, 2022 |
| **Research updates**:***Yield performance of high stearic soybean lines in Advanced Yield Trial (AYT) in 2021***A total of three MG 4 high stearic soybean lines were tested in 2021 AYT. The AYT was conducted using a randomized complete block design with three replications in five different environments (two on loam, two on clay, and one on sandy soil). Yield ranged from 47.8 to 50.8 bu/ac (60.0 to 74.6% and 73.2 to 77.7% of the Xtend and RR checks, respectively) (Table 1).

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| **Line** | **Maturity** | **Pedigree** | **Yield****(bu/ac)** | **XTa** | **RRb** | **Stearic acid (%)** |
| S19-19183 | 4.8 | S14-9017 x S17-21178 | 50.8 | 74.6 | 77.7 | 16.0 |
| S19-19186 | 4.3 | S14-9017 x S17-21178 | 47.9 | 70.3 | 73.2 | 18.5 |
| S19-19190 | 4.9 | S14-9017 x S17-21178 | 47.8 | 60.0 | -c | 17.0 |

**Table 1.** Yield performance and stearic profile of three soybean lines in 2021 AYT.a**XT**, the percentage of yield of lines compared to Xtend checks. Prolonged off-target dicamba exposure significantly affected the yield performance of non-Xtend soybean lines. b**RR**, the percentage of yield of lines compared to Round-up Ready checks. cData not available.***Yield performance of high stearic soybean lines in Preliminary Yield Trial (PYT) in 2021.***A total of four high stearic soybean lines were tested in 2021 PYT. The PYT was conducted in a non-replicated randomized design in four different environments (two on loam soil and two on clay soil). Yield ranged from 45.5 to 48.7 bu/ac (60.5 to 67.1% and 66.7 to 74.8% of the Xtend and RR checks, respectively) (Table 2).**Table 2. The yield performance and stearic concentration of four soybean lines in 2021 PYT.**

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| **Line** | **Maturity** | **Pedigree** | **Yield(bu/ac)** | **XTa** | **RRb** | **Stearic acid (%)** |
| S20-22175 | 5-E | S15-16886C x S17-21184 | 48.5 | 65.0 | 66.7 | 8.8 |
| S20-22725 | 4-L | S14-9051R x S17-21161 | 45.5 | 60.5 | 74.8 | 9.9 |
| S20-22697 | 5-E | S14-9051R x S17-21161 | 48.7 | 67.1 | -c | 11.8 |
| S20-22715 | 5-E | S14-9051R x S17-21161 | 46.9 | 64.6 | - | 9.9 |

a**XT**, the percentage of yield of lines compared to Xtend checks. Prolonged off-target dicamba exposure significantly affected the yield performance of non-Xtend soybean lines. b**RR**, the percentage of yield of lines compared to Round-up Ready checks. cData not available.***Developing new populations and 2022 progeny rows.***We have entered five high stearic breeding lines in our crossing block and will attempt to develop 8-10 new high-yielding, high stearic populations**.** In addition,nine high stearic bi-parental populations (F4:5) will be tested in progeny rows in Portageville, MO in 2022. All genotypes were screened with GC, and interestingly, we were able to achieve many high stearic and high oleic/low linolenic combinations, a unique fatty acid composition that could potentially enhance the high oleic trait. Lastly, a total of 10 high stearic breeding populations made in Summer 2021 are being advanced in off-season nurseries in Costa Rica and Puerto Rico. Roughly 100 F4:5 lines per population will be planted in 2023 progeny rows in Portageville, MO.***Molecular analysis***Sequencing analysis is ongoing with two high stearic mapping populations (S17-21178 × S13-10590C and S17-21178 × S14-9017R). A total of 17 lines, including six high stearic and six low stearic RILs, two mutant lines included in the pedigree, one historical high stearic mutant line, and two wild-type parental lines were selected for whole-genome sequencing analysis and targeted sequencing analysis for two known high stearic genes on chromosome 2 (SACPD-B) and 14 (SACPD-C). DNA extraction and sample delivery will be conducted in June 2022. |
| **Summary and Highlights:*** **High stearic soybean lines tested in 2021 AYT and PYT showed high-yielding potential.**
* **Some lines in new breeding populations showed extremely high stearic acid content and interesting fatty acid combinations (high stearic and high oleic/low linolenic).**
* **Whole-genome sequencing and targeted sequencing analysis for 17 soybean lines are ongoing.**
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