

KANSAS SOYBEAN COMMISSION

FY 2025 Progress 1 report

Accomplishment 1: We completed the development and release of non-nodulating soybean germplasm for research.

Kansas Agricultural Experiment Station (AES) and the Arkansas AES

Notice of Release of Non-nodulating and Nodulating Isolines from Soybean Cultivar "KS4120NSGT"

The Kansas Agricultural Experiment Station (AES) and the University of Arkansas AES announce the release of four non-nodulating near-isogenic soybean [*Glycine max* (L.) Merr.] lines (KS4120-1_rj1, KS4120-2_rj1, KS4120-3_rj1, and KS4120-4_rj1), developed from the Harosoy NN source, and four nodulating lines (KS4120-5_Rj5/rj6, KS4120-6_Rj5/rj6, KS4120-7-1_Rj5/rj6, and KS4120-7-2_Rj5/rj6) and four non-nodulating lines (KS4120-5_rj5/rj6, KS4120-6_rj5/rj6, KS4120-7-1_rj5/rj6 and KS4120-7-2_rj5/rj6) developed from heterogeneous BC₄F₂-derived families from the William-NN source. Scientists participating in this development were Ugochukwu N. Ikeogu¹, Rene Hessel¹, Zenglu Li², Jeffery D. Ray³, William T. Schapaugh Jr.¹, and Larry C. Purcell⁴


The recurrent parent, KS4120NSGT, and all near-isogenic lines are early maturity group 4 genotypes with purple flowers, tawny pubescence, brown pods at maturity, indeterminate growth habit. Seeds have yellow cotyledons, yellow seed coats, and black hilum color. Line advancement and selection for non-nodulation/nodulation from the elite × non-nodulation donors were made using both phenotypic and marker-assisted selection. Field evaluations across five environments in 2021 and 2022 demonstrated the superior performance in yield potential, agronomic traits, and adaptability of the recurrent parent as well as the lines compared to check NN genotypes, Harosoy-NN and William-NN sources. The lines are important resources in soybean studies to elucidate biological nitrogen fixation and nitrogen management in relation to soybean yield and seed composition.

Seed for research purposes of the near-isolines and the recurrent parent will be deposited in the United State Department of Agriculture National Plant Germplasm System.


Director, Kansas Agricultural Experiment Station

11/20/2024

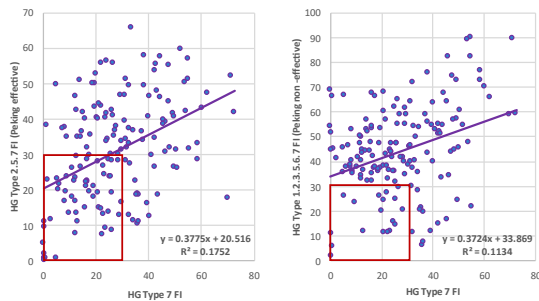
Date


Jean-Francois Meulenet (Nov 26, 2024 17:58 CST)
Director, Arkansas Agricultural Experiment Station

Date

Accomplishment 2: A total of **160 breeding lines** and **27 KSVPT entries** were screened for resistance to 3 diverse SCN populations during 2024 (~1,200 individual plants screened). Fourteen K-lines in our advanced trials possessed SCN resistance to 3 diverse SCN populations common in KS.

KAES Advanced Screening, 2024



14 lines with FI < 30 on all three populations

Accomplishment 3: Engaged in coordinated projects with USDA and state soybean researchers, plant breeders, geneticists, physiologists, plant pathologists, agronomists, computer scientists, electrical engineers and ag engineers to address genomic selection, disease resistance, high-throughput phenotyping, genotypic predictions, abiotic stress and seed composition challenges.

Accomplishment 4: Fostered partnerships promoting germplasm sharing and collaborative field evaluations including with private companies. A total of 11 new Material Transfer Agreements

were completed in 2024.

Accomplishment 5: Finalized the completion of 3 peer-reviewed research publications:

- Chiozza, M.V., Parmley, K., Schapaugh, W.T., Asebedo, A.R., Singh, A.K. 2024. Changes in the leaf area-seed yield relationship in soybean driven by genetic, management, and environments: implications for high-throughput phenotyping. *in silico Plants*, 6(2): 123-135.
- Menke, E., Steketee, C.J., Song, Q., Schapaugh, W.T., Carter Jr, T.E., Fallen, B.D., & Li, Z. (2024). Genetic mapping reveals the complex genetic architecture controlling slow canopy wilting in soybean. *Theoretical and Applied Genetics*, 137(5), Article e107. <https://doi.org/10.1007/s00122-024-04609-w>.
- Koebernick, J., Gillen, A.M., Fett, R.A., Patel, S., Fallen, B.D., Pantalone, V., Shannon, G., Li, Z., Scaboo, A., Schapaugh, W., Mian, R.M., & Read, Q.D. (2024). Soybean test weight in relation to genotype, environment, and genotype × environment interaction in the southern USA. *Agronomy Journal*, 116, 1265–1274. <https://doi.org/10.1002/agj2.21551>.

Accomplishment 6: Presented our research findings to our peers at the 2024 Agronomy Society of American Annual meetings:

- Lima, J. E., Bolouri, F., Awan, A. S., Pramanik, S., Sari-Sarraf, H., Caragea, D., Turner, C., Dhandapani, R., Schapaugh, W. T. Jr., Ahmad, N., Ichinose, Y., Saini, D. K., Bangari, M. P. S., Bardhan, K., Mehla, M. K., Ye, H., Nguyen, H. T., Patil, G., Shekoofa, A., Fischel, L., Cruz, A., Somayanda, I., & Jagadish, K. (2024) Soybean Phenotyping Under Irrigated and Drought Conditions: A Machine Learning Approach for Flower and Pod Counting [Abstract]. ASA, CSSA, SSSA International Annual Meeting, San Antonio, TX. <https://scisoc.confex.com/scisoc/2024am/meetingapp.cgi/Paper/161863>
- Chatti, D., Walta, D., Todd, T., Ikeogu, U., Rainey, K. M., McHale, L., & Schapaugh, W. T. Jr. (2024) Phenotypic Selection for Seed Yield Using Spectral Imagery in Soybean Progeny Rows [Abstract]. ASA, CSSA, SSSA International Annual Meeting, San Antonio, TX. <https://scisoc.confex.com/scisoc/2024am/meetingapp.cgi/Paper/159654>
- Chatti, D., Schapaugh, W. T. Jr., Bakshi, A., Caragea, D., & Prasad, P. V. V. (2024) High Throughput Phenotyping to Evaluate Post Flowering Heat Tolerance in Soybean Using Pollen Germination [Abstract]. ASA, CSSA, SSSA International Annual Meeting, San Antonio, TX. <https://scisoc.confex.com/scisoc/2024am/meetingapp.cgi/Paper/159051>
- Schapaugh, W. T. Jr., Ikeogu, U., Hessel, R., Li, Z., Ray, J. D., & Purcell, L. C. (2024) Non-Nodulating and Nodulating Isolines Developed from Two Donor Sources and an Elite Soybean Cultivar [Abstract]. ASA, CSSA, SSSA International Annual Meeting, San Antonio, TX. <https://scisoc.confex.com/scisoc/2024am/meetingapp.cgi/Paper/158977>

Accomplishment 7: Completed the 2024 field season which included the following germplasm development and evaluation activities.

- We completed our 2024 crossing season with over 90 different populations created. A detailed list of the populations will be included in the final report.
- The F1 generation of progeny was sent to the Puerto Rico winter nursery in October for increase and advancement.
- We completed the 2024 of our field trials involving the evaluation of over 7000 experimental K-lines and another 350 elite experimental lines from other states field trials. Productivity and precision of the 2024 trials were good, and much better than 2022 and 2023. Data are being compiled for all K-lines and experimental lines from other experiment stations.
- We evaluated the 3756 Conventional K-lines in National Regional and Regional trials this year in maturity groups IV and V.
- We increased five conventional MG IV lines for possible release in 2024.
- Decisions on what lines to advance, increase, release, discard and use to create new populations will be finalized in early 2025.
- Working with Caragea (Computer Science) we captured over 12,600 remotely sensed observations of spectral images and videos on breeding plots to characterize drought response, seed yield, plant maturity, and flower abortion of soybean germplasm and continue to develop methods to better evaluate and predict soybean variety performance. The success of some of this work at improving breeding selections was presented at the ASA meeting this past year (Chatti, et al., 2024).