UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Services
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NOTICE OF RELEASE OF SOYBEAN GERMPLASM LINE DS31-243 WITH TOLERANCE TO MATURE SEED DAMAGE

The Agricultural Research Service of the U.S. Department of Agriculture announces the release of soybean [Glycine max (L.) Merr.] DS31-243, an early maturity group IV germplasm line with reduced mature seed damage (visual mold, stink bug feeding, discoloration, green seed, etc.) when subjected to hot humid conditions during plant maturation and dry down. Mature seed damage results in price discounts when grain is sold and can cause economic loss to producers in the southern U.S., as well as in other hot humid production environments. This is the first improved U.S. soybean germplasm release that addresses this problem. Tolerance to mature seed damage was derived principally from Huang mao bai shui dou (PI 587982A), a soybean accession from Sichuan, China. Scientists participating in the development and testing of DS31-243 were J.R. Smith (Principal developer), A.M. Gillen, S. Li, A. Mengistu, H. Abbas, and G. Cai (USDA-ARS, Stoneville, MS; Jackson, TN; and West Lafayette, IN). DS31-243 is being released because of its improved tolerance to mature seed damage, relative to susceptible commercial and public soybean cultivars, that is manifest as reduced damage to mature seeds (including reduced visual mold, stink bug feeding, discoloration, wrinkling, purple seed stain, and green seed) and improved germination with smooth yellow seed coats. It will be useful for improving seed quality in hot humid environments.

DS31-243 was derived from a cross of LG04-1459 x 07055-237 made at Stoneville, MS in 2010. ARS LG04-1459 was developed by R.L. Nelson from S32-Z3 x LG00-3056. S32-Z3 is a commercial cultivar developed by Syngenta Seeds, Inc. ARS LG00-3056 was derived from LG94-1128 x Savoy. Savoy is a public cultivar developed by the University of Illinois. ARS LG94-1128 was derived from PIs 361064, 407710, 189930, and 68600. ARS breeding line 07055-237 was a BC1F4 selection from ARS DT97-4290(2) x PI 587982A. Based on pedigree analysis, DS31-243 has 25% exotic germplasm.

F1 plants were harvested at the Tropical Agriculture Research Station at Isabela, Puerto Rico in 2011. The F2 through F5 generations were grown at Stoneville, MS from 2011 through 2014, where only single plants with the highest germination and best agronomic plant type were advanced. Bulked seed from one F5-derived selection were harvested in 2015 and became 10031-243-12, later renamed DS31-243.

DS31-243 was tested for total seed damage (DKT) at Stoneville, MS using Federal Grain Inspection Service standards in a Phomopsis seed decay (PSD) nursery that featured inoculation with a spore suspension of an isolate of Phomopsis longicolla after growth stage R5, daily overhead irrigation after inoculation, and a two-week delay in harvest after R8 for each plot. Three-year (2018-2020) DKT means for SS93-6181 (PSD resistant check), DS31-243, Progeny 4211 (commercial cultivar), LG03-4561-14 (PSD susceptible check), and LD06-7620 (public cultivar) were 3.1, 4.1, 5.9, 10.9, and 27.6%, respectively, while PSD means were 44.7, 38.9, 54.9, 67.8, and 64.9%, respectively. DS31-243 was significantly lower for DKT and PSD than LG03-4561-14 and LD00-7620, whereas it was not different from SS93-6181. DS31-243 was also significantly lower than Progeny 4211 for PSD. Seed of DS31-243 produced in the PSD Nursery had significantly less (5.2 ng/g) nivalenol toxin than LD06-7620 (23.9 ng/g) and significantly less (0 ng/g) T-2 toxin than LG03-4561-14 (16.6 ng/g), both trichothecene toxins.

DS31-243 was also tested at Stoneville, MS in a non-irrigated (rainfed) nursery, where each plot was harvested two weeks after R8. Based on visual ratings averaged over two years (2019-2020), DS31-243 had significantly less (10%) seed coat wrinkling than LD00-3309 (public cultivar, 28%), Progeny 4211 (18%) and LG03-4561-14 (23%), but similar levels to SS93-6181 (13%). In addition, DS31-243 (0.0, 0.0, respectively) and SS93-6181 (0.0, 0.0, respectively) had significantly less visual mold and purple seed stain than Progeny 4211 (13 and 30%, respectively), and P40A47X (commercial cultivar, 8 and 10%, respectively). In 2020, DS31-243 had higher seed germination (88%) than Progeny 4211 (66%).

In furrow-irrigated trials at Stoneville, MS over two years (2019 and 2020), DS31-243 had significantly higher germination (88%) than AG39X7 (58%), AG4135 (66%), and P40A47X (70%), but the same germination as SS93-6181. DS31-243 had significantly lower (13%) seed coat wrinkling than AG39X7 (18%) and AG4135 (27%), but the same level of wrinkling as SS93-6181 and P40A47X. DS31-243 and SS93-6181 had smaller seeds (13.6 and 14.1 g/100 seed, respectively) than those of AG4135, AG39X7, and P40A47X (14.7, 15.0, and 15.6 g/100 seed, respectively). Averaged across three years (2019-2021) at Stoneville, mean seed yield of DS31-243 (3890 kg/ha) was not significantly different than AG39X7 (3857 kg/ha), AG4135 (3528 kg/ha), SS93-6181 (3568 kg/ha), and P40A47X (4253 kg/ha). DS31-243 matured on the same day as P40A47X, one day earlier than SS93-6181, one day later than AG4135, and four days later than AG39X7. DS31-243 was taller (78 cm) than P40A47X (63 cm), and AG4135 (63 cm), and lodged (1.5 on a 1 to 5 scale) the same as AG4135 (1.3), but greater than P40A47X (1.2).

DS31-243 was tested in the Uniform Soybean Tests Southern States (SUST) from 2017 to 2019. Over two years (2018-2019) mean seed yield, protein, protein meal, and oil for DS31-243 were 3581 kg/ha, 35.4%, 47.7%, and 19.5% (all 13% moisture), respectively, whereas for AG4135 they were 4078 kg/ha, 34.5%, 47.2%, and 20.4%, respectively. When comparing only the means of five early-planted locations (April 13 through May 1) across three years (2017-2019), DS31-243 yielded similar (3622 kg/ha) to AG4135 (3722 kg/ha). When comparing only early-planted (April 15 and 22) years (2019 and 2021) at Stoneville, DS31-243 yielded significantly higher (3984 kg/ha) than AG4135 (3386 kg/ha), but not different than P40A47X (4052 kg/ha). In the

2019 United Soybean Board 4E DT over four locations, DS31-243 and AG4135 were not different for maturity or seed yield (3447 and 3601 kg/ha, respectively).

DS31-243 is early MG IV, indeterminate, and has white flowers, gray pubescence, brown pod walls, buff hila, and yellow seed coats. In tests at Jackson, TN in 2020 and 2021, DS31-243 was resistant to frogeye leaf spot (Cercospora sojina Hara), with a mean severity rating of 1.5% (based on percent leaf area covered; 0-100%) compared to resistant PI 80837 (0.7%) and susceptible AG4703 (22.3%). In 2021 tests at W. Lafayette, IN, DS31-243 was resistant to races 1, 3, 4, and 7 of Phytophthora root and stem rot caused by Phytophthora sojae, while having mixed reactions to races 17 and 25. Based on the SUST (2017-2019), DS31-243 is resistant to stem canker (Diaporthe phaseolorum var. meridionalis).

A limited quantity of seed is available from J.R. Smith (USDA-ARS, Crop Genetics Research Unit, P.O. Box 345, Stoneville, MS 38776, rusty.smith@usda.gov). Seed of this release will be deposited in the National Plant Germplasm System where it will be available for research purposes, including development and commercialization of new cultivars. It is requested that appropriate recognition be made if this germplasm line contributes to the development of new germplasm and cultivars.

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Signatures:

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Date