



UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
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**NOTICE OF RELEASE OF CONVENTIONAL SOYBEAN GERMPLASM JTN-5110
WITH RESISTANCE TO MULTIPLE NEMATODE POPULATIONS AND FUNGAL
PATHOGENS, COMBINED WITH POTENTIAL FOR VERY HIGH YIELD**

The Agricultural Research Service, U.S. Department of Agriculture, announces the release of soybean [*Glycine max* (L.) Merr] JTN-5110. This is a new conventional germplasm line with very high yield potential, and broad resistance to soybean cyst nematode populations [SCN, *Heterodera glycines* Ichinohe (races 2, 3, and 5)], reniform nematode (*Rotylenchulus reniformis*), sudden death syndrome (SDS, caused by *Fusarium solani* f. sp. *glycines*), southern stem canker (caused by *Diaporthe phaseolorum* var. *meridionalis*), and frogeye leaf spot (FLS; caused by *Cercospora sojina* K. Hara). Currently, conventional soybean cultivars with combined resistance to these nematode populations and fungal pathogens are not readily available to growers. JTN-5110 will be an excellent parent material in breeding programs for providing more durable resistance to the pathogens, especially to newly emerging nematode populations, while maintaining very high yield potential in developing new cultivars for sustainable soybean production. It can also be an excellent conventional soybean for seed producers to plant in the Mid-South and Southeast U.S., and reduce high seed costs associated with herbicide resistant soybeans. JTN-5110 was developed by the USDA-ARS in Jackson, TN. Participating researchers include: Prakash R. Arelli (USDA-ARS-CGRU, Jackson, TN worksite), Lawrence D. Young (ARS, retired), Alemu Mengistu (USDA-ARS-CGRU, Jackson, TN worksite), Anne M. Gillen (USDA-ARS-CGRU, Stoneville, MS), and Lisa A. Fritz (USDA-ARS-CGRU, Jackson, TN worksite). JTN-5110 is being released in 2017 because of its resistance to multiple pathogens endemic to the Mid-Southern and Southeastern regions, combined with its very high yield potential.

JTN-5110 is an F2-derived line from a bi-parental cross: J98-32 X 'Anand'. The cross was made in 1999 at USDA-ARS, Jackson, TN worksite. The pedigree for J98-32 includes 'Manokin' X 'Fowler'. Manokin was derived from cross L70L-3048 X D74-7824, and is resistant to SCN populations: races 1 and 3. Soybean Fowler was derived from cross 'Holladay' X 'Hartwig', and is resistant to SCN populations: races 2, 3, 5, and 14. Anand also shares the pedigree Holladay X Hartwig, and derives its resistance from 'Peking' via 'Forrest' and PI 437654 via Hartwig.

Progenies of the cross J98-32 X Anand were advanced using bulk-row method. Several

individual F2 plants were harvested in 2003, and the seed was planted out to rows for progeny testing in 2004. Based on a desirable agronomic appearance, selected F2:4 progenies entered a preliminary yield test in 2005, and F2:5 seed was screened in the greenhouse for SCN races 3 and 14 in 2006. Established methods were used for greenhouse bioassays; standard indicator lines were included in each bioassay. For each of the SCN races, stable reactions were achieved by using curated nematode populations to inoculate seedlings in separate experiments. Approximately 30 days after inoculation, plants were rated based on the number of cysts on the roots. A line with purple flowers and tawny pubescence was found resistant to both race 3 and race 14 SCN, and progressed into yield trials. Yield tests were conducted in Jackson, TN and at Ames Plantation, near Grand Junction, TN, in 2006. This line was later designated JTN-5110.

Marker assisted selection using simple sequence repeat (SSR) markers over multiple years confirmed greenhouse bioassay results. JTN-5110 has the same reaction as resistant soybean Hartwig for markers Satt309 and Sat_168, associated with rhg1 on linkage group G (chromosome 18), and for Satt574, associated with confirmed quantitative trait locus cqSCN-005, on linkage group D2 (chromosome 17).

Breeder yield evaluations were conducted at Ames Plantation from 2006 to 2009, at the West Tennessee Research and Education Center in Jackson, TN from 2005 to present, and at the Research and Education Center at Milan, TN from 2010 to present. JTN-5110 was first submitted as a maturity group V soybean for testing in the USDA Uniform Soybean Tests, Southern States in 2010, and was tested in the Uniform Test V from 2011-2016. In addition, JTN-5110 was tested for multiple years in several state soybean performance tests, including: Tennessee (2011-2016), Arkansas (2012-2016), Kentucky (2012-2016), North Carolina (2013-2016), Virginia (2013-2016), Mississippi (2014-2016), and Georgia (2015-2016). JTN-5110 is entered in these seven state soybean performance tests again in 2017.

Screening for stem canker and SDS was conducted as a part of USDA Uniform Soybean Tests, Southern States over multiple years, and JTN-5110 was found to have resistance to both of these diseases. Screening for SCN races 2, 3, and 5 (corresponding to HG Types 1.2.5.7, 0, and 2.5.7, respectively) was also conducted, and JTN-5110 was found resistant to all three. The methods for screening are well established. In separate tests, evaluations for FLS resistance were conducted in an infested field Milan from 2010 to 2012. JTN-5110 was rated resistant, with an average score of 1.3 (0 = highly resistant; 9 = highly susceptible). Screening for reniform nematode resistance was conducted by Dr. Bob Robbins at the University of Arkansas in 2010 and 2014. For both years, JTN-5110 scored within the range of the resistant checks for the test.

JTN-5110 produced an average of 57.0 bushels/acre (bu/a) or 3833 kilograms/hectare (kg/ha) from 2012-2015 in the USDA Uniform Soybean Tests, Southern States, when tested across locations in multiple states. This was the same as SCN resistant check JTN-5203, and slightly lower than commercial yield check 'AG 5332RR2Y', which yielded an average 59.1 bu/a (3976 kg/ha) in the same trial. For SCN races 2, 3, and 5, the resistance of JTN-5110 is superior to either AG 5332RR2Y or JTN-5203. For the same four years, JTN-5110 averaged 39.8 percent protein and 21.4 percent oil, compared to 39.5 percent protein and 21.3 percent oil for JTN-5203, and 39.7 percent protein and 21.1 percent oil for AG 5332RR2Y. JTN-5110 matures 0.7 days earlier than JTN-5203, and 1 day earlier than AG 5332RR2Y. Of the three lines, JTN-5110 has

the largest seed size at 15.3 grams/100 seed, followed by AG 5332RR2Y at 14.9 grams/100 seed and JTN-5203 at 13.5 grams/100 seed. JTN-5110 has purple flowers, tawny pubescence, and seed coats are yellow with black hila. It has a determinate growth habit.

A limited quantity of seed is available from Prakash R. Arelli (USDA-ARS-Southeast Area, Crop Genetics Research Unit, Jackson, TN). He can be contacted at Prakash.Arelli@ars.usda.gov. Seed of this release, JTN-5110, 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 new germplasm or cultivars.

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Signature:



Deputy Administrator, Crop Production and Protection
Agricultural Research Service, U.S. Department of Agriculture

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Date