Published online September 8, 2006

Registration of Soybean Germplasm Lines TN03–350 and TN04–5321 with Improved Protein Concentration and Quality

Soybean [*Glycine max* (L.) Merr.] germplasm lines TN03–350 (Reg. no. GP-322, PI 636460) and TN04–5321 (Reg. no. GP-323, PI 636461) were developed by the Tennessee Agricultural Experiment Station and released in April 2004. TN03–350 (maturity group VI) and TN04–5321 (maturity group V) were released because those lines combine high yield and increased protein concentration. TN04–5321 also has increased total sulfur containing amino acids (cysteine plus methionine). Breeders targeting improved protein concentration and quality would find these materials to be useful for population development. Both TN03–350 and TN04–5321 are F_6–derived lines from the cross N87–984–16 × TN93–99. The N87–984–16 parent is one of the two F_8–derived sister lines of N87–984 which constitute the high protein cultivar 'Prolina' (Burton et al., 1999). TN93–99 is the registered germplasm GP-280 (Pantalone et al., 2003a).

Crossing of N87–984–16 × TN93–99 occurred during the summer of 1998. The F_1 seeds were harvested in October 1998 and F_1 plants were grown in Costa Rica during winter 1998–99. Generations were advanced via single seed descent (Brim, 1966) to the F_5 in Costa Rica, and F_6 seeds were harvested in May 2000. Approximately 300 F_6 single plants were grown at the East Tennessee Research and Education Center in Knoxville, TN as a recombinant inbred line (RIL) population, and 101 random plants of similar maturity were selected as a source population for evaluation. All 101 RIL and their two parents were planted in two-row plots of 6.1-m length with three replications in a randomized complete block design at the Plant Sciences Unit, East Tennessee Research and Education Center, Knoxville, TN in 2001. All 101 RIL, their two parents, and two checks '5002T' (Pantalone et al., 2004) and '5601T' (Pantalone et al., 2003b) were grown in four-row plots of 6.1-m length at three locations (the Holston and Plant Science Units of the East Tennessee Research and Education Center, and the Research and Education Center at Ames Plantation, near Grand Junction, TN) with three replications in 2002 and 2003. On the basis of field performance in TN in 2002, one of the $F_{6:8}$ RIL, designated as TN03–350, was also included as an entry in the 2003 MG V Southern Regional Uniform Preliminary Test (Paris, 2003). In that test, agronomic, protein, oil, and disease reaction data were collected from 11 locations.

TN03–350 had the highest protein concentration (439 g kg^{-1}) of the 48 entries included in the 2003 MG V Southern Regional Uniform Preliminary Test (Paris, 2003). However, yield of TN03–350 was significantly lower than that of the check cultivars 5601T and 5002T averaged over the 11 locations in 2003. But in our separate two year, six environment field experiment, TN03–350 outperformed the parents and checks for seed yield and protein concentration in TN. In that study, average protein concentration of TN03–350 (426 g kg^{-1}) was significantly higher than that of the checks 5601T (405 g kg^{-1}) and 5002T (392 g kg^{-1}). TN03–350 had an average (197 g kg^{-1} seed) seed oil concentration. The seed yield of TN03–350 (3655 kg ha^{-1}) was significantly higher than that of the checks 5601T (3347 kg ha^{-1}) and 5002T (3272 kg ha^{-1}), averaged over the six environments in TN (2002–2003).

TN03–350 has white flower color, gray pubescence, tan pod wall, and a determinate growth habit. Seeds are yellow with shiny seed coats and buff hila. In the 2003 Southern Uniform Preliminary Test (Paris, 2003), TN03–350 was resistant to stem canker [caused by *Diaporthe phaseolorum* (Cooke and Ellis) Sacc. Var. *caulivora* K.L. Athow & R.M. Caldwell]. Lodging resistance in TN03–350 was similar to that for 5601T. TN03–350 matured about 5 d later than 5601T, thus its relative maturity (RM) is approximately 6.0. The seed size was 14.2 g 100 seeds^{-1}.

TN04–5321 was released as a germplasm because of its increased protein concentration and total sulfur containing amino acids, combined with favorable seed yield. TN04–5321 outperformed the parents and checks for seed protein concentration. It outperformed the parents and was on par with commercial checks for seed yield averaged over six TN environments (2002–2003). Average protein concentration of TN04–5321 (431 g kg^{-1} seed) was significantly higher than that of the checks 5601T (405 g kg^{-1} seed) and 5002T (392 g kg^{-1} seed) as well as the parents N87–984–16 (427 g kg^{-1} seed) and TN93–99 (390 g kg^{-1} seed). The total sulfur containing amino acid concentration (33 g kg^{-1} of total protein) of TN04–5321, averaged over six TN environments (2002–2003), was significantly higher than that of the parents and checks, and the value was very close to the World Health Organization standard for animal feed (35 g kg^{-1} of total protein) which is based on egg protein (George and de Lumen, 1991). The seed yield of TN04–5321 (3222 kg ha^{-1}) was not significantly different than that of the checks 5601T (3347 kg ha^{-1}) and 5002T at (3272 kg ha^{-1}), averaged over the six testing environments in TN (2002–2003).

TN04–5321 has white flower color, gray pubescence, tan pod wall, and a determinate growth habit. The seeds are yellow with shiny seed coats and buff hila. TN04–5321 is similar to commercial checks for lodging resistance. TN04–5321 matures about 3 d later than 5601T, thus its RM is approximately 5.9. The seed size is approximately 16 g 100 seeds^{-1}.

Breeder Seed of TN03–350 and TN04–5321 will be maintained by the Tennessee Agricultural Experiment Station for 5 yr in cold storage and small samples (up to 200 seeds) will be distributed to breeders and other researchers on request.

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doi:10.2135/cropsci2005.11.0437
Published in Crop Sci. 46:2328–2329 (2006).