Registration of Sunflower Genetic Stock RS3 with Reduced Levels of Palmitic and Stearic Acids

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A sunflower (Helianthus annuus L.) genetic stock, RS3 (Reg. No. GS-50, PI 642702), having reduced levels of palmitic and stearic acids, was developed and released by the USDA-ARS and the North Dakota Agricultural Experiment Station, Fargo, ND, in 2006. This genetic stock provides an additional source of lower saturated fatty acids combined with a plant type more typical of cultivated sunflower. Ten other sunflower genetic stocks with reduced palmitic (41.2–47.9 g kg\(^{-1}\)) and stearic acids (19.7–41.1 g kg\(^{-1}\)) have been previously released. RHA 274 (LP-1), RHA 274 (LP-2), and HA 821 (LP-1) have reduced palmitic acid content, while RHA 274 (LS-1), RHA 274 (LS-2), HA 821 (LS-1), HA 382 (LS-1), and HA 832 (LS-2) have reduced stearic acid content (Miller and Vick, 1999). RS1 and RS2 are reduced in both palmitic and stearic acids (Vick et al., 2003). In comparison, RS3 has palmitic and stearic acid contents similar to RS1 and RS2, but in some environments the stearic acid content is lower than in RS1 or RS2. RS3 also has improved seed set and plant architecture compared with RS1 and RS2. RS3 will facilitate breeders in introgressing the low saturated fatty acid trait into sunflower to meet consumers' demand for reduced saturated fat content in their diet.

RS3 is an F\(_6\)-derived F\(_7\) oilseed line resulting from the cross HA 89/cms HA 89/Ames 3406/3/RS1. HA 89 (PI 599773) is an oilseed maintainer line released by the USDA-ARS and the Texas Agricultural Experiment Station in 1971. Ames 3406 is a Havasupi Native American cultivar collected in the Grand Canyon, USA, and deposited into the USDA-ARS North Central Regional Plant Introduction Station, Ames, IA, in 1985. RS1 (PI 616494) is a genetic stock with reduced palmitic and stearic acids released by the USDA-ARS and the North Dakota Agricultural Experiment Station in 2001 (Vick et al., 2003).

Half-seed analyses of seeds from Ames 3406 identified a single seed with 50 g kg\(^{-1}\) palmitic acid and 19 g kg\(^{-1}\) stearic acid. This seed was grown and crossed with cms HA 89, which typically has a palmitic acid content of 58 g kg\(^{-1}\) and a stearic acid content of 45 g kg\(^{-1}\). The progeny were planted for four generations, alternately in the field and greenhouse, with self-pollination and selection for reduced saturated fatty acids. An F\(_1\) plant was backcrossed with HA 89 and self-pollinated alternately in the field and greenhouse for six generations, with selections for reduced saturated fatty acids. A BC\(_6\) F\(_7\) plant was pollinated with RS1 (41 g kg\(^{-1}\) palmitic acid and 25 g kg\(^{-1}\) stearic acid), and the progeny were self-pollinated for five generations alternately in the greenhouse and field, with continued screening for reduced saturated fatty acids. The resulting F\(_6\) seeds were released as RS3. RS3 has a striped black and dark gray achene.

The palmitic acid content of RS3 was 49 g kg\(^{-1}\) and the stearic acid content was 24 g kg\(^{-1}\) when grown in the research plots at North Dakota State University in Fargo, ND, in the summer of 2005. The total saturated fatty acid composition of RS3, including C16 to C24 fatty acids, was 82 g kg\(^{-1}\). This is 27% less than the total saturated fatty acid content in the oil of four commercial sunflower hybrids, which averaged about 112 g kg\(^{-1}\) in the same field. HA 89 contained 122 g kg\(^{-1}\) total saturated fatty acids in the same field. To determine the fatty acid composition, 30-seed samples from 10 heads were ground, transesterified at room temperature with a mixture of hexane–chloroform–0.5 M sodium methoxide in methanol (75:20:5, v/v/v), and analyzed by gas chromatography, and the results were averaged. RS3 plants are non-branched and had 64% seed set in the field. RS3 plant height was 119 cm, days-to-flowering was 79 d, and the 1000-seed weight was 71 g, compared with 134 cm, 68 d, and 54 g, respectively, for HA 89. RS3 is similar in fatty acid composition to previously released RS1 and RS2 but has improved phenotype. RS3 has one capitulum, whereas RS1 and RS2 often display bicephalism in which the two capitula are sometimes separated and sometimes fused. RS3 has better seed set in the field than RS1 or RS2.

Seed of this genetic stock will be available from the corresponding author for a period of 5 yr with limited quantities of seed available on request. We ask that appropriate recognition be made if this genetic stock is used in genetic studies or contributes to the development of new germplasm.

References