Registration of Three Low Cadmium (HA 448, HA 449, and RHA 450) Confection Sunflower Genetic Stocks

Two maintainer and one restorer confection sunflower (Helianthus annuus L.) genetic stocks were developed and released by the USDA-ARS, Fargo, ND, and the North Dakota Agricultural Experiment Station, Fargo, ND, in 2003; HA 448 (Reg. no. GS-30, PI 639171), HA 449 (Reg. no. GS-31, PI 639172), and RHA 450 (Reg. no. GS-32, PI 639173). These genetic stocks are available for use by confection sunflower industry and public researchers to create germplasms, parental lines, or hybrids with decreased Cd uptake into kernels. Confection sunflower having kernels with a lower Cd content would allow more growers to produce this crop and meet crop Cd limits imposed by kernel purchasers.

A guide value (Richtwert) for Cd concentration in confection sunflower was established by Germany in 1992 at 0.60 mg kg⁻¹ dry weight. This value caused considerable concern for the U.S. confection industry with respect to international marketing since seed being produced on poorly drained, fine-textured soils (containing higher chlorides) of North Dakota and Minnesota had kernel Cd concentrations reaching 1.33 mg kg⁻¹ dry weight. Two hundred genotypes, including USDA-ARS germplasm lines, plant introductions from various countries, and interspecific germplasm lines were screened at four locations with two replications at each location in 1994 (Li et al., 1995). The accesses with very low Cd uptake included Primrose (PI 490318) and HA 290 (PI 552935), an accession derived from crosses between cultivars ‘Pere dovik’ (PI 345611) and ‘VNIMK 1646’ (PI 307940) developed in the FSU. Among the USDA-ARS confection germplasm lines, the maintainer HA 323 (NSL 208771) and the restorer RHA 324 (NSL 202282) were intermediate in Cd uptake. Crosses among the accesses and lines were initiated and resulted in the development of lower Cd genetic stocks.

HA 448 and HA 449 are F₆-derived F₇ maintainer genetic stocks selected from the cross HA 323/HA 290. HA 323 (NSL 208771) is a maintainer line released by USDA-ARS and the North Dakota Agricultural Experiment Station in 1985 (Miller, 1986a). HA 290 is a maintainer line released by USDA-ARS and the Texas and North Dakota Agricultural Experiment Stations in 1975 (Fick et al., 1979). The pedigree method of breeding was used to develop HA 448 and HA 449. Plants selected in the F₂ generation were planted as F₃ seed in the USDA-ARS breeding nursery at Fargo, ND, in 1998. F₂ lines were compared with the commercial hybrid Hybrid 924, and harvested seed analyzed for Cd concentration. The Cd content of RHA 450 averaged 0.68 mg kg⁻¹ (range 0.62 to 0.78 mg kg⁻¹), respectively. The average of two check inbred lines, HA 294 and RHA 294, was 1.19 and 0.70 mg kg⁻¹, respectively.

Hybrids were produced by emasculating HA 449 and crossing with the restorer line RHA 450. Hybrids were compared with the commercial hybrid, and harvested seed analyzed for Cd concentration. The Cd content of hybrids HA 448/RHA 450 averaged 0.68 mg kg⁻¹ (range 0.62 to 0.78 mg kg⁻¹), respectively. The average of two check inbred lines, HA 294 and RHA 294, was 1.19 and 0.70 mg kg⁻¹, respectively.

Even though the values exceeded the 0.60 mg kg⁻¹ level, planting hybrids utilizing parent lines developed from these genetic stocks on well drained, sandy loam, or black calcarious loam soils of states should result in hybrids with kernel Cd content below the 0.60 mg kg⁻¹ level.

Limited quantities of seed of each genotypes are available from the Seedstocks Project, Dep. of Animal Manure and By-Products Lab., Bldg. 007, BARC-West, 10300 Potomac, MD 20854. Registration by CSSA. Accepted 3 June 2005.

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References


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