UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
WASHINGTON, D.C.

and

NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION
NORTH DAKOTA STATE UNIVERSITY
FARGO, ND

NOTICE OF RELEASE OF OILSEED SUNFLOWER GERMPLASMS RHA 478, RHA 479, RHA 480, AND HA 481

The United States Department of Agriculture, Agricultural Research Service, and the North Dakota Agricultural Experiment Station (NDAES), Fargo, ND, announce the release of four oilseed sunflower germplasms in 2016. These germplasms have been developed to provide diversity for resistance to Sclerotinia head and basal stalk rot [caused by Sclerotinia sclerotiorum (Lib.) de Bary], and Phomopsis stalk canker [caused by Diaporthe helianthi Munt.-Cvetk., Mihaljc. & M. Petrov] in a high yielding genetic background, and are available for use by industry and public researchers to create parental lines or germplasms.

Germplasm Pedigree Descriptions:
RHA 478 is an imidazolinone tolerant, Sclerotinia head and basal stalk rot resistant, high oleic F8-derived F9 restorer oilseed sunflower line selected from the cross RHA 443/RHA 455. RHA 443 (PI 639166) is an imidazolinone herbicide tolerant, downy mildew and Sclerotinia resistant oilseed restorer line released by the USDA and the NDAES in 2003. RHA 455 (PI 642774) is a Sclerotinia resistant, high oleic oilseed restorer line released by the USDA and the NDAES in 2005.

RHA 479 is a Sclerotinia head rot and Phomopsis stalk canker resistant F8-derived F9 restorer oilseed sunflower line selected from the cross RO 12-13//RHA 274/DOB/3/PSC8/4/RHA 418/RHA 419/3/RO12-13//RHA 274/PRS5, with a linoleic oil profile. RO 12-13 was developed in Romania and was entered into the 1999 Food and Agriculture Organization (FAO) Hybrid Sunflower Yield Trial. RHA 274 (PI 599759) is the male of Hybrid 894 and was released by the USDA and Texas Agricultural Experiment Station in 1973. Dobritch is a hybrid developed in Bulgaria and was entered in the 1997 FAO Hybrid Sunflower Yield Trial. PSC8 and PRS5 are Sclerotinia head rot resistant restorer lines obtained through a germplasm exchange with Dr. Felicity Vear, Station d'Amelioration des Plantes, INRA, Clermont-Ferrand, France. RHA 418 (PI 607508) is a sunflower midge tolerant restorer line released by USDA and NDAES in 1998

and RHA 419 (PI 619204) is a downy mildew resistant restorer line released by USDA and NDAES in 1999.

RHA 480 is an imidazolinone tolerant, Phomopsis stalk canker resistant F8-derived F9 restorer oilseed sunflower line selected from the cross RHA 443/Olivko, with a linoleic oil profile. Olivko was a hybrid entered in the Food and Agriculture Organization (FAO) Hybrid Sunflower Yield Trial from Serbia.

HA 481 is an imidazolinone tolerant, high oleic F8-derived F9 maintainer oilseed sunflower line with moderate resistance to Phomopsis stalk canker and Sclerotinia head and basal stalk rots, selected from the cross HA 441/HA 444/4/HA 411/ROM PH/3/HA 425/87 CAEB//HA 434/HA 412. HA 441 (PI 639164) and HA 444 (PI 639167) are Sclerotinia resistant oilseed maintainer lines released by the USDA and the NDAES in 2003. HA 444 also possesses genes for high oleic acid in the seed oil. HA 411 (PI 603992) and HA 412 (PI 603993) are Sclerotinia resistant oilseed maintainer lines released by the USDA and the NDAES in 1995. ROM PH is a Phomopsis stalk canker resistant population obtained from a germplasm exchange with the Agricultural Research and Development Institute, Fundulea, Romania. HA 425 (PI 617098) is an imidazolinone tolerant oilseed maintainer line released by the USDA and the NDAES in 2000. 87 CAEB is a short-statured line with excellent lodging resistance obtained through a germplasm exchange with W.J. Vermeulen, Oil and Protein Seed Centre, Potchefstroom, South Africa. HA 434 (PI 633744) is a high oleic maintainer oilseed line released by USDA and NDAES in 2001.

Days from planting to flowering were measured on the finished germplasms in Rancagua, Chile. RHA 478, RHA 479, RHA 480, and HA 481 reached 50 percent bloom 67, 71, 65, and 70 days after planting, respectively. RHA 478, RHA 479, and RHA 480 contain genes for recessive branching and restoration of PET1 male sterile cytoplasm.

Sclerotinia Head Rot Evaluations: Sclerotinia head rot resistance of RHA 478, RHA 479, and RHA 480 was determined by evaluating testcross hybrids of these lines with either HA 412HO (PI 642777) or HA 412, the former being a BC4-derived, high oleic acid version of the latter. HA 481 was evaluated as a testcross hybrid with RHA 377 (PI 560145). These hybrids were tested at the Carrington Research and Extension Center in Carrington, ND, in 2007, 2009, and 2010; the Bayer CropScience research station at Sabin, MN in 2009, 2010, and 2011; and the Central Lakes College Agriculture and Energy Center in Staples, MN, in 2011, under artificially inoculated conditions. Ascospores of Sclerotinia sclerotiorum pv. 'NEB 274' were sprayed on each head in each plot during bloom, and the plots subjected to mist irrigation to ensure proper conditions for spore germination and infection. Incidence and severity were measured by scoring each individual plant on a 0 to 5 scale for severity (0 for uninfected; 5 for all quadrants of the head infected), and considering any plant with a score of 1 to 5 as being infected in order to determine percentage incidence.

Average incidence of head rot in plots of testcross hybrids with RHA 478, RHA 479, RHA 480, and HA 481 was 30.8, 38.0, 62.9, and 49.4 percent, respectively, compared to an average of 69.0 percent for Cargill 270, 51.4 for NK 277, 31.0 for Croplan 305, and 32.0 for Croplan 343 (CV = 38.9 percent). RHA 478 and RHA 479 had similar performance to the highly resistant checks

Croplan 305 and Croplan 343 and were significantly higher performing than the susceptible check Cargill 270. HA 481 was not statistically different from any check. RHA 480 was similar to the susceptible check, indicating poor resistance to Sclerotinia head rot.

Sclerotinia Basal Stalk Rot Evaluations: Sclerotinia basal stalk rot resistance evaluations were conducted on the same testcross hybrids as in the head rot evaluations. The hybrids were tested at the Carrington Research and Extension Center in Carrington, ND, in 2008, 2009, and 2010; and the Croplan Genetics field site at Crookston, MN, in 2009, under artificially inoculated conditions. Millet grain infested with live mycelia of Sclerotinia sclerotiorum pv. 'NEB 274' was sidedressed in the root zone of the plants using a tractor-mounted Gandy applicator. Incidence was measured after physiological maturity as the percentage of plants exhibiting the sign of mycelia at the base of the stalk.

Incidence in these experiments was generally low. RHA 478, RHA 479, RHA 480, and HA 481 averaged 0.0, 3.2, 4.5, and 16.0 percent infection, respectively, compared to an average of 12.5 for Cargill 270, 4.6 for NK 277, 3.0 for Croplan 305, and 3.7 for Croplan 343 (CV = 118 percent). RHA 478 was the only line statistically superior to the susceptible check, but all four lines were statistically similar to the two most resistant checks.

Yield, Phomopsis Stalk Canker, and Agronomic Evaluations: Yield and oil content of RHA 478, RHA 479, and RHA 480 were determined by evaluating hybrids of these lines with the testers HA 412 (or isogenic line HA 412HO), and HA 445 (PI 639168). Hybrids of HA 481 were made with RHA 377 and RHA 373 (PI 560141) as testers. Evaluations were conducted at the NDAES Agronomy Seed Farm in Casselton, ND, in 2008, 2009, and 2010; the Carrington Research and Extension Center in Carrington, ND, in 2009 and 2010 (under different field conditions than the Sclerotinia head rot tests); Okaton, SD, in 2010; and Eureka, SD, in 2011. Data on yield at Okaton, SD, in 2010 were not considered in the averages because of poor germination in the plots; however, the oil percentage values are included in the averages. The best female tester (HA 412HO) mated with RHA 478, RHA 479, and RHA 480, resulted in 2836 kg ha-1 (2532 lbs A-1), 2549 kg ha-1 (2276 lbs A-1), and 2971 kg ha-1 (2653 lbs A-1) yields, respectively. HA 481 mated with the best male tester (RHA 377) resulted in 2612 kg ha-1 (2332 lbs A-1) yield. Testcrosses with RHA 478 and RHA 480 were significantly greater than the average yield of 2306 kg ha-1 (2059 lbs A-1) for check Hybrid HA 412HO/RHA 377, and all four testcrosses were statistically similar to check hybrid Croplan 3080 at 2774 kg ha-1 (2477 lb A-1; CV = 18.8 percent). Seed oil content of those same hybrids with RHA 478, RHA 479, RHA 480, and HA 481 were 416 g kg-1, 419 g kg-1, 400 g kg-1, and 395 g kg-1, respectively, compared to 423 g kg-1 and 421 g kg-1 for HA 412HO/RHA 377 and Croplan 3080, respectively (CV = 4.2 percent). All but the HA 481 testcross were statistically similar to the two check hybrids. Phomopsis stalk canker incidence was measured in four environments with substantial natural infection (range 0 to 100 percent). The same hybrids with RHA 478, RHA 479, RHA 480, and HA 481 had 5.5, 0.0, 2.5, and 24.5 percent infection, compared to 27.9 and 20.6 percent for HA 412HO/RHA 377 and Croplan 3080, respectively (CV = 64.2 percent). RHA 479 and RHA 480 are statistically superior to both checks, RHA 478 is statistically superior to HA 412HO/RHA 377, and HA 481 is statistically similar to both checks.

Availability: Small quantities of seed of each germplasm will be available from the North Dakota

Foundation Seed Stocks Project, NDSU Dept. 7670, P.O. Box 6050, Fargo, ND 58108-6050. Seed of these releases will be deposited in the National Plant Germplasm System, where it will be available for research purposes. U.S. Plant Variety Protection will not be requested for RHA 478, RHA 479, RHA 480, and HA 481.

It is requested that appropriate recognition be made if these genetic stocks contribute to the development of a new germplasm, breeding line, or cultivar. These germplasms were developed with support from the National Sclerotinia Initiative, USDA-ARS.

ARS GIVES NO WARRANTIES OR GUARANTEES, EXPRESSED OR IMPLIED, FOR THE MATERIAL, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Signatures:

Vice President for Agricultural Affairs
North Dakota State University

12/2/16
Date

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

12/15/16
Date