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AND

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

NOTICE OF RELEASE OF OIL SUNFLOWER GERMPLASMS BSR DIV 830, BSR STR 1623, BSR CAL 2376, BSR MAX 1018+1314+1323, and BSR NUT 1008+1324

The most significant disease threat to sunflower (*Helianthus annuus* L.) production in humid temperate, as well as tropical and subtropical regions of the world is *Sclerotinia sclerotiorum* (Lib.) de Bary, a necrotrophic fungus that causes three distinctly different diseases on sunflower: basal stalk rot or wilt, mid-stalk rot, and head rot. Basal stalk rot (BSR) is a serious disease problem in sunflower-growing areas of the USA, especially the northern Great Plains that starts by myceliogenic germination of buried sclerotia that infect the roots. Management tools for controlling this disease are insufficient; crop rotation is of marginal use due to the long-lived nature of the sclerotia, foliar fungicide application (commonly used for management of white mold in other crops) is not useful due to the unique infection process in sunflower, fungicide seed treatments provide insufficient control, and the present-day hybrids and cultivated lines lack sufficient tolerance and resistance. BSR resistance is genetically complex and quantitatively conditioned by multiple genes, each having a small effect. Low levels of resistance are available in some inbred lines and hybrids, but greater levels of resistance are needed to combat this emerging pathogen, providing a more efficient, durable and environmentally friendly host plant resistance.

BSR-DIV 830 is derived from a backcross progeny family with the *Sclerotinia* BSR resistance genes derived from perennial *Helianthus divaricatus* (DIV 830) and *H. grosseserratus* (GRO A25690=PI 613793) accessions from the USDA, National Plant Germplasm System (NPGS) crop wild relatives gene bank. The pedigree of BSR DIV 830 is amphiploid DIV(68)/amphiploid GRO(68)//3*HA 410, BC2F2)/3/HA 410, BC3F2. HA 410 (PI 603991) is an oilseed maintainer line developed and jointly released in 1999 by the USDA-ARS and North Dakota Agricultural Experiment Station at Fargo, ND for tolerance to *Sclerotinia* BSR caused by *Sclerotinia sclerotiorum*. NMS HA 89 (PI 559477) is an induced nuclear male sterile line released by the USDA-ARS and North Dakota Agricultural Experiment Station, Fargo, ND in 1990.

Office of the Administrator
Jamie L. Whitten Federal Building, Room 302-A
1400 Independence Avenue, SW.
Washington, D.C. 20250
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BSR STR 1623 is derived from three backcross progeny families from a perennial *Helianthus strumosus* (STR 1623) accession from the NPGS crop wild relatives gene bank. The pedigree of BSR STR 1623 is amphiploid STR(68)/3*HA 410, BC2F3, BC3F4. Recurrent parents HA 410 and NMS HA 89 were previously described.

BSR CAL 2376 is derived from 21 backcross progeny families from a perennial *Helianthus californicus* (CAL 2376) accession from the NPGS crop wild relatives gene bank. The pedigree of BSR CAL 2376 includes four families with CAL 2376/5*HA 410, BC4F4, 14 families with CAL 2376/5*HA 410, BC4F5, two families with CAL 2376/5*HA 410, BC4F6, and one family with CAL 2376/5*HA 410, BC4F7. Recurrent parents HA 410 and NMS HA 89 were previously described.

BSR MAX 1018+1314+1323 is a bulk of seven backcross progeny families derived from perennial *Helianthus maximiliani* (MAX 1018, MAX 1314, and MAX 1323 accessions) from Agriculture and Agri-Food Canada, Morden, Manitoba. The pedigree of BSR MAX 1018+1314+1323 consists of seven families: NMS HA 89/MAX 1018//HA 441, BC1F5, BC2F5; NMS HA 89/MAX 1314//HA 441, BC1F5; NMS HA 89 x MAX 1314//3*HA 441, BC3F3; NMS HA 89/MAX 1323//HA 441, BC1F5; NMS HA 89/MAX 1323//HA 441, BC3F4; and two families with NMS HA 89/MAX 1018//2*HA 441. HA 441 (PI 639164) is an oilseed maintainer line developed and jointly released in 2003 by the USDA-ARS and North Dakota Agricultural Experiment Station at Fargo, ND for tolerance to *Sclerotinia* head rot caused by *Sclerotinia sclerotiorum*. Recurrent parent NMS HA 89 was previously described.

BSR NUT 1008+1324 is a bulk of three backcross progeny families derived from perennial *Helianthus nuttallii* (NUT 1008 and NUT 1324 accessions) from Agriculture and Agri-Food Canada, Morden, Manitoba. The pedigree of the three families for BSR NUT 1008+1324 are NMS HA 89/NUT 1008//2*HA 441, BC2F6, and two families with NMS HA 89/NUT 1324//HA 441, BC1F5. Recurrent parents HA 441 and NMS HA 89 were previously described.

Sclerotinia BSR resistance of BSR DIV 830, BSR STR 1623, BSR CAL 2376, BSR MAX 1018+1314+1323, and BSR NUT 1008+1324 was determined under artificially inoculated rainfed field trials located at the NDSU, Carrington Research and Extension Center at Carrington, ND, in 2009, 2010, 2012 and 2014, and Cenex Harvest States, Grandin, ND in 2014. The inoculum consisted of dried millet grain infected with live mycelia of *Sclerotinia sclerotiorum* fungal isolate NEB 274 side-dressed in the root zone of the plants at the V-6 growth stage using a tractor-mounted Gandy disk applicator. Disease incidence (DI) was measured at physiological maturity as the percentage of plants exhibiting white mycelial lesions at the base of the stalk.

Average DI of BSR DIV 830, BSR STR 1623, BSR CAL 2376, BSR MAX 1018+1314+1323, and BSR NUT 1008+1324 was 7.0, 1.6, 1.9, 2.8, and 3 percent, respectively, compared to the susceptible hybrid check Cargill /Mycogen 270 with DI of 35 percent, tolerant hybrid checks Croplan 305 with 9.6 percent, and Croplan 343 with 15.2 percent. Recurrent parents HA 441 had DI of 10.6 percent, HA 410 23 percent, and HA 89 29.6 percent.

Agronomic data was taken from plants grown in a field nursery at Fargo, ND during the summer of 2014. Plants of BSR DIV 830, BSR STR 1623, BSR CAL 2376, BSR MAX 1018+1314+1323, and BSR NUT 1008+1324 were segregating for branching with plant heights of 75, 69, 70, 99, and 105 cm, respectively, compared to the single-headed check hybrid 894 of 114 cm; days to 50 percent flowering 74, 78, 75, 78 and 78 days, respectively, compared to the check of 71 days; days to maturity 118, 121, 111, 121, and 120 days, respectively, compared to 123 for the check; head diameter 22.6, 13.4, 13.7, 13.7, and 16.8 cm, respectively, compared to 24 cm for the check; and 1000-seed weight 101, 62, 69, 41, and 53 grams, respectively, compared to the check with 62 grams.

Small quantities of seed of the BSR DIV 830, BSR STR 1623, BSR CAL 2376, BSR MAX 1018+1314+1323, and BSR NUT 1008+1324 germplasms will be available from the North Dakota Foundation Seedstocks Project, Department of Plant Sciences, NDSU Dep. 7670, P. O. Box 6050, Fargo, ND 58108-6050. Seed of this release will also be deposited in the USDA National Plant Germplasm System, where it will be available for research purposes, including development and commercialization of new cultivars. U.S. Plant Variety Protection will not be pursued for BSR DIV 830, BSR STR 1623, BSR CAL 2376, BSR MAX 1018+1314+1323, and BSR NUT 1008+1324.

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


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Signatures:



Vice President for Agricultural Affairs
North Dakota State University

4/7/17
Date



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

4/18/17
Date