



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

**NOTICE OF RELEASE OF OILSEED SUNFLOWER GERMPLASMS HA 482,
RHA 483, and RHA 484**

The United States Department of Agriculture, Agricultural Research Service (USDA-ARS) announces the release of three oilseed sunflower germplasms in 2017. 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* spp.] 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:

HA 482 is a *Sclerotinia* head rot and *Phomopsis* stalk canker resistant, high oleic F8-derived F9 maintainer oilseed sunflower line selected from the cross HA 456/FR B. HA 456 (PI 642775) is a *Sclerotinia* resistant oilseed maintainer line released by the USDA and the North Dakota Agricultural Research Station (NDAES) in 2005. FR B was a collection of pollen from several maintainer lines obtained from Dr. Felicity Vear, Institut National de la Recherche Agronomique (INRA), Clermont-Ferrand, France.

RHA 483 is a imidazolinone tolerant, high oleic, *Sclerotinia* head and basal stalk rot resistant, *Phomopsis* stalk canker resistant F8-derived F9 restorer oilseed sunflower line selected from the cross RHA 440/RHA 377/RHA 348/3/IMI/4/BUL R2. RHA 440 is a *Sclerotinia* resistant restorer line released by USDA and NDAES in 2003. RHA 377 is a restorer line released by USDA and NDAES in 1990. RHA 348 is a high oleic restorer line released by USDA and NDAES in 1986. IMI is an imidazolinone resistant line from the USDA breeding program and BUL R2 was a collection of pollen from multiple restorer lines obtained through a germplasm exchange with Dr. Mikhail Christov of Bulgaria.

RHA 484 is a imidazolinone tolerant, high oleic, *Sclerotinia* head rot resistant, *Phomopsis* stalk canker resistant F6-derived F7 restorer oilseed sunflower line selected from the cross RHA 440//RHA 377/RHA 348/3/IMI/4/France R-line bulk. France R-line bulk was a collection of pollen from several restorer lines obtained from Dr. Felicity Vear, Institut National de la Recherche Agronomique (INRA), Clermont-Ferrand, France.

Days from planting to flowering were measured on the finished germplasms in El Monte, Chile, during the 2015-2016 field season. HA 482, RHA 483, and RHA 484 reached 50 percent bloom 66, 69, and 67 days after planting and were 1.04, 1.24, and 1.23 m in height at maturity, respectively.

RHA 483 and RHA 484 contain genes for recessive branching and restoration of PET1 male sterile cytoplasm.

Sclerotinia Head Rot Evaluations: Testcross hybrids were evaluated at the Bayer CropScience research station at Sabin, MN in 2011; Central Lakes College Agriculture and Energy Center in Staples, MN, in 2011, 2012 and 2014; and Carrington Research and Extension Center, Carrington, ND, in 2014 and 2015, 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.

Sclerotinia head rot resistance of HA 482, RHA 483, and RHA 484 was evaluated on testcross hybrids of HA 482 with RHA 464 (PI 655015) and RHA 468 (PI 667184), RHA 483 with HA 412HO (PI 642777) and HA 467 (PI 670489), and RHA 484 with HA 412HO and HA 467. Best linear unbiased estimates of head rot over environments and replications for these six testcross hybrids was 51.8, 42.6, 40.4, 31.6, 36.7, and 30.8 percent, respectively, compared to an average of 74.7 percent for Cargill 270, 49.9 for NK 277, 62.4 for Croplan 305, and 47.3 for Croplan 343. All testcross hybrids except HA 482/RHA 464 were statistically superior to susceptible check Cargill 270, and HA 467/RHA 483 and HA 467/RHA 484 were both statistically superior to the highly resistant check Croplan 305 ($p < 0.05$). HA 482, RHA 483, and RHA 484 confer a high level of 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 Croplan Genetics field site at Crookston, MN, in 2010 and 2012; Carrington Research and Extension Center in Carrington, ND, in 2012, 2014, and 2015; and the CHS field site in Grandin, ND, in 2014, 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.

Best linear unbiased estimates of basal stalk rot incidence over environments and replications for the six testcross hybrids was 30.6, 44.5, 12.2, 16.5, 25.3, and 21.2 percent, respectively, compared to an average of 35.4 percent for Cargill 270, 14.1 for NK 277, 14.6 for Croplan 305, and 28.5 for Croplan 343. HA 412HO/RHA 483 was statistically superior to susceptible check Cargill 270 ($p < 0.05$). HA 482/RHA 468 was statistically inferior to resistant checks NK 277 and Croplan 305 ($p < 0.05$). All other comparisons with checks were statistically similar. Altogether, this indicates that RHA 483 confers a high level of *Sclerotinia* basal stalk rot resistance whereas HA 482 and RHA 484 are moderately resistant.

Yield, Phomopsis Stalk Canker, and Agronomic Evaluations: Yield and oil content of HA 482, RHA 483, and RHA 484 were determined by evaluating the same six testcross hybrids as above. Eastern mega-environment locations were the NDAES Agronomy Seed Farm in Casselton, ND, in 2010; and on-farm locations near Wyndmere, ND, in 2012, and Glyndon, MN, in 2015. Western mega-environment locations were on-farm locations near Eureka, SD, in 2011 and 2012, and USDA-ARS Northern Great Plains Agricultural Research Laboratory in Mandan, ND, in 2015. Best linear

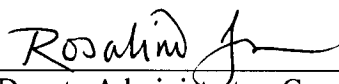
unbiased estimates of seed yield of the six testcross hybrids were 2832, 2200, 2934, 2684, 2545, and 2519 kg ha⁻¹, compared to 3269 for Croplan 3080, 3192 for Mycogen 8H449 CL DM, 2707 for Nuseed Camaro II, 3073 for Pannar 7813 NS, and 2911 kg ha⁻¹ for Syngenta 7717 HO CL DM, which are high yielding commercial hybrids. Testcross yields were statistically similar to the commercial checks, except that HA 482/RHA 468 was statistically inferior to Croplan 3080, Mycogen 8H449 CL DM, and Pannar 7813 NS; and HA 467/RHA 483, HA 412HO/RHA 484, and HA 467/RHA 484 were statistically inferior to Croplan 3080 and Mycogen 8H449 CL DM (p<0.05). Best linear unbiased estimates of oil content were 403, 400, 427, 393, 437, and 398 g kg⁻¹ seed mass, compared to 446, 445, 418, 413, and 407 for Croplan 3080, Mycogen 8H449 CL DM, Nuseed Camaro II, Pannar 7813 NS, and Syngenta 7717 HO CL DM, respectively. HA 412HO/RHA 484 was statistically superior to Pannar 7813NS and Syngenta 7717 HO CL DM; and only HA 412HO/RHA 483 and HA 412HO/RHA 484 were statistically similar to the very high oil checks Croplan 3080 and Mycogen 8H449 CL DM (p<0.05). Best linear unbiased estimates for Phomopsis stalk canker incidence in the six testcross hybrids were 41.7, 21.9, 25.9, 4.5, 1.8, and 23.8, respectively, compared to 55.1, 44.3, 18.1, 66.3, and 36.2 for Croplan 3080, Mycogen 8H449 CL DM, Nuseed Camaro II, Pannar 7813 NS, and Syngenta 7717 HO CL DM, respectively. All comparisons of testcrosses with commercial checks showed the testcrosses to be statistically similar or superior (p<0.05). Of note is the observation that all testcross hybrids except HA 482/RHA 464 were statistically superior to at least one and as many as four checks, showing these materials have high relative resistance to Phomopsis stalk canker while maintaining similar yield and oil content to several commercial 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 HA 482, RHA 483, and RHA 484.

It is requested that appropriate recognition be made if these germplasms 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.

Signature:



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

Acting

Dec. 1, 2017
Date