

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

and

THE NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION  
NORTH DAKOTA STATE UNIVERSITY  
Fargo, North Dakota

NOTICE OF RELEASE OF THREE MAINTAINER (HA 465 TO HA 467) AND ONE RESTORER (RHA 468)  
IMIDAZOLINONE HERBICIDE-RESISTANT OILSEED SUNFLOWER GERMPLASMS

The United States Department of Agriculture, Agricultural Research Service, and the North Dakota Agricultural Experiment Station, Fargo, ND, announce the release of three maintainer (HA 465, HA 466, and HA 467) and one restorer (RHA 468) sunflower germplasms. These germplasms are resistant to the imidazolinone herbicide imazamox (Beyond, BASF Corporation, Mount Olive, NJ)  $\{(\pm)\text{-}2[4,5\text{-dihydro-}4\text{-methyl-}4\text{-(1-methylethyl)-}5\text{-oxo-}1H\text{-imidazol-}2\text{-yl]}\text{-}5\text{-methoxymethyl-}3\text{-pyridinecarboxylic acid}\}$ , are tolerant to *Sclerotinia* head rot [caused by *Sclerotinia sclerotiorum* (Lib.) de Bary], a major disease of sunflower, and provide diversity for agronomic characteristics. These germplasms are available for use by industry and public researchers to create hybrids, parental lines, or germplasms with resistance to imidazolinone herbicides and *Sclerotinia* head rot.

HA 465 is an F<sub>5</sub>-derived F<sub>6</sub> maintainer line advanced by pedigree selection from the cross HA 89/NIV//HA 434/HA412/3/HA 434/HA 425. HA 89 (PI 599773) is an oilseed maintainer line released by USDA and Texas Agricultural Experiment Station in 1971. NIV is a germplasm line 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 fatty acid germplasm line released by USDA and the North Dakota Agricultural Experiment Station in 2001. HA 412 (PI 603993) is a *Sclerotinia*-tolerant maintainer line released by USDA and the North Dakota Agricultural Experiment Station in 1995. HA 425 (617098) is an imidazolinone-resistant germplasm released by USDA and the North Dakota Agricultural Experiment Station in 2000.

HA 466 and HA 467 are F<sub>5</sub>-derived F<sub>6</sub> maintainer lines advanced by pedigree selection from the cross HA 411/ ROM PH//HA 425/87CAEB/3/HA 434/HA 412. HA 411 (PI 603992) is a *Sclerotinia*-tolerant maintainer line released by USDA and the North Dakota Agricultural Experiment Station in 1995. ROM PH is a *Phomopsis* stem canker (caused by *Phomopsis helianthi* Munt.-Cvet., et al.) resistant population obtained from a germplasm exchange with the Agricultural Research and Development Institute, Fundulea, Romania. 87CAEB 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.

RHA 468 is an F<sub>5</sub>-derived F<sub>6</sub> restorer line advanced by pedigree selection from the cross RHA 428/RHA 426//RO 12-13/3/RHA 274/PRS 5. RHA 428 (PI 619206) is a downy mildew [caused by *Plasmopara halstedii* (Farl.) Berl. & De Toni] resistant germplasm released by USDA and the North Dakota Agricultural Experiment Station in 2000. RHA 426 (PI 617099) is an imidazolinone-resistant germplasm released by USDA and the North Dakota Agricultural Experiment Station in 2000. The hybrid RO 12-13 was developed in Romania and was entered into the 2000 Food and Agriculture Organization (FAO) Hybrid Sunflower Yield Trial. RHA 274 (PI 599759) is a restorer germplasm line released by USDA and the Texas and North Dakota Agricultural Experiment Stations in 1973. PRS 5 is a *Sclerotinia* head rot-tolerant restorer line obtained through a germplasm exchange with Dr. Felicity Vear, Station d'Amelioration des Plantes, INRA, Clermont-Ferrand, France.

The pedigree breeding method was used to develop HA 465, HA 466, HA 467, and RHA 468. HA 465, HA 466, and HA 467 have single heads. RHA 468 has genes for fertility restoration of the PET1 cytoplasmic male sterility and has upper stem branching conditioned by a recessive gene. Height of HA 465 to RHA 468 was 135, 110, 112, and 110 cm,

respectively, compared with 108 cm for HA 425. Percent of plants of HA 465 to RHA 468 infected with *Phomopsis* was 20, 25, 5, and 30%, respectively, compared with 40% for HA 425 in plants grown in the Fargo, ND, field nursery during the summer of 2004 and 2005. HA 465, HA 466, and HA 467 averaged 861, 895, 879 g kg<sup>-1</sup> oleic fatty acid in seed from plants grown in the Fargo, ND, field nursery during the summer of 2005. RHA 468 is resistant to the North American races of downy mildew, 730, 733, and 770. HA 465 to RHA 468 were resistant to imazamox applied at a 2X (6.0 mL L<sup>-1</sup>) rate in plants grown in the Fargo, ND, field nurseries of 2003, 2004, and 2005.

Sclerotinia head rot tolerance of HA 465, HA 466, HA 467, and RHA 468 was determined by evaluating testcross hybrids that were artificially inoculated under mist irrigation at the North Dakota Agricultural Experiment Station, Carrington Research and Extension Center, Carrington, ND, during the 2003 to 2005 summer seasons. Hybrids with HA 465, HA 466, and HA 467 were produced by crossing with RHA 377. Hybrids with RHA 468 were produced by crossing with CMS HA 412. Hybrids were evaluated utilizing one replication in year 2003 and three replications in years 2004 and 2005. Disease incidence, measured as percentage of plants showing symptoms of head rot for each plot, was recorded 35 d after inoculation. Sclerotinia incidence averaged over all 3 yr of hybrids with HA 465 to RHA 464 was 8, 18, 22, and 12%, respectively, compared to 73% for the susceptible check, SF 270, and 22% for the tolerant check, NK 277.

Testcross hybrids were compared with the commercial hybrids, Mycogen 8N429, Advanta NA F10125, and Seeds 2000 X978 in 2003 to 2005 trials planted at Casselton, ND, for agronomic characteristics. Yield of hybrids with HA 465 to RHA 468 was 3051, 3257, 3294, and 3206 kg ha<sup>-1</sup>, respectively, compared to a 3154 kg ha<sup>-1</sup> average for the three check hybrids. Oil content of hybrids with HA 465 to RHA 468 was 421, 422, 417, and 423 g kg<sup>-1</sup>, respectively, compared to a 436 g kg<sup>-1</sup> average for the three check hybrids. Height of hybrids with HA 465 to RHA 468 was 187, 167, 145, and 182 cm, respectively, compared to a 189 cm average for the three check hybrids. Days to flower of hybrids with HA 465 to RHA 468 was 68, 69, 69, and 68 d, respectively, compared to a 69 d average for the three check hybrids. Days to maturity of hybrids with HA 465 to RHA 468 was 110, 107, 113, and 110 d, respectively, compared to a 113 d average for the three check hybrids.

Limited quantities of seed of each germplasm are available from the Seedstocks Project, Dep. of Plant Sciences, Loftsgard Hall, North Dakota State University, Fargo, ND 58105. Seed of this release will be deposited in the 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 requested for HA 465, HA 466, HA 467, and RHA 468.

The release date for these germplasms will be on the date of final signature. It is requested that appropriate recognition be made if these germplasms contribute to the development of a new breeding line or cultivar.