



UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Services
Washington, D.C.

and

NORTH DAKOTA STATE UNIVERSITY
North Dakota Agricultural Experiment Station
Fargo, ND

**NOTICE OF RELEASE OF HA-DM9, HA-DM10, HA-DM11,
HA-DM12, HA-DM13, AND HA-DM14**

The Agricultural Research Service of the United States Department of Agriculture and North Dakota State University announces the release of six germplasms HA-DM9, HA-DM10, HA-DM11, HA-DM12, HA-DM13, AND HA-DM14.

Downy mildew (DM), incited by the *Plasmopara halstedii* (Farl.) Berlese & de Toni, is one of the most severe biotic factors affecting sunflower production worldwide. The deployment of disease resistance in sunflower is the most effective and environmentally sound means of controlling DM. Resistance against DM in sunflower is governed by a single dominant gene (designated as P1), however, DM resistance is often rendered ineffective by the rapid genetic changes in the pathogen populations due to the coevolution between the pathogen and the sunflower host. Pyramiding of more than one resistance gene in a single genotype is expected to considerably extend the durability and longevity of resistance due to the low probability of the pathogen being able to assemble multiple rare virulence genes by mutation or recombination. Six germplasms, HA-DM9, HA-DM10, HA-DM11, HA-DM12, HA-DM13, and HA-DM14 were developed to pyramid different DM resistance genes, with the last three also combining a rust resistance gene, providing durable resistance to DM and rust.

HA-DM9 (P18/P117) is a F3-derived F4 maintainer selection from the cross of HA 458 and RHA 340. HA 458 (PI 655009) is an oilseed maintainer line harboring the DM resistance gene P117 mapped to linkage group (LG) 4 of the sunflower genome. RHA 340 (PI 518778) is an oilseed restorer line harboring the DM gene P18 mapped on LG13. HA-DM9 was developed by the pedigree breeding method and DNA marker-assisted selection for pyramiding the DM genes P18 from RHA 340 and P117 from HA 458. The F3-derived HA-DM9 is homozygous for both the DM genes P18 and P117 verified by DNA markers and is resistant to all known DM races.

HA-DM10 (P18/P118) is a F3-derived F4 maintainer selection from the cross of HA-DM1 and

RHA 340. HA-DM1 (PI 674793) is an oilseed maintainer line harboring the DM gene P118 mapped to LG2 of the sunflower genome. RHA 340 is described above. HA-DM10 was developed by the pedigree breeding method and DNA marker-assisted selection for pyramiding the DM genes P18 from RHA 340 and P118 from HA-DM1. The F3-derived HA-DM10 is homozygous for both the DM genes P18 and P118 verified by DNA markers and is resistant to all known DM races.

HA-DM11 (P117/P118) is a F3-derived F4 maintainer selection from the cross of HA 458 and HA-DM1. HA 458 and HA-DM1 are described above. HA-DM11 was developed by the pedigree breeding method and DNA marker-assisted selection for pyramiding the DM genes P117 from HA 458 and P118 from HA-DM1. The F3-derived HA-DM11 is homozygous for both the DM genes P117 and P118 verified by DNA markers and is resistant to all known DM races.

HA-DM12 (P18/PlArg/R12) is a F3-derived F4 restorer selection from the cross of RHA 340 and RHA 464. RHA 340 is described above. RHA 464 (PI 655015) is an oilseed restorer line harboring the DM gene PlArg mapped to LG1 of the sunflower genome and the rust gene R12 mapped to LG11, respectively. HA-DM12 was developed by the pedigree breeding method and DNA marker-assisted selection for pyramiding of the DM genes P18 from RHA 340 and PlArg from RHA464 and the rust gene R12 from RHA 464. The F3-derived HA-DM12 is homozygous for both the DM genes P18 and PlArg and the rust gene R12 verified by DNA markers and is resistant to all known DM races and all known races of North American sunflower rust.

HA-DM13 (P117/PlArg/R12) is a F3-derived F4 maintainer selection from the cross of HA 458 and RHA 464. HA 458 and RHA 464 are described above. HA-DM13 was developed by the pedigree breeding method and DNA marker-assisted selection for pyramiding the DM genes P117 from HA 458 and PlArg from RHA464 and the rust gene R12 from RHA 464. The F3-derived HA-DM13 is homozygous for both the DM genes P117 and PlArg and the rust gene R12 verified by DNA markers and is resistant to all known DM races and all known races of North American sunflower rust.

HA-DM14 (P118/PlArg/R12) is a F3-derived F4 maintainer selection from the cross of HA-DM1 and RHA 464. HA-DM1 and RHA 464 are described above. HA-DM14 was developed by the pedigree breeding method and DNA marker-assisted selection for pyramiding the DM genes P118 from HA-DM1 and PlArg from RHA464 and the rust gene R12 from RHA 464. The F3-derived HA-DM14 is homozygous for both the DM genes P118 and PlArg and the rust gene R12 verified by DNA markers and is resistant to all known DM races and all known races of North American sunflower rust.

Small quantities of seed of the HA-DM9, HA-DM10, HA-DM11, HA-DM12, HA-DM13, and HA-DM14 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 these releases 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 HA-DM9, HA-DM10, HA-DM11, HA-DM12, HA-DM13, and HA-DM14. It is requested that appropriate recognition be made if these germplasms contribute to the development of a new breeding line or

variety/cultivar.

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

08/18/2021

Date

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

Date