

WASHINGTON AGRICULTURAL RESEARCH CENTER  
WASHINGTON STATE UNIVERSITY  
PULLMAN, WASHINGTON 99164

and

UNITED STATES DEPARTMENT OF AGRICULTURE  
AGRICULTURAL RESEARCH SERVICE  
WASHINGTON, D.C. 20250

**NOTICE OF RELEASE OF 'MDM'  
Hard White Winter Wheat**

'MDM' (J980628, WA007936) hard white winter wheat (HWW) (*Triticum aestivum* L.) (Reg. No. CV-XXX, PI 634716) was released in 2005 by the Washington Agricultural Research Center. MDM is a semidwarf cultivar adapted to the low- to intermediate-rainfall (<460 mm average annual precipitation) HWW wheat growing regions of Washington State. It was released for its high grain yield, stripe rust resistance and superior quality attributes. MDM is named in honor of Michael D. Moore (deceased), a wheat producer from Kahlotus, WA. Mr. Moore was a strong supporter of Washington State University (WSU) wheat research and had cooperated with WSU for many years toward the improvement of winter wheat for the low rainfall areas of the State of Washington.

Stephen Jones selected MDM ['Klasic' (PI 486139)/5\*'Eltan' (PI 536994)] in the BC<sub>5</sub>F<sub>6</sub>. The pedigree of Klasic (hard white spring) is 'Klein Rendidor' (PI 351622)/2\* 'Sonora' (Cltr 13131)// 'Inia'/3/'Ciano'/4/ 'Yecora' (PI 478279) and the pedigree of Eltan (soft white winter) is 'Luke' (Cltr 14586)//BR-70443-4 (PI 167822) / 'Sel.101' (Cltr 13438). The original cross and subsequent backcrosses were made in the WSU Wheat Plant Growth Center. Plants of the BC<sub>5</sub>F<sub>1</sub> were harvested in bulk and planted in the field at Pullman, WA in 1998. BC<sub>5</sub>F<sub>2</sub> and BC<sub>5</sub>F<sub>3</sub> were managed as bulk populations. BC<sub>5</sub>F<sub>4</sub> plots were selected for general adaptation, maturity, resistance to stripe rust (caused by *Puccinia striiformis* Westend f. sp. *tritici*), grain yield and test weight. Approximately 100 single spikes were randomly harvested from the selected BC<sub>5</sub>F<sub>4</sub> plots. BC<sub>5</sub>F<sub>4.5</sub> head rows were bulk harvested and seed hardness was determined for each head row. BC<sub>5</sub>F<sub>4.6</sub> seed from head rows that were hard (> 70 single kernel hardness) were then bulked for each head row and planted as individual breeding lines in replicated yield trials. BC<sub>5</sub>F<sub>2</sub>– BC<sub>5</sub>F<sub>5</sub> progeny were advanced in field nurseries in Pullman, WA while subsequent generations were advanced in replicated yield trials throughout Washington State. Breeder seed of MDM was produced in 2004 from 2000 BC<sub>3</sub>F<sub>4.8</sub> heads selected from a pure seed increase at Pullman, WA and planted in head rows under irrigation at Othello, WA.

MDM has an awned lax spike with long midwide, white glumes. The kernels are elliptical, white, hard, and midlong, with a shallow crease. The germ is midsized.

MDM exhibits resistance to snow mold (caused by *Typhula idahoensis* Rems and *T. ishikariensis* Imai.) and stripe rust similar to Eltan. MDM was tested in various field

nurseries under natural infection for stripe rust across Washington State in 2002 to 2004. Stripe rust was well developed in all locations in each of the three years. In most tests, MDM had infection types (ITs) from 0 (no symptom) to 5 (moderately resistant). In a few tests it had IT 8 (moderately susceptible) or mixed ITs, but with severity never beyond 40%. Thus, MDM has adequate resistance to stripe rust in the fields. In greenhouse seedling stripe rust tests performed under low temperature cycle (diurnal temperature gradually changing from 4°C at 2:00 am to 20°C at 2:00 pm), MDM showed resistance to race PST-21, intermediate resistance to races PST-41, 58 and 95, and susceptibility to races PST-17, 37, 43, 45, 78, 79, 97, 98, 100 and 105 of *Puccinia striiformis* f. sp. *tritici*. In greenhouse adult-plant stripe rust tests performed under high temperature cycle (diurnal cycle gradually changing from 10°C at 2:00 am to 35°C at 2:00 pm), MDM had resistant to moderately resistant reactions to races PST-37, 43, 58, 97, 98 and 100 of *Puccinia striiformis* f. sp. *tritici*. The contrasting reactions of the adult-plant vs. seedling tests indicate MDM has an adequate level of non-race specific high-temperature adult-plant resistance for the Pacific Northwest wheat production regions. MDM showed moderate resistance to dwarf bunt (caused by *Tilletia controversa* Kühn) differentials Bt3, Bt9, and Bt10 in inoculated field trials. Visual disease assessments in inoculated field trials indicate MDM is moderately susceptible to Cephalosporium stripe (caused by *Cephalosporium gramineum* Nis. & Ika) and eyespot foot rot (caused by *Tapesia yallundae* Wallwork and Spooner = *Pseudocercospora herpotrichoides* (Fron.) Deighton), similar to Eltan. In naturally infected fields, visual disease assessments show MDM to be susceptible to powdery mildew (caused by *Blumeria graminis* (DC.) Golovin ex Speer (syn. *Erysiphe graminis* DC.) f. sp. *tritici* Em Marchal) similar to Eltan and moderately susceptible to leaf rust (caused by *Puccinia triticina* Eriks: syn. *Puccinia recondita* Roberge ex Desmaz. f. sp. *tritici* Eriks. and E. Henn.) also similar to Eltan.

Grain yields of MDM typically exceed those of Golden Spike. In three field trials in areas with less than 380 mm annual precipitation in Washington State conducted from 2002 to 2004, grain yields of MDM, 'Golden Spike' (PI 614813) (Hole et al., 2000.), and 'Gary' (PI 63063) (Souza et al., 2002) were 4133 kg ha<sup>-1</sup>, 4079 kg ha<sup>-1</sup> and 3689 kg ha<sup>-1</sup>, respectively. In three field trials conducted from 2003 to 2004 in areas receiving 380 mm to 460 mm annual precipitation, grain yields of MDM, Golden Spike and Gary were 9062 kg ha<sup>-1</sup>, 9024 kg ha<sup>-1</sup> and 8306 kg ha<sup>-1</sup>. Grain volume weight of MDM (777 g L<sup>-1</sup>) is similar to Golden Spike (778 g L<sup>-1</sup>), and Gary (783 g L<sup>-1</sup>). In artificial freeze tests conducted in growth chambers at the WSU Wheat Plant Growth Center, the LD<sub>50</sub> (temperature at which 50% of fully hardened plants survived) of MDM was -14.9°C, slightly less than Golden Spike (-14.1°C) and Gary (-13.9°C). It typically heads about 142 d of year, 1 to 2 d later than Golden Spike and Gary. The average thousand-kernel weight of MDM is (35.7 g), less than Golden Spike (37.0 g) and Gary (37.1 g). The average plant height of Bauermeister is 95 cm, shorter than Golden Spike (99 cm) and Gary (100 cm). Its coleoptile length (79 mm) is longer than Golden Spike (71 mm) and Gary (72 mm).

Milling and baking evaluations were conducted by the USDA-ARS Western Wheat Quality Lab in Pullman, WA using grain produced in rain fed breeding and commercial variety testing trials in Washington State from 2003 and 2004. Results from quality

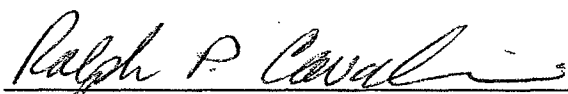
assessments were averaged over all trials in which MDM and the cultivars Eltan (n=20) and 'Finley' (PI 586757) (Donaldson et al., 2000) (n=21) were grown. (Due to the lack of varieties in this new market class, relevant quality checks were not always available for comparison.) MDM had milling yields of 63.4 g kg<sup>-1</sup> similar to Eltan (63.8 g kg<sup>-1</sup>), but less than Finley (66.9 g kg<sup>-1</sup>). MDM dough mix time (3.7 min.) is longer than Finley (2.9 min), and less than Eltan (3.9 min.). MDM had an average flour protein concentration of 110 g kg<sup>-1</sup> and loaf volume of 885 mL, similar to Eltan (106 g kg<sup>-1</sup> flour protein concentration, 883 mL loaf volume), but less than Finley (122 g kg<sup>-1</sup> flour protein concentration, 942 mL loaf volume). Alkaline noodle sheet brightness for MDM was 82.2 and 84.9 for Eltan.

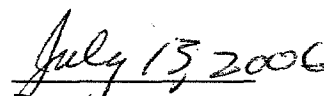
MDM will be protected by US plant variety protection. Seed of MDM will be maintained by the WA State Crop Improvement Association under supervision of the Department of Crop and Soil Sciences and the Washington State Agricultural Research Center and may be obtained by contacting the corresponding author or through the National Small Grains Germplasm Collection of the National Plant Germplasm System ([http://www.ars-grin.gov/npgs/\[homepage\]](http://www.ars-grin.gov/npgs/[homepage])).

#### References

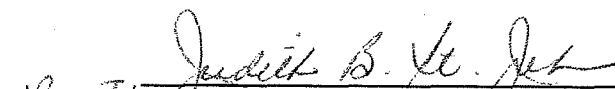
Donaldson, E., B. Sauer, S.R. Lyon, C.F. Morris, R.F. Line. 2000. Registration of Finley wheat. *Crop Sci* 40(4):1197.

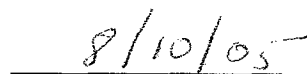
Peterson, Jr., C.J., R.E. Allan, G.L. Rubenthaler, and R.F. Line. 1991. Registration of 'Eltan' wheat. *Crop Sci.* 31(6):1704.

  
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Director, Washington Agricultural Research Center  
Washington State University  
Pullman, WA 99164

  
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Date

Yes, the USDA-ARS wishes to join in the release of 'MDM' and has signed below.

  
\_\_\_\_\_  
Deputy Administrator, USDA Agricultural Research Service  
Washington, D.C. 20250

  
\_\_\_\_\_  
Date

**WASHINGTON STATE  
UNIVERSITY**

August 30, 2005

Department of Crop and Soil Sciences

**Variance Statement for MDM**

WSCIA

WSU Seedhouse  
Pullman, WA 99164-6420**To Whom It May Concern:**

MDM may contain up to a total of 1 in 10,000 of the following naturally occurring variant:

- Red seed

In addition to the above variants the following observations may be made:

- Height variation (2" to 10" taller) may occur at the rate of 1 in 10,000 for heads that are otherwise typical for of these varieties. Height variation will be noticeable under higher yielding environments.
- Awn length may be variable: awnletted (short tip awns) to normal.
- Red or tan chaff or awns

These variants described are distinct within the variety and are stable and predictable with a degree of reliability comparable to other varieties of the same kind, and within recognized tolerances, when the variety is reproduced or reconstructed and was originally part of the variety when released.

Sincerely,

A handwritten signature in black ink, appearing to read 'Stephen Jones'.

Stephen Jones  
Winter Wheat Breeder