

Registration of 'Otis' Wheat

'Otis' hard white spring wheat (*Triticum aestivum* L.) (Reg. no. CV-988, PI 634866) was developed and jointly released in August 2005 by the Agricultural Research Center of Washington State University in cooperation with the Agricultural Experiment Stations (AESs) of the University of Idaho and Oregon State University, and the United States Department of Agriculture-Agricultural Research Service (USDA-ARS). Otis was named in honor of Kody 'Otis' Kidwell, beloved nephew of and inspiration to Dr. Kidwell. Otis is targeted for production in the semiarid and intermediate rainfall (<400 mm of average annual precipitation), nonirrigated wheat production regions of Washington based on its high grain yield potential, high-temperature adult-plant (HTAP) resistance to local races of stripe rust (caused by *Puccinia striiformis* Westend. f. sp. *tritici*), partial resistance to the Hessian fly [*Mayetiola destructor* (Say)], and superior dual purpose end-use quality for making noodle and bread products.

Otis, tested under the experimental designations WA007931, HWN990071, and H95089, which were assigned through progressive generations of advancement, is an F_{4.5} head row selection derived from the cross 'Idaho 377s' (PI 591045)/3/ 'Tanager "S"' (PI 519878)/'Torim 73' (PI 433769)/'Spillman' (PI 506350), which was made in 1994. The following modified pedigree-bulk breeding method was used to advance early generation progeny. Bulk seed (10 g) from F₁ plants was used to establish an F₂ population in the Wheat Research Facility at Pullman, WA, which was segregating for red and white seed color. White seed selected from approximately 100 heads from individual F₂ plants was bulked together to establish a single F₃ plot that was planted in the field at the Washington State University Dryland Experiment Station in Lind, WA. A 60-g subsample of the bulk-harvested seed was used to establish an F₄ field plot at Spillman Farm in Pullman, WA. Single heads from approximately 150 F₄ plants were threshed individually to establish F_{4.5} head row families at that same site the following year. Following selection among rows for general adaptation, plant height, and grain appearance, seed from 30 to 50 plants within each selected head row were bulk harvested to obtain F_{4.6} seed for grain yield assessment trials. Breeder seed of Otis was produced as a reselection based on phenotypic uniformity of 1200 F_{4.10} head rows grown under irrigation at Othello, WA, in 2003. Selected head rows were bulked at harvest, resulting in the production of 668 kg of Breeder seed.

Otis is a tall, semidwarf cultivar, with lax, tapering, inclined curved heads with white awns and white glumes that are long in length, wide in width with narrow, acuminate shoulders, and narrow beaks. Kernels are ovate, white, and hard in texture. Seed of Otis has a midsize germ with a narrow, shallow crease, rounded cheeks, and a short, noncollared brush.

In greenhouse seedling tests conducted in 2003 and 2004 under a low diurnal temperature cycle gradually changing from 4°C at 0200 h to 20°C at 1400 h (Chen and Line, 1992) reaction to wheat stripe rust races PST-37, PST-43, PST-45, PST-78, and PST-98 was assessed. Otis was resistant to PST-43, PST-45, and PST-98 but susceptible to PST-37 and PST-78 indicating that it has race-specific, all-stage (seedling) resistance to some races. When tested with races PST-78 and PST-100 in adult-plant stages under a high diurnal temperature cycle gradually changing from 10°C at 0200 h to 35°C at 1400 h (Chen and Line, 1995), Otis was highly resistant indicating that it has HTAP resistance. In field tests conducted at various locations in Washington from 2001 to 2004, Otis displayed a high level of non-race-specific HTAP resistance to the primary virulent races of current stripe rust populations in the Pacific Northwest (PNW) region of the United States, including PST-78, PST-98 and PST-

100. On the basis of insect screening trials conducted at the University of Idaho using a collection containing the three primary biotypes found in the PNW, Otis is heterogeneous (47%) for resistance to Hessian fly biotypes E, F and GP. On the basis of pedigree and natural field infestation ratings from Pullman, WA, Otis is susceptible to the Russian wheat aphid [*Diuraphis noxia* (Mordvilko)].

Otis was evaluated in replicated field trials under fallow, nonirrigated, and irrigated conditions. Grain yields of Otis typically equaled or exceeded those of hard white spring entries in nonirrigated and irrigated field evaluations conducted in Washington, Oregon, and Idaho from 2002 to 2004. In 51 tests conducted across 3 yr in Washington, the average grain yield of Otis was 3642 kg ha⁻¹, which was comparable to the yield average of 'Lolo' (3715 kg ha⁻¹) (Souza et al., 2003) and significantly ($P < 0.05$) higher than 'Macon' (3373 kg ha⁻¹) (Kidwell et al., 2003) and Idaho 377s (3473 kg ha⁻¹) (Souza et al., 1997). On the basis of 40 site-years of data from the semiarid and intermediate rainfall zones (<400 mm of average annual precipitation), Otis (3195 kg ha⁻¹) produced less grain than Lolo (3303 kg ha⁻¹), but significantly ($P < 0.05$) more grain than Idaho 377s (3063 kg ha⁻¹) and Macon (3006 kg ha⁻¹).

On the basis of 51 tests, grain volume weight of Otis averaged 763 kg m⁻³, which was comparable to Lolo (767 kg m⁻³) and significantly ($P < 0.05$) higher than Macon (740 kg m⁻³) and Idaho 377s (752 kg m⁻³). Thousand-kernel weight averages of Otis, Macon, Idaho 377s, and Lolo were 40.5, 46.1, 36.6, and 47.6 g, respectively. The average plant height of Otis was 84 cm, which was 9 cm taller than Macon and Idaho 377s (75 cm) and 7 cm taller than Lolo (77 cm). Lodging percentages of Otis (2–5%) when grown with irrigation were identical to those of Macon, Idaho 377s, and Lolo. Otis headed 3 d later than Macon (Day of Year [DOY] 164) and 1 d later than Idaho 377s and Lolo (DOY 166).

In tests conducted at the USDA-ARS Western Wheat Quality Laboratory in Pullman, WA, using grain produced in breeding and commercial variety testing trials in Washington State from 2002 through 2004, average grain protein content of Otis (131 g kg⁻¹) was significantly ($P < 0.05$) higher than Macon (128 g kg⁻¹) and significantly ($P < 0.05$) lower than Idaho 377s (136 g kg⁻¹). Flour yield of Otis (663 g kg⁻¹) was comparable to Macon (652 g kg⁻¹), and significantly ($P < 0.01$) higher than Idaho 377s (619 g kg⁻¹). Flour ash content for Otis (4.1 g kg⁻¹) was similar to Idaho 377s (4.0 g kg⁻¹) and higher than Macon (3.9 g kg⁻¹). The flour protein content of Otis (121 g kg⁻¹) was similar to Macon (122 g kg⁻¹) and Idaho 377s (125 g kg⁻¹). Rapid Visco Analyzer (RVA) values of Otis (2236 cP), which reflect starch quality, were lower than those of Idaho 377s (2438 cP), which like Otis, is a partial waxy type, and were significantly ($P < 0.01$) higher than Macon (1999 cP), a normal starch type. Mixograph water absorption for Otis (62.1%) was similar to Idaho 377s (62.3%), and Macon (61.8%). The dough mixing time for Otis (3.1 min) was significantly ($P < 0.01$) shorter than Macon (4.8 min) and Idaho 377s (4.4 min). Average loaf volume for Otis (963 cm³) was smaller than Macon (1031 cm³) and larger than Idaho 377s (930 cm³). Alkaline noodle color stability, expressed as the brightness (L*) value of a noodle sheet stored at room temperature for 24 h, were comparable for Otis (24 h L* = 80.7), Macon (24 h L* = 81.1), and Idaho 377s (24 h L* = 81.9).

Seed of Otis will be maintained by the Washington State Crop Improvement Association under supervision of the Department of Crop and Soil Sciences, Washington State University, Pullman, WA, and the Washington State Agricultural Research Center. Small quantities may be obtained for research purposes

by contacting the National Plant Germplasm System. U.S. Plant Variety Protection status for this cultivar is pending.

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Acknowledgments

We greatly appreciate the dedicated assistance of the following support personnel who assisted with field testing, quality assessment, and disease and insect screening during the development of this variety: Pat Reisenauer (WSU), John Kuehner (WSU), Tracy Harris (WSU), Doug Engle (USDA-ARS), Dave Wood (USDA-ARS), Mary Moore (WSU), and Dennis Schotzko (Univ. of Idaho). We also thank the Washington Wheat Commission and the Washington State Agriculture Research Center for providing funding for this research.

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doi:10.2135/cropsci2005.06-0177

Published in *Crop Sci.* 46:1386–1387 (2006).