Registration of ‘Arrowsmith’ Hard White Winter Wheat

‘Arrowsmith’ (Reg. no. CV-969, PI 633911) hard white winter wheat (*Triticum aestivum* L.) was developed cooperatively by USDA-ARS, the Nebraska Agricultural Experiment Station, and the Wyoming Agricultural Experiment Station. Arrowsmith is adapted to dryland environments in western Nebraska and eastern Wyoming. It was released on the basis of its white grain color, medium-long coleoptile length, and tall plant height, all desirable features for wheat grown on dryland sites in the Nebraska Panhandle and eastern Wyoming.

Arrowsmith was derived from the cross KS87809-10/‘Arapahoe’, made in 1993. KS87809-10 is an experimental hard winter wheat from Kansas State University with the pedigree KS831374-141B/YE1110. KS8321374-141B was a reselection out of ‘Karl’ (PI 527480), while YE1110 was descended from a cross between ‘Gerek 79’ (PI 559560), a winter wheat from Turkey, and ‘Aurora’, a winter wheat from the former Soviet Union. Arapahoe (PI 518591) is a Nebraska developed hard red winter wheat (Baenziger et al., 1989). F₁ through F₃ generations were advanced via self-pollination and maintained as bulk populations. From the F₃ generation, 100 heads were selected and planted as F₄ single-head-progeny rows. Arrowsmith originally was selected from one of these rows as an F₄-derived F₅ line, and assigned the experimental number NW97S182. Breeder seed originated from a composite of 30 F₅-derived headrows which were selected for uniformity in plant type and grain color.

Arrowsmith is awned and white-glumed. The glume beak is awned, and the shoulder is elevated. Kernels are elliptical, with a narrow, mid-deep crease, rounded beak and mid-sized to large brush. Grain samples provided to USDA-Federal Grain Inspection Service were classified as hard white, with color characteristics acceptable for this class. Arrowsmith contains less than 0.1% hard red grain and also contains tall variants at a frequency of approximately 0.5%. Coleoptile length (44 mm) is shorter than that of Arapahoe (50 mm), and longer than that of Nuplains (36 mm). Average plant height (90 cm) is greater than that both of Arapahoe (86 cm) and Nuplains (78 cm). Sprouting tolerance of Arrowsmith is less than that of Nuplains; in three Nebraska environments in which sprouting occurred, mean respective falling numbers of Arrowsmith and Nuplains were 168 and 289 s. Hence, cultivation of Arrowsmith is recommended only west of the 100th meridian. Average heading date (day of year 134) in Nebraska environments is identical to that of Arapahoe. Winter hardiness is similar to Arapahoe, and winter survival is adequate for cultivation in Nebraska and similar environments.

Arrowsmith is postulated to carry the *Lr21* resistance gene for leaf rust (caused by *Puccinia recondita* Roberge ex Desmaz.), but is susceptible to current prevalent races. Postulated resistance genes to current races of stem rust (caused by *Puccinia graminis* Pers.: Pers.) include *Sr6* and *Sr10*. Arrowsmith was moderately resistant to natural infestations of stripe rust (*Puccinia striiformis* *f. sp. tritici*) and powdery mildew (*Blumeria graminis* f. sp. *Triticci*), but is susceptible to current prevalent races. Postulated resistance genes to current races of stripe rust include *Sr1*, *Sr1b*, *Sr4*, *Sr5*, and *Sr13*. Arrowsmith was evaluated in Nebraska from 2000 to 2003, average grain yield of 3589 kg ha⁻¹, while respective grain yields of hard red winter wheat cultivars ‘Alliance’ (PI 573096) (PI 613099) were 3761 and 3845 kg ha⁻¹, and the hard white wheats Trego and Nuplains were 3761 and 3845 kg ha⁻¹, respectively. Grain protein content of Arrowsmith was equal to that of ‘Buckskin’ (18.7 g kg⁻¹) and higher than that of Millennium (88 cm). Grain protein content (122.8 g kg⁻¹) of Arrowsmith was equal to that of ‘Buckskin’ (122.1 g kg⁻¹) and higher than Alliance (113.9 g kg⁻¹) and Trego (117.4 g kg⁻¹).

Arrowsmith was evaluated in Wyoming for 2002 and 2003 (17 site-years). Mean grain yield of Arrowsmith (3589 kg ha⁻¹) was equal to that of ‘Buckskin’ (3589 kg ha⁻¹), only slightly less than that of Alliance, and higher than Trego (3641 kg ha⁻¹). Arrowsmith exceeded Nuplains in height under dryland conditions by 7.4 cm.

The milling and bread baking properties of Arrowsmith were determined by the Nebraska Wheat Quality Testing Laboratory and by the USDA-ARS Grain Marketing Research Center at Manhattan, KS. Mean values of Arrowsmith (870 mL) exceeded that of Nuplains (793 mL). Dough strength parameters of Arrowsmith and Nuplains. Respective mean bake mix times and bread volume were 4.3 min, 3.4 min, and 3.0 while those of Nuplains were 3.8 min, 2.8 min, and 3.0. Arrowsmith was similar to Nuplains in molecular weight glutenin subunits 1, 17 + 19, and 11 + 13. The raw noodle making properties were evaluated by the Wheat Marketing Center, Portland, OR. Texture profile analysis of cooked noodles produced from Arrowsmith and Nuplains had chewiness scores of 1222 g and 1134 g, and mean values of 1202 and 743 g for Nuplains. Arrowsmith was equal to that of Nuplains (122.1 g kg⁻¹) as compared with Alliance (113.9 g kg⁻¹) and Trego (117.4 g kg⁻¹).

The Breeder seed class of Arrowsmith was released by the Nebraska Foundation Seed Division, Agronomy & Horticulture, University of Nebraska, Lincol, NE 68583. Other recognized seed classes are Foundation, Regulatory, Registration of ‘Arrowsmith’ hard white winter wheat (T. aestivum L.) has been deposited in the Small Grains Collection, Aberdeen, ID, with 5-yr usage for research purposes, including development and marketing.