

**NEBRASKA AGRICULTURAL EXPERIMENT STATION
UNIVERSITY OF NEBRASKA-LINCOLN
DEPARTMENT OF AGRONOMY**

**SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION
SOUTH DAKOTA STATE UNIVERSITY
DEPARTMENT OF PLANT SCIENCE**

and

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

RELEASE OF MILLENNIUM HARD RED WINTER WHEAT

Millennium is a hard red winter wheat (*Triticum aestivum* L.) cultivar developed cooperatively by the Nebraska Agricultural Experiment Station and the USDA-ARS. It was jointly released in 1999 by the developing institutions and South Dakota Agricultural Experiment Station. Millennium was selected from the cross Arapahoe/Abilene//NE86488. The pedigree of NE8648 is Colt/3/Warrior 5*/Agent//Kavkaz. Millennium was released primarily for its superior adaptation to dryland wheat production systems in Nebraska (except southeastern Nebraska) and similar growing areas in South Dakota and adjacent states. It has performed well in South Dakota, but additional years of testing, including more severe winters, are needed to identify Millennium's area of adaptation.

Millennium is an awned, white-glumed cultivar. Its field appearance is most similar to 'Arapahoe'. After heading, the canopy is moderately open and upright. The flag leaf is erect and twisted at the boot stage. The foliage is green with a waxy bloom at anthesis. The leaves are glabrous. The spike is tapering in shape, long, and middense. The glume is short to midlong and midwide, and the glume shoulder is square to rounded. The beak is medium in length with an acuminate tip. The spike is usually nodding at maturity. Kernels are red colored, hard textured, midlong, and elliptical in shape. The kernel has no collar, a midsize brush of medium length, rounded cheeks, midsize germ, and a narrow and shallow crease.

Millennium was performance tested as NE94479 in Nebraska yield nurseries starting in 1995 and in the Northern Regional Performance Nursery in 1997 and 1998, and in Nebraska cultivar performance trials in 1998 and 1999. In two years of testing in Nebraska cultivar performance trials, it has performed extremely well throughout most of Nebraska, but it is best adapted to southwestern and western Nebraska. The average dryland yield of Millennium (26 environments) was 4200 kg/ha (62.5 bu/a) which compares favorably to Alliance (4150 kg/ha, 61.7 bu/a), Culver (4190 kg/ha, 62.3 bu/a) and Niobrara (4160 kg/ha, 61.9 bu/a). Millennium also performed quite well under irrigation (5760 kg/ha, 85.6 bu/a), though would not be considered a high management wheat due to its height being a taller semi-dwarf with good, but not exceptional straw strength under irrigation. Millennium was tested in the Northern Regional Performance Nursery in 1997 and 1998. It ranked 9th of 35 entries in 1997 and 9th of 28 entries

in 1998 and averaged 320 kg/ha (5 bu/a) higher yielding than 'Abilene'. The main advantages Millennium has when compared to most other available wheat cultivars, within its area of adaptation, is its high grain yield, ability to yield well under favorable production conditions, and broad adaptation in dryland production systems.

Other measurements of performance from comparison trials show that Millennium is medium in maturity, about 0.5 d later flowering than Arapahoe and 2 d later than Alliance. It has a shorter length coleoptile, shorter than TAM 107 and Arapahoe. The mature plant height of Millennium (34.7 in, 88 cm) is similar to Niobrara and one cm taller than Arapahoe. Millennium has good straw strength, similar to Ogallala and superior to Alliance, Arapahoe, Culver, Niobrara, and Pronghorn. The winterhardiness of Millennium is good to very good, similar to Abilene and comparable to other winter wheat cultivars adapted and commonly grown in Nebraska.

Millennium is moderately resistant to stem rust (caused by *Puccinia graminis Pers.* : *Pers.*; most likely containing *Sr6* and *Sr24*), leaf rust (caused by *P. triticina* Erikss.; most likely contains *Lr24*, *Lr10*, and possibly *Lr16*), and Hessian fly (*Mayetiola destructor* Say, similar to Arapahoe, and most likely contains the Marquillo-Kawvale genes for resistance), and susceptible to wheat soilborne mosaic virus, and barley yellow dwarf virus. In preliminary field tests, Millennium has exhibited a low level of tolerance to wheat streak mosaic virus. Millennium has a good grain volume weight (59.5 lbs/bu, 76.5 kg/hl) is higher than Arapahoe, Niobrara, and Culver, but lower than Pronghorn. The milling and baking properties of Millennium were determined for five years by the Nebraska Wheat Quality Laboratory. In these tests, Arapahoe and Scout 66 were used as check cultivars. The average wheat protein content of Millennium was lower than Arapahoe and Scout 66. The average flour extraction on the Buhler Laboratory Mill for the Millennium was similar to Scout 66, and higher than Arapahoe. The flour ash content was similar to the check varieties. The average flour protein content was less than the check varieties. Dough mixing properties of Millennium were lower than Arapahoe and stronger than Scout 66. Average baking absorption was slightly less than the check varieties. The average loaf volume of Millennium was similar to Arapahoe and larger than Scout 66. The scores for the internal crumb grain and texture were good, which was similar to Arapahoe, but less than Scout 66. The overall end-use quality characteristics for Millennium should be acceptable to the milling and baking industries.

In positioning Millennium, based on performance data to date, it should be well adapted to most dryland wheat production systems, with average or above average yield potential in most of Nebraska except the southeastern district. It should perform well in similar growing areas in adjacent states. It has performed well in South Dakota, but additional years of testing including more severe winters are needed to identify Millennium's area of adaptation. Where it is adapted, Millennium should be a good replacement for Arapahoe as it has a higher yield potential, better straw strength, and grain volume weight. Millennium is genetically complementary to 2137, Alliance, Jagger, Pronghorn, and Windstar. It is non-complementary to Arapahoe (one of its parents), Culver, Niobrara, and Vista. Unlike Arapahoe and Culver, Millennium appears to have an early spring growth pattern less susceptible to drought stress which can reduce yield and yield stability.

Millennium has been uniform and stable since 1998. Less than 0.5 % of the plants were rogued from the Breeder's seed increase in 1998. The rogued variant plants were taller in height

(10 - 15 cm), or were awnless with red chaff. Up to 1% (10:1000) variant plants may be encountered in subsequent generations. The Nebraska Crop Improvement Association provided technical assistance in describing the cultivar characteristics and accomplishing technology transfer. The Nebraska Foundation Seed Division, Department of Agronomy, University of Nebraska-Lincoln, Lincoln, NE 68583 had foundation seed available to qualified certified seed enterprises in 1999. The U.S. Department of Agriculture will not have seed for distribution. The seed classes will be Breeder, Foundation, Registered, and Certified. The Registered seed class will be a nonsalable seed class. Millennium will be submitted for registration and plant variety protection under P. L. 10577 with the certification option.

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Approval

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date

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date

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date