

Registration of 'Chukar' Wheat

Chukar winter club wheat (*Triticum aestivum* L.) (Reg. no. CV-967, PI 628641) was developed by the USDA-ARS with assistance from the Washington Agricultural Experiment Station and the Oregon Agricultural Experiment Station. Chukar was tested under experimental numbers WA7855 and A9623 and released September 2001 because of its combination of yield potential and disease resistance with the quality characteristics desired for the club wheat market class. Chukar is best suited to the intermediate to high rainfall zones of Washington State and northern Idaho.

The pedigree of Chukar is WA7665/'Rulo'. The pedigree of WA7665 is 'Tyee'/'Capelle Desprez'/'Tres'. The pedigree of Rulo is Tyee/'Roazon'/'Tres' (Allan et al., 1980, 1986). The final cross was made under the direction of R.E. Allan in 1988. Chukar was developed by the pedigree breeding method. The population was advanced to the F₂ generation as 88X1013 when 188 F_{2.3} heads were selected. A single F_{2.4} head row was harvested in 1993 after selection for standability, resistance to stripe rust (caused by *Puccinia striiformis* Westend. f. sp. *tritici*) and heading date. In 1995 and 1996, the selected line was designated A9623 and grown in the USDA-ARS Advanced Club nursery at Pullman and Walla Walla, WA. In 1997, A9623 was advanced to the USDA-ARS Elite nursery and renamed WA7855.

Chukar was grown in the USDA-ARS Elite nursery over 56 location-years from 1997 to 2000. It was entered into the Western Regional Soft Winter Wheat Nursery from 1998 through 2000. Chukar was evaluated at 18 locations in both 2000 and 2001 in the Washington State University Commercial Winter Wheat Variety Trial (<http://variety.wsu.edu/>; verified 3 March 2005). In 2001, it was evaluated in the Oregon State Extension Cereal Variety Trial at seven locations and the Northern Idaho Extension Small Grain Performance Trials at four locations. In the USDA-ARS replicated yield trials, the average grain yield of Chukar was 5784 kg ha⁻¹ or 5% greater than 'Coda' and 'Hiller' (5515 kg ha⁻¹), 9% greater than 'Eltan' and 'Madsen' (5313 kg ha⁻¹), and 13% better than 'Stephens' (5111 kg ha⁻¹). Chukar exhibited this yield advantage in all rainfall zones tested. In the USDA-ARS trials, the grain weight per volume (test weight) of Chukar averaged 773 kg m⁻³, 13 kg higher than that of Hiller, and 13 kg less than that of Coda and Madsen. In the 47 location-years of testing in the Washington, Oregon, and Idaho State Extension Variety trials, average yields of Chukar, Coda, and Madsen were 6869, 6376, and 6438 kg ha⁻¹, respectively. The grain weight per volume of Chukar averaged 760 kg m⁻³, 1.7% heavier than Hiller and 3.3% (26 kg) less than Coda.

Chukar is medium to late maturing with a heading date averaging 155 d from Jan 1 at locations in Washington. This is similar to Eltan, 2 d later than Coda and Hiller and 5 d later than Stephens. It is a semidwarf wheat with an average height of 88 cm, similar to Hiller and 4 cm shorter than Coda and Rely. Lodging of Chukar, rated in the absence of strawbreaker foot rot (caused by *Tapesia yallundae* Wallwork & Spooner) has averaged less than 5%, similar to that of Madsen and Hiller.

Chukar is a soft white club wheat with white chaffed, dense clavate heads with tip awns. Kernel size has ranged between 32 and 35 g per 1000 seed depending on the harvest season. Kernels are medium, smooth, and elliptical with asymmetrical sides and rounded cheeks. The germ is oval with a short, uncollared brush. The kernel color is white and the texture is soft. Chukar met Federal Grain Inspection Service (FGIS) kernel grading standards for club wheat from test locations harvested in 2001 and 2002. The average coleoptile length of

Chukar is 57 mm, similar to that of Rely and Madsen. First leaf length was 112 mm, shorter than Madsen (126 mm).

Chukar is resistant to strawbreaker foot rot and carries the *Pch1* gene for resistance, derived from Roazon, as indicated by the presence of the *Ep1-D* isozyme marker (McMillin et al., 1986). Yield loss due to strawbreaker foot rot was 6% for Chukar as compared with 20% for the susceptible cultivars Hiller and Rely, over 4 yr in the inoculated USDA-ARS-Foot Rot Yield Loss nursery at Pullman. Lodging due to strawbreaker foot rot was similar to that of Madsen (3.8%).

Chukar is resistant to stripe rust. Only traces of stripe rust were detected on Chukar in field nurseries at Pullman that had been inoculated with stripe rust races PST17, PST37, PST43, and PST45, the most prevalent races in the PNW from 1998 to 2001. No disease was observed under natural infection at Walla Walla, WA, from 1997–1999 or at Mt Vernon, WA, from 1998–2000. Since its release, Chukar has been evaluated against the currently prevalent stripe rust races, PST78, PST100, and several additional races in the PST collection and has exhibited high levels of resistance to all races. Chukar was rated as moderately susceptible to leaf rust (caused by *Puccinia triticina* Eriks.) under natural infection at Pullman and Walla Walla in 1998 and at Pullman in 2001.

In the presence of severe *Cephalosporium* stripe (caused by *Hymenula cerealis* Ellis & Everh.), the yields of Chukar were similar to those of Coda and Hiller and 30% better than the susceptible cultivar Stephens. Visual rating of *Cephalosporium* stripe symptoms on a 1-to-5 scale, with 1 equal to healthy green tissue of normal height and 5 equal to severe chlorosis and stunting, was conducted at four locations from 1998–1999 and was 1.8, similar to Madsen. In those trials, Stephens rated 3.1.

Chukar had less than 5% leaf infection by powdery mildew (caused by *Erysiphe graminis* DC. f. sp. *tritici* Em. Marchal) at Central Ferry, WA, in 1999 and at Mt. Vernon in 2001, when susceptible check cultivars had greater than 30% infection. It is susceptible to dwarf bunt (caused by *Tilletia controversa* Kühn) as rated by B. Goates at Logan, UT, and susceptible to the GP isolate of Hessian Fly [*Mayetiola destructor* (Say)] that is commonly found in fields in the Pacific North West. Chukar is also susceptible to snow mold (caused by *Typhula idahoensis* Remsberg and *T. incarnata* Fr) and *Barley yellow dwarf virus* on the basis of observations in field experiments conducted at Hermiston, OR, St Andrews, WA, and Pendleton, OR, from 1999–2000. Cold hardiness of Chukar is moderate, not as good as Eltan, and better than Madsen. In artificial freeze trials conducted from 1999–2001, the LT₅₀ (temperature at which 50% of the plants died) of Chukar has averaged –14.25°C as compared with –11.0, –16.5, and –12.0°C for Coda, Eltan, and Madsen.

The end use quality of Chukar has been evaluated at the USDA-ARS Western Wheat Quality Laboratory in Pullman, WA for 35 location-years spanning the 1997–2000 harvest years. Grain protein of Chukar was 7.2 g kg⁻¹, which was 0.6 g kg⁻¹ lower than Coda. The milling score of Chukar was 88.4%, similar to Coda and better than Rely (86%). Flour yield of Chukar was 71%, similar to Coda and Rely. Break flour yield of Chukar was 53%, 1% higher than those cultivars. Cookie diameter was 9.6 cm, 0.2 cm greater than Coda and Rely. Sponge cake volume of Chukar was 1304 mL, similar to Rely and 50 mL more than Coda.

Chukar is a composite of single head selections made from F_{4:11} head rows at Pullman, WA. Approximately 2500 heads were selected from pure seed increase plots at Pullman in 2000. Head rows were planted at Othello, WA, by the Washington State Crop Improvement Association (WSCIA) for Breeder seed increase in 2001 and approximately 10% were

removed because they did not have a short-rachis club head type and were taller than other head rows. Foundation seed was planted in 2002. Chukar was released as a nonexclusive public variety to certified seed producers through the WSCIA. Chukar will be sold as a class of Certified seed. The generation sequence of seed production is Breeders, Foundation, Registered, and Certified. Plant Variety Protection under the Plant Variety Act, Public Law 91-577 with the Title V exclusion has been approved (PVP Number: 200300326). Chukar has been deposited in the National Small Grains Germplasm Collection. Small samples of seed are available from the corresponding author for research purposes.

K.A. GARLAND CAMPBELL,* R.E. ALLAN, J. ANDERSON,
J.A. PRITCHETT, L.M. LITTLE, C.F. MORRIS, R.F. LINE,
X. CHEN, M.K. WALKER-SIMMONS, B.P. CARTER,
J.W. BURNS, S.S. JONES, AND P.E. REISENAUER

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677 S. Segoe Rd., Madison, WI 53711 USA