

Colorado Agricultural Experiment Station  
Colorado State University

Notice of Release of THUNDER CL Winter Wheat

'Thunder CL' hard white winter wheat (*Triticum aestivum* L.) was developed by the Colorado Agricultural Experiment Station and released to seed producers in August 2008. Thunder CL was released based on its tolerance to imazamox herbicide, moderate resistance to stripe rust and wheat streak mosaic virus, superior milling and bread baking quality characteristics, and adaptation for dryland and irrigated production in eastern Colorado and the west-central Great Plains.

Thunder CL was selected from the cross KS01-5539/CO99W165 made in fall 2000 at Fort Collins, CO. KS01-5539 is an unreleased experimental line from the Kansas State University wheat breeding program at Hays, KS, with the pedigree 'Fidel'/KS97HW150//KS97HW349. CO99W165 is an unreleased experimental line from the Colorado State University wheat breeding program with the pedigree KS92WGRC25/'Halt'.

Thunder CL was developed using the single seed descent breeding procedure. All early generation population and line development was done in the greenhouse or an irrigated field-testing location at Fort Collins, CO. The cross between the parents was made in the greenhouse in fall, 2000. The F<sub>1</sub> seed was harvested in January, 2001, and planted in a field nursery in mid-February, 2001. Seed from the F<sub>1</sub> plants was harvested in bulk in July, 2001. A subsample of F<sub>2</sub> seed was vernalized in a cold room prior to planting in the greenhouse in October, 2001. A single seed was harvested from each F<sub>2</sub> plant and vernalized for planting the F<sub>3</sub> generation in the greenhouse in March, 2002. Single seeds were harvested from the F<sub>3</sub> plants in June, 2002, and vernalized for planting the F<sub>4</sub> in the greenhouse in October, 2002. A single spike was harvested from the F<sub>4</sub> plants in February, 2003. Following vernalization, seedlings were hand-transplanted in May, 2003, to a field nursery in the San Luis Valley, CO. Thunder CL was selected as an F<sub>4.5</sub> line, and assigned experimental number CO03W239, in early September, 2003. Thunder CL was evaluated in replicated preliminary yield trials in 2004, replicated advanced yield trials in 2005, replicated CSU Elite trials from 2006 to 2008, replicated statewide dryland and irrigated variety trials from 2006 to 2008, and the Southern Regional Performance Nursery (SRPN) in 2007 and 2008. Seed purification of Thunder CL was done by headrow progeny purification beginning with harvest of a group of visually uniform headrows grown under irrigation at Fort Collins in 2006. Progeny plots from these headrows were grown at Fort Collins in 2007 and treated with an aqueous solution of imazamox herbicide. Following sodium hydroxide testing to confirm kernel color purity, seed of 19 progeny plots was used to plant a 4 acre Foundation Seed increase in 2008.

Thunder CL is an awned, white-glumed, hard white winter wheat. Thunder CL has medium-early maturity, about 2.0 days earlier than 'Hatcher' and 2.5 days later than 'Above'. Plant height of Thunder CL is medium-short, similar to Hatcher and Above. Coleoptile length of Thunder CL is similar to that of Hatcher and shorter than that of Above. Straw strength of Thunder CL is good, similar to Above and better than Hatcher. Pre-harvest sprouting tolerance of Thunder CL is intermediate (moderately susceptible), less tolerant than 'Danby' and 'Aspen', similar to 'NuDakota' and 'RonL', and more tolerant than 'Platte' and 'NuFrontier'. No objective data are available for winter survival ability of Thunder CL though field observations under extremely dry soil conditions during recent winters in Colorado suggest that it is at least adequate for production in the central Great Plains region.

On the basis of field evaluations under natural infection in Colorado and cooperative evaluations through the USDA Regional Testing Program, Thunder CL is moderately resistant to stripe rust (caused by *Puccinia striiformis* Westend.; likely conditioned by one or more adult

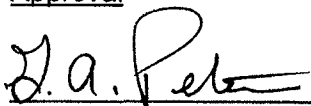
plant resistance genes), moderately susceptible to leaf rust (caused by *Puccinia triticina* Eriks.), moderately resistant to stem rust (caused by *Puccinia graminis* Pers.:Pers f. sp. *tritici* Eriks. & E. Henn; likely carrying the *Sr2* resistance gene conferring adult plant resistance to the *Ug-99* race of stem rust), moderately resistant to wheat streak mosaic virus, susceptible to wheat soilborne mosaic virus, heterogeneous for resistance to the Great Plains Biotype of Hessian fly [*Mayetiola destructor* (Say)], and susceptible to greenbug Biotype E [*Schizaphis graminum* (Rondani)]. Thunder CL is resistant to Russian wheat aphid (*Diuraphis noxia* Kurdjumov) Biotype 1 and susceptible to Russian wheat aphid Biotype 2. Resistance to Russian wheat aphid Biotype 1 in Thunder CL is conditioned by resistance from the CO99W165 parent, originating either from KS92WGRC25 or from Halt (*Dn4* resistance gene).


Field performance of Thunder CL has been determined from field trials in Colorado. In the CSU Elite Trial (2006-08, 25 site-years), Thunder CL had the third highest grain yield in the trial, similar to Hatcher and greater than the imazamox-tolerant checks Above and 'Bond CL' and the hard white wheat checks 'Danby' and 'Avalanche'. Test weight of Thunder CL in these trials was average, similar to Above and greater than Bond CL. In the dryland CSU Uniform Variety Performance Trial (UVPT, 2006-08, 28 site-years), Thunder CL had grain yield similar to Above and Bond CL and greater than Danby and 'Trego'. In the CSU Irrigated Variety Performance Trial (IVPT, 2006-08, nine site-years), Thunder CL showed average grain yield and test weight, similar to the longtime irrigated standard 'Yuma'.

Milling and bread baking characteristics of Thunder CL were determined in the CSU Wheat Quality Laboratory from multiple individual-location grain samples from the 2005-07 seasons. Hatcher was included as a "good" baking quality check while Above and Danby were included as "poor" baking quality checks. Values for milling-related variables were generally good for Thunder CL compared to the check entries, with comparable kernel characteristics, flour extraction, flour ash, and grain protein content as the check entries. Values for baking-related variables were generally superior for Thunder CL compared to Hatcher and especially the poor baking quality checks Above and Danby. Thunder CL shows strong dough mixing characteristics (i.e., longer mixograph and bake mix times, higher mixograph tolerance score) and superior functionality in a standard straight-dough pup loaf bake test (i.e., very high loaf volume and superior crumb grain score).

The Colorado Agricultural Experiment Station will maintain breeder seed of Thunder CL. Multiplication and distribution rights of other classes of pedigreed seed have been transferred from the Colorado Agricultural Experiment Station to the Colorado Wheat Research Foundation, 7100 S. Clinton St. Suite 120, Centennial, CO 80112. Thunder CL has been submitted for U.S. Plant Variety Protection under P.L. 91-577 with the certification option.

Approval

  
Head, Soil and Crop Sciences      10/30/08  
Department, Colorado State Univ.      Date

  
Director, Colorado Agricultural      10/30/08  
Experiment Station      Date