

ITEMS FROM THE UNITED STATES OF AMERICA

COLORADO**COLORADO STATE UNIVERSITY****Department of Soil and Crop Sciences, Ft. Collins, CO 80523, USA.***Wheat breeding and genetics.*

S. Haley, J. Stromberger, J. Butler, E. Heaton, H. Miller, B. Beyer, and J. Roth.

Production conditions, test sites, and cultivar distribution. Total winter wheat production in 2007 was estimated at 94.0×10^6 bushels, a 135% increase from the 2006 crop and 37% higher than the 10-year average. Average grain yield at 41.0 bu/acre was the highest since 1999, 90% higher than in 2006 and 28% higher than the 10-year average. The area harvested for grain was estimated at 2.35×10^6 acres, up from 1.90×10^6 acres in 2006.

In 2006–07, the breeding program conducted field trials at six main locations in eastern Colorado (Akron, Burlington, Dailey, Julesburg, Sheridan Lake, and Walsh) in addition to the main location at the ARDEC research facility near Fort Collins. Overall, environmental conditions experienced were much more favorable for high yields than what was experienced in 2005 and 2006. Above-average yields were achieved at most trial locations as a result of good autumn stand establishment, heavy winter snowfall, and adequate spring rains. Some drought stress was observed at most locations, however, due to lush autumn and spring growth and inadequate spring precipitation to sustain growth. The trials at Burlington were on the end of this spectrum, with drought stress limiting yields significantly in many entries (trial range 15–45 bu/acre). In general, relatively mild temperatures were observed throughout the growing season through to the end of grain filling. Most trial locations avoided significant disease or insect infestations, with the exception of stripe rust at the Lamar (most severe), Sheridan Lake, and Arapahoe locations. Leaf rust was observed at low levels at a few trial locations but did not cause any appreciable damage, despite severe localized infections and damage in nearby fields in southeast Colorado. A severe infection of WSMV was observed at the Dailey irrigated trial location and yields of susceptible entries were reduced significantly.

Planted acreage estimates for the 2007 crop were as follows: Jagalene – 14.2%; Prairie Red – 10.3%; Akron – 7.4%; Jagger – 7.4%; Hatcher – 6.5%; TAM 111 – 6.3%; TAM 107 – 5.6%; Ankor – 5.6%; Above – 5.0%; Trego – 3.7%; Prowers/Prowers99 – 2.9%; Yuma – 2.5%; Bond CL – 1.9%; Lamar – 1.9%; Avalanche – 1.6%; Other – 17.2%.

New cultivar release – Bill Brown hard red winter wheat. One new winter wheat cultivar was released in autumn 2007. The new cultivar, named **Bill Brown**, is a HRWW with very high dryland and irrigated yields, excellent drought stress tolerance, high test weight, resistance to both leaf and stripe rust, and excellent milling and baking quality characteristics. The name Bill Brown was chosen in honor of the memory of the former CSU Extension Plant Pathologist who devoted his career to the improvement and management of diseases of wheat and other grain crops. In three years of statewide testing in the dryland Colorado Uniform Variety Performance Trial (UVPT; 32 locations), Bill Brown had grain yields equivalent to those of the high-yielding wheat cultivar Hatcher, higher than all other entries in the trials, and 0.7 bu/acre (1.7%) higher than Bond CL, 0.9 bu/acre (2.2%) higher than Ripper, and 4.0 bu/acre (10.7%) higher than Jagalene. In three years of statewide testing in the Colorado Irrigated Variety Performance Trial (IVPT; 9 locations), Bill Brown was the highest yielding entry in the trials, approximately 3.4 bu/acre (3.9%) higher than Bond CL and 5.2 bu/acre (6.0%) higher than TAM 111, the next highest yielding entries in trials. Bill Brown will be an excellent replacement for wheat cultivars targeted specifically for high yield, irrigated production conditions and an excellent complement to both Hatcher and Ripper for dryland production conditions.

Detailed data on Bill Brown and other recently released cultivars may be found at the home page of the CSU Wheat Breeding and Genetics Program (<http://wheat.colostate.edu>).

New foundation seed increase. One new experimental line, designated as CO03W239, was advanced for Foundation Seed increase in autumn 2007. Pending further yield and quality evaluations in 2007-08, CO03W239 is targeted for re-

lease as a new cultivar in autumn 2008. CO03W239 is a HWW *Clearfield** line best adapted for dryland production conditions. In two years of testing in the UVPT (22 locations), CO03W239 has been slightly lower yielding than Hatcher and higher yielding than all other HWW cultivars except NuDakota. Relative to the available *Clearfield** wheats, CO03W239 has shown a yield equivalent to that of Infinity CL from Nebraska and a higher yield than both Bond CL and Above. CO03W239 has moderate resistance to stripe rust, moderate susceptibility to preharvest sprouting (similar to that of NuHills and NuDakota), and excellent milling and bread-baking quality characteristics. If released, CO03W239 would be the only dryland-adapted HWW *Clearfield** wheat available for production in the High Plains region.

Russian wheat aphid resistance.

Frank Peairs and Nora Lapitan collaborators.

Projects include:

- advancing a group of 70 biotype 2-resistant lines to replicated yield trials in 2008,
- screening a group of synthetic hexaploid wheats for RWA biotype-2 resistance,
- transferring RWA resistance from tetraploid wheat (Ben Beyer MS thesis project),
- characterizing triticale-derived, RWA-resistant wheat lines (collaboration with Dr. Kabwe Nkongolo, Laurentian University, Canada),
- developing several mapping populations with Iranian landrace selections for DNA marker identification,
- continuing to separate *Dn7* from the negative quality effects of the T1BL·IRS wheat:rye translocation (collaboration with Nora Lapitan, Junhua Peng, and Guihua Bai, USDA-ARS Genotyping Lab, Manhattan KS),
- evaluating elite RWA-susceptible lines for biomass loss from RWA, and
- exchanging RWA-resistant germ plasm with researchers in Australia and France for characterization of response to virulent biotypes from other areas of the world.

Clearfield* wheat development.

Projects in *Clearfield** wheat development included:

- advanced a set of 7 single-gene *Clearfield** lines for a second year of testing in the 2008 CSU Elite nursery,
- advanced a group of 45 double-gene *Clearfield** lines to replicated yield trials in 2008 (Advanced Yield Nursery), and
- implemented DNA markers for confirmation of the presence B-genome and D-genome *Clearfield** mutants in experimental wheat lines.

End-use quality evaluation and research (Brad Seabourn collaborator).

Evaluation and research included:

- expanding the CSU Wheat Quality Laboratory to isolate single kernel characterization system (SKCS) and milling equipment in a separate lab,
- implementing barcode readers for SKCS and Mixograph devices,
- developing a relational database system for storage and retrieval of routine screening data,
- analyzing over 2,950 grain and flour samples from the 2006 season, including 2,396 whole grain NIR tests, 1,737 flour NIR tests, 1,996 SKCS tests, 1,800 Mixographs, 540 Quad Senior mills, and 527 100-gram pup-loaf bakes,
- participating as a test collaborator in the Pacific Northwest Wheat Quality Council evaluation program,
- implementing a higher-throughput, modified Quadromat Senior milling system (with assistance from Doug Engle, USDA-ARS-PNWWQL, Pullman WA),
- characterizing the utility of whole-grain calibrations for SKCS kernel weight, diameter, and hardness for rapid selection (Josh Butler PhD dissertation research),
- characterizing the agronomic management effects on wheat end-use quality (project led by Jerry Johnson),
- documenting high and low molecular weight glutenin subunit composition of Great Plains winter wheat cultivars and experimental lines (project led by Pat Byrne), and

- documenting the influence of allelic variation *Glu-A1*, *Glu-B1*, *Glu-D1*, *Glu-A3*, and *Glu-B3* loci on Mixograph properties (project led by Pat Byrne).

USDA-CAPS project.

Pat Byrne, Nora Lapitan, Jorge Dubcovsky, and Guihua Bai (collaborators).

As part of this project, we have

- completed seed increase of our mapping population (Platte/CO940610) and planted a subset of this population at Fort Collins for phenotypic evaluation in 2006–07,
- planted 192 individuals from the CAP population at Fort Collins in fall 2007 under a linear move for side-by-side evaluation under full- and limited-irrigation,
- continued marker genotyping and mapping of CAP population (led by Pat Byrne and Nora Lapitan), and
- implemented marker assisted selection (MAS) for allele enrichment in segregating top-cross populations for various glutenin alleles, stripe rust resistance (Yr5 and Yr15), leaf and stem rust resistance (*Lr19/Sr25*, *Sr2*, *Sr24* sources), and the high grain protein content gene from tetraploid wheat.

Preharvest sprouting tolerance.

Research in this area investigated

- using of the petri-dish germination test to characterize sprout tolerance of over 350 different hard red and hard white samples collected at Fort Collins and Akron,
- using of the intact-head sprout test for line reselection with over 1,200 individual heads sampled from hard white preliminary lines at Fort Collins, and
- assessing the utility of previously reported DNA markers to identify lines with improved sprout tolerance.

Graduate student research.

Three graduate student projects were on-going in 2006–07.

- Development and validation of near infrared reflectance (NIR) spectroscopy calibrations for whole-grain prediction of end-use quality characteristics (Joshua Butler). Josh is planning to submit and defend his PhD dissertation in spring 2008.
- Validation of the BYDV resistance and high grain protein content traits introgressed to several elite backgrounds as part of the IFAFS molecular marker grant (Jennifer Roth). Jennifer is planning to submit and defend her MS thesis in spring 2008.
- RWA biotype 2 resistance gene mapping and gene transfer from *Triticum turgidum* subsp. *dicoccoides* (Ben Beyer). Ben successfully defended his MS thesis in autumn 2007.

Publications.

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Clayshulte SR, Haley SD, Byrne PF, and Shan X. 2007. Trait associations at the *Xgwm261* and *Rht-B1* loci in two winter wheat recombinant inbred line populations. *Crop Sci* 47:2346-2355.

Haley SD, Johnson JJ, Peairs FB, Quick JS, Stromberger JA, Clayshulte SR, Butler JD, Rudolph JB, Seabourn BW, Bai G, Jin Y, and Kolmer J. 2007. Registration of 'Ripper' wheat. *J Plant Reg* 1:1-6.

Hesler LS, Haley SD, Nkongolo KK, and Peairs FB. 2007. Resistance to *Rhopalosiphum padi* (Homoptera: Aphididae) in triticale and triticale-derived wheat lines with resistance to *Diuraphis noxia* (Homoptera: Aphididae). *J Entomol Sci* 42:217-227.

- Johnson JJ, Haley SD, and Butler J. 2007. Helping producers make better variety planting decisions. Agron Abstr.
- Peng Z, Wang H, Haley SD, Peairs FB, and Lapitan NLV. 2007. Molecular mapping of Russian wheat aphid resistance gene *Dn2414* in wheat. *Crop Sci* 47:2418-2429.
- Roth J, Haley SD, Peng J, Lapitan NLV, Bai G, and Bockus B. 2007. Characterization of wheat lines derived through MAS for barley yellow dwarf virus resistance and high grain protein content. Agron Abstr.
- Shan X, Clayshulte SR, Haley SD, and Byrne PF. 2007. Variation for glutenin and waxy alleles in U.S. hard winter wheat germplasm. *J Cereal Sci* 45:199-208.
- Zheng S, Shan X, Byrne P, and Haley SD. 2007. Effects of glutenin subunit variation and 1RS.1AL translocation on dough properties of wheat grown in Colorado (USA) environments. PAGXV Abstr, P281.
- Zheng S, Shan X, Byrne P, Reid S, Bai G, and Haley SD. 2007. Effects of allelic variation at the wheat *Glu-B3* locus on dough properties identified by association mapping. Agron Abstr.

GEORGIA / FLORIDA

GEORGIA EXPERIMENT STATION / UNIVERSITY OF GEORGIA Griffin, GA 30223-1197, USA.

J.W. Johnson, J.W. Buck, G.D. Buntin, and Z. Chen.

The 2007 Georgia winter wheat crop was grown on about 320,000 planted acres. Yields of wheat grown by top producers were around 6000 kg/ha on resistant cultivars to stripe rust. Average yield for the state was 3,200 kg/ha. The growing season was characterized by drought conditions in the autumn, which delayed planting, and in the spring by very dry conditions during the grain-filling period. A lack of vernalization was a problem for late maturing varieties. A late freeze in April with low temperatures of -4°C during boot stage resulted in very low yields for early and medium-maturing cultivars.

Breeding.

Three wheat cultivars, GA951231-4E25 (**Oglethrope**), GA951231-4E26 (**AGS 2026**), and GA96693-4E16 (**AGS 2020**), which are high-yielding, broadly adapted cultivars, were released by the University of Georgia in 2007 for growers in the Southeast. These three soft red winter wheat cultivars are high yielding with excellent test weight, disease and insect resistance, and will offer new sources of resistance to both pathogens and insects. Oglethrope and AGS 2026 have excellent Hessian fly (*H13*) and stripe and leaf rust resistance (*Lr37 Yr17*). Both cultivars are medium-maturing soft wheats. AGS 2020 is stripe and leaf rust resistant and is a medium maturing soft wheat with excellent milling and baking quality. All three cultivars have good resistance to wheat soil-borne mosaic virus.

GA 96693-4E16 (AGS 2020) is an early maturing, white chaffed, medium height line. AGS2020 was derived from the cross 'GA 88151/Hickory//AGS 2000'. The maturity is 3 days earlier than that of AGS 2000. AGS2020 is moderately resistant to current biotypes of Hessian fly in Georgia, resistant to races of leaf rust and stripe rust in the southeast U.S., and also resistant to soil-borne mosaic virus and powdery mildew.

GA 951231-4E25 (Virgoro Oglethrope) is a medium-maturing, white chaffed, medium height line. The line was derived from the cross 'GA881130/Coker 9134'. The pedigree of GA 881130 is 'KSH8998/FR 81-10//Gore'. KSH8998 was developed from the cross of a hard wheat with *Ae. tauchii* to transfer Hessian fly resistance (*H13*). FR 81-10 was selected due to its resistance to leaf rust (*Lr37 Yr17*) from the cross 'Novisad 138/4/(4) *Ae. ventricosa*/T. persicum/2/Marve*3/3/Moisson'. Maturity is similar to that of AGS 2000. Virgoro Oglethrope is resistant to current biotypes of Hessian fly in Georgia including biotype L and is resistant to races of leaf rust and stripe rust due to adult-plant resistance, resistant to soil-borne mosaic virus, and susceptible to powdery mildew.