

Burnside extra strong hard red spring wheat

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Humphreys, D. G., Townley-Smith, T. F., Lukow, O., McCallum, B., Gaudet, D., Gilbert, J., Fetch, T., Menzies, J., Brown, D. and Czarnecki, E. 2010. **Burnside extra strong hard red spring wheat**. Can. J. Plant Sci. **90**: 79–84. Burnside is a hard, red, spring wheat (*Triticum aestivum* L.) that meets the end-use quality specifications of the Canada Western Extra Strong wheat class. Burnside was evaluated in the Canada Western Extra Strong Wheat Cooperative Test in 2000, 2001, and 2002. In comparison with CWES cultivars Glenlea, Bluesky, AC Corinne, and CDC Walrus, Burnside had higher grain yields than Bluesky and AC Corinne, was similar to Glenlea and lower yielding than CDC Walrus. Burnside had maturity similar to Bluesky and was earlier maturing than Glenlea, AC Corinne, and CDC Walrus. Burnside is resistant to moderately resistant to prevalent races of leaf and stem rust and resistant to loose smut. End-use quality tests showed that Burnside had significantly higher grain protein content than the check cultivars.

Key words: *Triticum aestivum* L., Canada Western Extra Strong, hard red extra strong spring wheat, cultivar description, yield, disease resistance

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Mots clés: *Triticum aestivum* L., blé extra fort de printemps, description du cultivar, rendement, résistance aux maladies

Burnside, an extra strong, hard, red spring wheat (*Triticum aestivum* L.), was developed at the Cereal Research Centre, Agriculture and Agri-Food Canada, Winnipeg, MB. It received restricted registration No. 5860 from the Variety Registration Office of the Canadian Food Inspection Agency on 2004 Sep. 24. Burnside is registered for production in all Canadian provinces except Quebec. Burnside is particularly adapted to the wheat-growing regions of the Canadian prairies, and meets the kernel shape, kernel colour, and end-use quality characteristics of the Canada Western Extra Strong (CWES) wheat class.

Pedigree and Breeding Method

Burnside was selected from the cross of Glenlea*2//90B07-W3B/2*RL4452, where Glenlea (Evans et al. 1972) is the CWES class quality standard and 90B07-W3B is a Canada Western Red Spring (CWRS) breeding line developed at the Cereal Research Centre (CRC)

with the pedigree Pasqua*2/Glupro. Pasqua is a hard red spring cultivar with excellent leaf rust resistance developed at the CRC, and Glupro is a hard red spring cultivar developed by North Dakota State University with high grain protein content. Burnside carries the XNOR-B2 cleaved amplified product DNA marker associated with high grain protein content (Khan et al. 2000). RL4452 is a semi-dwarf CWES breeding line with the pedigree Glenlea*6/Kitt developed at CRC. The final backcross was made in 1996 at the Agriculture and Agri-Food Canada, Cereal Research Centre in Winnipeg. BC₁F₁ plants that carried the XNOR-B2 marker were used to produce doubled haploid lines at the CRC using the corn pollen technique (Aung et al. 1995). DH₁ lines from the cross were increased in the 1997–1998 CRC winter nursery near Irwell, New Zealand. DH₂ lines were evaluated for agronomic performance at Glenlea and Portage la Prairie, Manitoba in 1998. From this yield test, the four lines including

97E05*C57, with the highest yield potential, desirable disease resistance and suitable end-use quality were entered into the 1999 CWES “B” Test. In 2000, 96E05*C57 was given the designation “ES54” and entered into the 2000 CWES Cooperative Test. ES54 was evaluated in the CWES Cooperative Test in 2000, 2001, and 2002. The variables measured and the protocols followed in the Canada Western Extra Strong Cooperative test have been described by Graf and Fox (2000).

Area of Adaptation and Usage of CWES Wheat

Burnside is adapted to the wheat growing areas of the Prairie Provinces. CWES wheat such as Burnside, is used in blends with weaker wheat to improve dough strength and functionality. Burnside is grown principally in Manitoba. In 2008, it was grown on 32.8% of the Manitoba CWES acreage and 9.7% of the CWES acreage in western Canada (Anonymous, 2008).

Performance

Across all stations, Burnside was similar to Glenlea in grain yield, was 1.5% higher yielding than AC Corrine and 4.4% higher yielding than Bluesky, but 3% lower yielding than CDC Walrus over 3 yr of testing (2000–2002) in the CWES Cooperative test (Table 1). At eastern prairie locations (Zone 1), Burnside had grain yield similar to CDC Walrus and 1.7% greater than Glenlea, 2.8% greater than AC Corinne, and 6.6% greater than Bluesky over 3 yr (2000–2002) of testing (Table 1). Agronomic attributes are summarized in Table 2. On average, Burnside was 2 d earlier maturing than Glenlea and CDC Walrus, 3 d earlier than AC Corinne, and similar to Bluesky. Burnside was 3–4 cm shorter on average compared to Glenlea and AC Corinne, 2 cm shorter than Bluesky, and 1 cm shorter than CDC Walrus. Burnside had lower mean lodging

scores than the other cultivars. Burnside was similar to Glenlea, AC Corinne, and CDC Walrus for test weight, but had smaller seed mass than the other cultivars. Burnside appears intermediate to AC Corinne and Glenlea for preharvest sprouting resistance. Disease reactions for Burnside are summarized in Table 3. Burnside is resistant to moderately resistant to prevalent races of leaf and stem rust and resistant to loose smut. Its reaction to common bunt ranged from moderately susceptible to intermediate. Burnside is similar to Glenlea in resistance to Tan Spot, *Septoria nodorum*, and *Septoria tritici* and appears to be intermediate between Glenlea and Bluesky for reaction to Fusarium head blight.

Other Characteristics

SPIKE: Oblong, erect, lax, medium length with slight waxy bloom, white at maturity, apically awnleted, glumes are long with medium width, glabrous, lower glume shoulders are elevated, medium width, lower glume beak is short and acuminate; glumes are white at maturity.

KERNEL: Hard and light red colour, large size, long with medium width, elliptical, rounded cheeks; mid-long brush hairs; small to medium brush size; large and rounded embryo; shallow and narrow crease.

DISEASE REACTION: As part of the cooperative testing, leaf and stem rust reactions were evaluated in an epiphytotic nursery. Burnside is resistant to moderately resistant to prevalent races of leaf rust and stem rust, resistant to loose smut, moderately susceptible to intermediate resistance to common bunt. Burnside is similar to Glenlea in resistance to Tan Spot, *S. nodorum*, and *S. tritici*. Over the 3-yr trial, Burnside was more susceptible to Fusarium head blight compared with

Table 1. Mean grain yield for Burnside, CDC Walrus and check cultivars based on data collected in the Canada Western Extra Strong Cooperative test (2000–2002)

Cultivar	Yield (t ha ⁻¹)						
	2000–2002			All sites			
	Zone 1 ^z	Zone 2 ^y	Zone 3 ^x	2000	2001	2002	Grand mean
Glenlea	3.62	3.02	3.33	3.90	3.17	2.85	3.31
Bluesky	3.45	2.62	3.23	3.64	3.03	2.88	3.18
AC Corinne	3.57	3.06	3.09	3.88	3.05	2.89	3.27
CDC Walrus	3.67	3.22	3.31	4.05	3.23	2.97	3.42
Burnside	3.67	3.05	3.11	3.95	3.09	2.91	3.32
LSD _{.05}	0.47	0.69	0.39	0.23	0.18	0.26	0.12
No. tests	15	16	5	12	12	12	36

^z2000 and 2001 Zone 1 locations included Glenlea, Morden, Rosebank, and Elgin in Manitoba and Indian Head in Saskatchewan. In 2002, Zone 1 locations included Glenlea, Morden, Souris, and Rosebank in Manitoba and Indian Head in Saskatchewan.

^y2000 Zone 2 locations included Regina, Elrose, Swift Current, Scott, and Melfort in Saskatchewan and Lethbridge in Alberta. In 2001 and 2002, Zone 2 locations included Regina, Swift Current, Scott, and Melfort in Saskatchewan and Lethbridge in Alberta.

^x2000 Zone 3 included Beaverlodge, Alberta. In 2001 and 2002, Zone 3 locations included Ellerslie and Beaverlodge, Alberta.

Table 2. Mean agronomic characteristics of Burnside, CDC Walrus and check cultivars based on data collected in the Canada Western Extra Strong Cooperative test (2000–2002)

Cultivar	Maturity (d)				Overall mean	Height (cm)	Lodging ^z (1–9 scale)	Test weight (kg hL ⁻¹)	Kernel weight (mg)	Sprouting score ^y (1–9 scale)
	Zone 1	Zone 2	Zone 3	Zone 4						
Glenlea	95.4	104.5	114.4	102.0	91.0	3.9	76.6	40.4	4.7	
Bluesky	93.6	103.3	112.2	100.4	90.0	3.7	75.5	40.3	4.6	
AC Corinne	96.2	105.6	114.5	102.9	92.0	3.5	76.7	41.5	3.5	
CDC Walrus	94.9	104.1	113.0	101.4	89.0	3.7	76.7	39.0	4.4	
Burnside	92.7	102.8	112.6	99.8	88.0	3.1	76.7	37.3	3.8	
LSD ($P < 0.05$) ^x	0.6	0.7	1.4	0.4	1.0	0.6	0.4	0.6	2.8	
Station years	15	15	5	35	35	12	36	36	2	

^zLodging scale: 1 = vertical; 9 = flat.

^ySprouting score: 1 = resistant; 9 = susceptible.

^xLSD of means was based on the checks and Burnside and calculated using the SAS Proc-Mixed procedure.

Glenlea, AC Corinne, and CDC Walrus, but more resistant than Bluesky (Table 3).

The leaf rust races used were those multiplied from collections made the previous year (McCallum and Seto-Goh 2002, 2003, 2004). Stem rust (*Puccinia graminis* f. sp. *tritici*) races used for one or more years were: TPMKR, TMRTK, RKQSR, QFCSH, RTHJT, and QTHST (Fetch 2003). The races of loose smut [caused by *Ustilago tritici* (Pers.) Rostr.] included: T2, T9, T10, and T39, and the races of common bunt [caused by *Tilletia laevis* Kühn in Rabenh and *T. tilletia* (Bjerk.) G. Wint. in Rabenh.] included: T1, T6, T13, T19, L1, and L16 in a ratio of 1:1:1:1:2:2, respectively (Gaudet and Puchalski 1989a,b). Race designations are described by Roelfs and Martens (1988) for stem rust, Nielsen (1987) for loose smut, and Hoffman and Metzger (1976) for common bunt.

END-USE SUITABILITY: Burnside cannot be excluded from the highest grades of the Canada Western Extra Strong wheat class (Table 4). Burnside had significantly higher grain and flour protein content than the check cultivars. Burnside had grain protein content 1.1% higher than Glenlea and 0.6% higher than Bluesky. Burnside had significantly higher falling numbers compared with Bluesky and Glenlea. Burnside appeared similar to Bluesky for dough strength because Burnside had significantly longer farinograph dough development time and longer farinograph stability than Glenlea, but was similar to Bluesky for these parameters (Table 4).

Maintenance and Distribution of Pedigreed Seed

The breeder lines were derived from heads taken at random from a rogued fourth generation increase plot. These heads were grown in isolation as 1m rows at Glenlea, MB, in 2001 and as 15-m rows at Indian Head, SK, in 2002. Burnside breeder seed was generated from a bulk of 188 breeder's lines. Distribution rights are held by Fauschou Farms Ltd. III of Portage La Prairie, Manitoba. Breeder seed will be maintained by the Seed Increase Unit of the Experimental Farm, Indian Head, Saskatchewan, Canada S0G 2K0.

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Table 3. Disease reactions² of Burnside, CDC Walrus and check cultivars in the Canada Western Extra Strong Wheat Cooperative test (2000–2002)

Cultivar	Stem rust ^y			Leaf rust ^x			Loose smut ^w			Common bunt ^u			Fusarium head blight index ^t		
	2000	2001	2002	2000	2001	2002	2000	2001	2002	2000	2001	2002	2000	2001	2002
Glenlea	3 RMR	5 RMR	tr R	25 MRMS	20 MRMS	3 MR	0 R	–	0 R ^v	26.5 MS	8.0 I	–	60 S	52.5 S	70.7 S
Bluesky	5 RMR	5 RMR	3 RMR	70 S	15 MRMS	15 MR	0 R	0 R ^v	0 R	19.0 I	9.0 I	–	68 S	60.8 S	82.7 S
AC Corinne	tr R	3 RMR	tr R	20 MR	10 MR	5 MR	0 R	0 R	0 R	26.5 MS	13.0 I	–	48 S	45.0 S	76.3 S
CDC Walrus	tr R	1 R	tr R	15 MRMS	15 MR	3 MR	0 R	0 R ^v	0 R	14.8 MR	11.8 I	–	52 S	58.5 S	72.3MS
Burnside	tr R	3RMR	10MR	tr R	10 MR	tr R	0 R ^v	–	0 R	26.5 MS	10.8 I	–	51 S	68.0 S	81.5 S

Cultivar	Tan spot ^s			<i>Septoria nodorum</i> MKW ^r reduction			<i>Septoria nodorum</i> ^s score			<i>Septoria tritici</i> MKW ^r reduction			<i>Septoria tritici</i> ^s score		
	2000	2001	2002	2000	2001	2002	2000	2001	2002	2000	2001	2002	2000	2001	2002
Glenlea	7.5	–	–	–6.6	–	–	8.7	9.3	–	12.8	–	–	9.3	10.0	–
Bluesky	8.0	–	–	8.6	–	–	8.0	10.0	–	15.7	–	–	10.3	10.0	–
AC Corinne	7.3	–	–	–13.9	–	–	8.3	10.0	–	11.4	–	–	9.7	10.0	–
CDC Walrus	7.0	–	–	2.5	–	–	8.0	9.0	–	10.6	–	–	10.3	9.3	–
Burnside	7.5	–	–	10.5	–	–	8.3	10.0	–	7.0	–	–	10.0	10.0	–

²Percent infection and type of reaction: tr, trace; R, resistant; MR, moderately resistant; M, intermediate resistance, MS, moderately susceptible; S, susceptible.

³Caused by *Puccinia graminis* Pers. f. sp. *tritici* Eriks. E. Henn. Races used include TPMKR, TMRTK, RKQSR, QFCSH, RTHJT, and QTHST (Roelfs and Martens 1988; Fetch 2003).

⁴Caused by *Puccinia triticina*. Inoculum was a composite of all leaf rust races multiplied from collections made the previous year (McCallum and Seto-Goh 2002, 2003, 2004).

⁵Caused by *Ustilago tritici* (Pers.) Rostr. Races include T2, T9, T10, and T39 (Nielsen 1987; Menzies et al. 2003).

⁶Assessment made on fewer than 10 plants.

⁷Caused by *Tilletia laevis* Kühn in Rabenh and *T. tilletia* (Bjerk.) G. Wint. in Rabenh. The inoculum used was a composite of races T1, T6, T13, and T19 of *T. tritici* and L1, L16 of *T. laevis* mixed (vol/vol) in a 1:1:1:2:2 ratio (Gaudet and Puchalski 1989a) and represents the virulence spectrum of bunt isolates in western Canada (Gaudet and Puchalski 1989b).

⁸Caused by *Fusarium graminearum*, Index = [(% Incidence) × (% severity)]/100.

⁹McFadden' scale <5 = R; 6 = MR; 7 = I; 8–9 = MS; 10–11 = S.

¹⁰MKW = thousand kernel weight.

Table 4. Wheat and flour analytical data for Burnside and check cultivars based on data from the Central Bread Wheat Cooperative test (2000–2002). End-use quality testing was performed by the Grain Research lab of the Canadian Grain Commission on a composite from each year of the Canada Western Extra Strong Cooperative Test^z

Cultivar	Test weight (kg hL ⁻¹)	Kernel mass (mg)	Grain protein (%)	Flour protein (%)	Protein loss (%)	Falling number (s)	Amylo- graph (BU)	Flour yield (%)	Flour ash (%)	Agtron colour (%)	Starch damage (%)	Particle size index (%)
Glenlea	80.4	45.0	13.5	12.9	0.6	333	350	75.6	0.49	74	8.7	50
Bluesky	79.6	45.8	13.8	13.3	0.5	352	620	75.7	0.49	67	7.6	53
CDC Walrus	80.6	43.7	13.8	13.1	0.7	363	590	75.5	0.43	79	7.2	54
Burnside	80.4	41.1	14.4	13.8	0.4	382	563	75.6	0.47	72	8.4	51
LSD (<i>P</i> < 0.05)	0.5	2.3	0.2	0.2	0.2	21	104	0.8	0.06	3	0.4	2.0
Station years	3	3	3	3	3	3	3	3	3	3	3	3

Cultivar	Farinograph					Remix to peak					
	Absorption (%)	Dough development time (min)	Mixing tolerance index (BU)	Stability index (min)	Loaf volume (cm ³)	Loaf appearance	Crumb structure	Crumb colour	Absorption (%)	Mixing energy (W h kg ⁻¹)	Mixing time (min)
Glenlea	64.1	7.53	35	10.8	933	8.6	6.3	6.4	66.3	4.2	4.6
Bluesky	63.0	9.03	15	15.8	1000	8.8	6.2	6.3	68.0	4.5	5.1
CDC Walrus	63.0	7.87	28	11.7	937	8.7	6.2	6.2	67.0	4.3	4.4
Burnside	64.0	9.20	22	15.2	1005	8.8	6.0	6.0	69.3	4.5	5.7
LSD (<i>P</i> < 0.05)	1.5	1.59	10	3.5	36	0.2	0.5	0.4	1.9	0.3	1.1
Station Years	3	3	3	3	3	3	3	3	3	3	3

^zAC Corinne was not used as a quality check in 2000; thus, this check variety could not be included in the table.

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