CULTIVAR DESCRIPTION

CDC Verona durum wheat

C. J. Pozniak[1], S. L. Fox[2], and D. R. Knott[1]

[1]Crop Development Centre and Department of Plant Sciences, University of Saskatchewan, 51 Campus Drive, Saskatoon, Saskatchewan, Canada S7N 5A8 (e-mail: curtis.pozniak@usask.ca); and [2]Agriculture and Agri-Food Canada, Cereal Research Centre, 195 Dafoe Rd., Winnipeg, Manitoba, Canada R3T-2M9.
Received 19 June 2008, accepted 13 November 2008.

Pozniak, C. J, Fox, S. L. and Knott, D. R. 2009. **CDC Verona durum wheat**. Can. J. Plant Sci. **89**: 321–324. CDC Verona durum wheat is adapted to the durum production area of the Canadian prairies. This conventional-height durum wheat combines good yield and high grain pigment and protein concentrations and is low in grain cadmium. CDC Verona is strong strawed and has similar maturity and disease resistance as other registered durum cultivars.

Key words: *Triticum turgidum* L. var *durum*, durum wheat, yield, yellow pigment, cadmium, cultivar description

Pozniak, C. J, Fox, S. L. et Knott, D. R. 2009. **lé dur CDC Verona**. Can. J. Plant Sci. **89**: 321–324. CDC Verona est une variété de blé dur adaptée à la zone de production des Prairies canadiennes. Ce cultivar de hauteur classique se caractérise par un rendement intéressant et une forte pigmentation du grain, qui contient aussi beaucoup de protéines mais peu de cadmium. CDC Verona a une paille robuste et sa précocité ainsi que sa résistance aux maladies rappellent celles des autres variétés homologuées de blé dur.

Mots clés: *Triticum turgidum* L. var *durum*, blé dur, rendement, pigment jaune, cadmium, description de cultivar

CDC Verona, a spring durum wheat (*Triticum turgidum* L. var *durum*) was developed at the Crop Development Center, University of Saskatchewan, and received registration no.6471 from the Canadian Food Inspection Agency on 2008 Jun. 17.

Pedigree and Breeding Method

CDC Verona was selected from the cross D95253/D95212 made in 1996 at the Crop Development Centre (CDC), Saskatoon, Saskatchewan. The breeding line D95253 was derived from the cross D950505/DT633 and D95212 is derived from DT657/8562-DH5B, all developed at the CDC. CDC Verona was developed using a modified-bulk breeding method. F_1 plants were grown at a contra-season nursery near Lincoln, New Zealand, in 1996, from which seed was bulk harvested. The resulting F_2 plants were space-planted at Saskatoon and plants with average height and acceptable maturity and standability were selected and bulk harvested. The F_3 seed was increased in near Lincoln, New Zealand. The F4 generation was space-planted in an artificially inoculated, irrigated leaf rust (caused by *Puccinia triticina* Eriks.) and stem rust (caused by *Puccinia graminis* Pers.:Pers. f.sp. *tritici* Eriks. & E. Henn.) nursery at Saskatoon and 278 single plants were selected and grown as F5 rows at Saskatoon. The rust races used in this nursery were representative of those found the previous year in disease surveys (Fetch 2003; McCallum and Seto-Goh 2003). Row D44-2428 was identified as having acceptable maturity and height and was evaluated in replicated yield trials near Saskatoon (Kernen Research Farm and the Goodale Crop Research Farm), SK, Elrose, SK, Lethbridge, AB and Scott, SK, in 2000 and 2001. Selection in replicated trials was for agronomic performance, disease resistance, and grain quality (protein, pigment, gluten strength and grain cadmium concentration). Resistance to leaf rust and stem rust was assessed in the F7 generation in a rust nursery at Saskatoon inoculated with mixtures of prevalent races (Fetch 2003; McCallum and Seto-Goh 2003). D44-2428 was further evaluated at Saskatoon, SK, Lethbridge, AB, Regina, SK, and Swift Current, SK, in the Western Durum Wheat "A" test in 2002 and advanced for yield trialing in the 2003 Durum Wheat "B" test. D44-2428 was evaluated as DT540 in the Durum wheat co-operative tests over three years (2004–2006). The variables measured and the protocols followed in the Durum Wheat Cooperative test have been described by Graf and Fox (2000). In co-operative trials, the stem rust races were TMRT, RKQS, TPMK, RTHJ, QTHS, and RHTS [races designated as per Roelfs and Martens (1988), Fetch (2003)]. The leaf rust races were MCDS, MBDS, MBR, MBRJ, MGB, TJB, TJBJ, TGBJ, and 128-1 (74-2) [races designated as per Long and Kolmer (1989), McCallum and Seto-Goh (2003)]. Resistance to races T26, T32, and T33 of loose smut [*Ustilago tritici* (Pers.) Rostr] (Nielsen 1987) and L1, L16, T1, T6, T13, and T19 of common bunt [*Tilletia laevis* Kuhn in Rabenh., and *T. tritici* (Bjerk.) G. Wint. In Rabenh.]

Table 1. Three-year averages for grain yield (kg ha^{-1}) of CDC Verona and check cultivars in the Durum Cooperative Test (2004–2006)

	2004			2005			2006			2004–2006		
Cultivar	Zone 1[z]	Zone 2[z]	Mean	Zone 1	Zone 2	Mean	Zone 1	Zone 2	Mean	Zone 1	Zone 2	Mean
AC Avonlea	5490	5212	5330	4580	4690	4660	4200	4070	4130	3815	3720	3770
AC Morse	5460	4798	5100	3980	4410	4260	4570	4050	4270	3920	3555	3740
AC Navigator	4970	5465	5240	3800	4860	4470	4430	4410	4420	3660	3940	3830
Strongfield	5740	5500	5610	5070	5040	5050	4500	4390	4430	4060	3950	3995
Commander	5420	5771	5610	3590	4710	4300	4515	4570	4550	3780	4080	3940
CDC Verona	5450	5287	5360	4990	4760	4850	4450	4027	4200	3960	3730	3840
$LSD_{0.05}$	550	320	330	560	320	370	431	274	238	410	290	340
No. Test	5	6	11	4	7	11	5	7	12	14	20	34

[z]Zone 1: Brandon, Glenlea (2004, 2006), Indian Head, Langdon, Souris. Zone 2: Avonlea (2006), Bieseker (2006) Irricana (2004, 2005), Saskatoon, Lethbridge (dry land), Regina (2005, 2006), Stewart Valley, Swift Current, Shouldice (irrigated; 2004, 2005).

(Hoffman and Metzger 1976) were evaluated in the Durum Cooperative tests.

Performance

On average, CDC Verona yielded similar to AC Navigator, Strongfield and Commander over three years of testing in the Durum Cooperative test ($P > 0.05$; Table 1). Time to maturity of CDC Verona (measured as time from planting to when seeds reached approximately 16% moisture) was similar to AC Navigator and 2 d later than checks AC Avonlea, AC Morse, Strongfield, and Commander (Table 2). CDC Verona is a standard height cultivar that has stronger straw than Strongfield and AC Avonlea, similar to AC Morse and Commander (Table 2). Test weight of CDC Verona was similar to AC Avonlea and Strongfield, and significantly greater than AC Morse (Table 2). 1000-kernel weight of CDC Verona was similar to all check cultivars. In all 3 yr of Cooperative testing, grain protein concentration of CDC Verona was similar to Strongfield and AC Avonlea, and significantly greater than AC Morse, AC Navigator, and AC Commander (Table 3). Like Strongfield, CDC Verona has low grain cadmium concentration and lacks the OPC-20 DNA marker associated with the low cadmium phenotype (Penner et al. 1995). Averaged over 3 yr of testing, CDC Verona had high yellow pigment concentration, similar to AC Navigator and Commander (Table 3). CDC Verona has intermediate gluten strength (as assessed by gluten index), better than AC Avonlea, and similar to AC Morse (Table 3). Over 3 yr of tests, average semolina milling yield of CDC Verona was significantly ($P < 0.05$) better than Strongfield. CDC Verona semolina protein (%) was higher than all checks (Table 3), but not statistically different from Strongfield.

Other Characteristics

Disease reaction. CDC Verona is resistant to the prevalent races of leaf and stem rust and common bunt (Table 4). CDC Verona is susceptible to prevalent races of loose smut in western Canada and moderately susceptible to the leaf spotting complex (caused by *Pyrenophora tritici-repentis* (Died.) Drechs. and *Stagonospora nodorum* (Berk.) Castellani & E.G. Germano) (Table 4). In most nurseries, CDC Verona had a lower Fusarium head blight (caused by *Fusarium graminearum* Schwabe.) index than all checks (Table 4).

Table 2. Three-year averages for agronomic characteristics and check cultivars in the Durum Cooperative test (2004–2006)

	Maturity (d)			Test weight (kg hL^{-1})			1000-Kernel wt (g)	Height (cm)	Lodging (1–9)[y]
Cultivar	Zone 1[z]	Zone 2[z]	Mean	Zone 1	Zone 2	Mean	Mean	Mean	Mean
AC Avonlea	105	110	108	76.3	79.5	78.2	40.9	97	3.1
AC Morse	104	110	108	75.2	78.8	77.3	40.5	92	2.2
AC Navigator	106	112	110	75.4	80.3	78.3	41.0	82	2.4
Strongfield	104	110	108	76.7	80.2	78.6	40.6	95	3.5
Commander	104	111	108	74.7	79.3	77.4	41.5	78	2.0
CDC Verona	106	112	110	76.8	79.6	78.4	40.8	96	2.0
$LSD_{0.05}$	2	1	1	1.2	0.8	0.8	1.3	2	0.9

[z]Zone 1: Brandon, Glenlea (2004, 2006), Indian Head, Langdon, Souris. Zone 2: Avonlea (2006), Bieseker (2006) Irricana (2004, 2005), Saskatoon, Lethbridge (dry land), Regina (2005, 2006), Stewart Valley, Swift Current, Shouldice (irrigated; 2004, 2005).
[y]Resistance to lodging where 1 is erect and 9 is completely lodged.

Table 3. Summary of grain protein concentration (expressed on 13.5% moisture basis) measured on location composites and grain cadmium concentration, pigment concentration, gluten index, semolina milling yield and semolina protein (expressed on 13.5% moisture basis) measured on yearly composite samples of CDC Verona and check cultivars evaluated from the 2004–2006 Durum Cooperative tests

	Protein concentration (%)											
	2004		2005		2006		Average					
Cultivar	Zone 1[z]	Zone 2[z]	Zone 1	Zone 2	Zone1	Zone 2	2004–2006	Cadmium[y] (mg kg^{-1})	Pigment[y] (g kg^{-1})	GI[y] (%)	Semolina[y] Yield (%)	Semolina[y] Protein (%)
AC Avonlea	13.2	13.7	15.5	14.4	15.1	14.3	14.2	198	8.2	28	66.1	12.8
AC Morse	12.7	13.5	14.7	13.9	14.5	14.2	13.8	182	8.1	57	65.6	12.8
AC Navigator	13.2	12.8	14.2	13.7	14.1	13.4	13.4	241	9.4	80	67.3	12
Strongfield	13.8	13.7	16	14.3	14.9	14.2	14.3	87	8.8	73	65.4	13
Commander	12.7	12.9	14.6	13.8	14.3	13.7	13.5	260	9.8	94	66.8	12
CDC Verona	13.6	13.8	15.3	14.3	15	14.6	14.3	88	9.5	57	66.2	13.3
$LSD_{0.05}$	0.5	0.4	0.7	0.6	0.8	0.5	0.4	16	0.3	9	0.6	0.3
No. tsts	4	6	3	7	4	7	31	3	3	3	3	3

[z]Zone 1: Brandon, Glenlea (2004, 2006), Indian Head, Langdon, Souris. Zone 2: Avonlea (2006), Bieseker (2006) Irricana (2004, 2005), Saskatoon, Lethbridge (dry land), Regina (2005, 2006), Stewart Valley, Swift Current, Shouldice (irrigated; 2004, 2005).
[y]Analyses performed on composite samples from each year.

Spikes. Spikes of CDC Verona are tapering, mid-dense, mid-long, erect, with white awns; glumes are mid-wide, mid-long, slightly pubescent; glume shoulders are straight, medium broad; the glume beak is slightly curved.

Kernels. Kernels are amber in color, midsize to large, and elliptical; cheeks are angular; crease is mid-deep to shallow, and mid-wide; brush is short; embryo is mid-size to large.

End-use suitability. CDC Verona is eligible for grades of the Canada Western Amber Durum wheat class.

Maintenance and Distribution of Pedigreed Seed

CDC Verona consists of a composite of 116 $F_{8:10}$ breeder lines selected from a rogued F_4:F_8 plot grown at Saskatoon in 2004. Breeder seed will be maintained by the Crop Development Centre, University of Saskatchewan, Saskatoon, Saskatchewan, Canada S7N 5A8. A Plant Breeders' Rights application has been filed (application number 08-6316). CDC Verona will be added to the OECD list of cultivars. Distribution and multiplication of pedigreed seed stocks will be handled by Paterson Grain, 22nd Floor, 333 Main Street, Winnipeg, Manitoba, Canada R3C 4E2.

Table 4. Disease reactions of CDC Verona and check cultivars grown in the Durum Cooperative test (2004–2006)

Entry	Year	Stem rust[z]	Leaf rust[z]	Common bunt[z]	Leaf spot[y]	FHB index[x]
AC Avonlea	2004	R	R	I	8.1	62
	2005	R	R	MR-I	7.6	53
	2006	R	R	VR	7.0	70
AC Morse	2004	R	R	R-	8.3	64
	2005	R	R	R	8.0	63
	2006	R	R	VR	8.0	65
AC Navigator	2004	R	R	I-	8.1	37
	2005	R	R	R	8.6	59
	2006	R	R	VR	8.0	77
Strongfield	2004	R	R	I-	7.5	37
	2005	R	R	R	7.1	43
	2006	R	R	VR	7.5	56
Commander	2004	R	R	R	8.1	44
	2005	R	R	R	7.7	61
	2006	R	R	VR	7.0	61
CDC Verona	2004	R	R	R-	8.0	25
	2005	R	R	R	7.5	36
	2006	R	R	VR	7.0	46

[z]VR = very resistant; R = Resistant; MR = moderately resistant; I = Intermediate resistance; MS = moderately susceptible; S = susceptible.
[y]Adult plant rated at mid-grain fill at Swift Current, using the McFadden Scale where <5 = 6, 6 = MR, 7 = I, 8–9 = MS, and S = 10–11.
[x]Fusarium head blight index: (% infected spikelets × % infected heads)/100. Indices are averages from Carman, MB (2004–2006), Ottawa, ON (2004–2006), Glenlea (2006), and Charlottetown, PEI (2004, 2006).

Financial support from the Saskatchewan Ministry of Agriculture, the University of Saskatchewan, and the Western Grains Research Foundation is greatly acknowledged. Appreciation is expressed to the following: J. Clarke (Semiarid Prairie Agricultural Research Centre, AAFC, Swift Current, SK), B. Beres (Lethbridge Research Centre, AAFC, Lethbridge, AB), E. Elias (North Dakota State University, Fargo, ND, USA) and T. Ferguson (Viterra, Calgary, AB) for agronomic performance testing; C. Perron (CDC, University of Saskatchewan, Saskatoon, SK), B. Marchylo, J. Dexter, and L. Schlichting (Grain Research Laboratory, Canadian Grain Commission, Winnipeg, MB) and J.S. Noll and D. Niziol (Cereal Research Centre, AAFC, Winnipeg) for end-use suitability analysis; A. Brule-Babel, (University of Manitoba), and J. Gilbert (Cereal Research Centre, AAFC, Winnipeg, MB), and M. Fernandez (Semiarid Prairie Agricultural Research Centre, AAFC, Swift Current, SK) for assessing reaction to Fusarium head blight and/or leaf spots; J.G. Menzies for determining reaction to loose smut, and G.R. Hughes (University of Saskatchewan, Saskatoon, SK), T. Fetch and B. McCallum (Cereal Research Centre, AAFC, Winnipeg) for assessing reaction to stem and leaf rust; D.A Gaudet and T. Despins (Lethbridge Research Centre, AAFC, Lethbridge, AB) for assessing reaction to common bunt; and D. Benallack (University of Saskatchewan, Saskatoon) for production and maintenance of Breeder Seed. The technical support provided by N. Hirji, C.V. Tang, R. Babonich (CDC, University of Saskatchewan, Saskatoon, SK) is gratefully acknowledged.

Hoffmann, J. A. and Metzger, R. J. 1976. Current status of virulence genes and pathogenic races of the wheat bunt fungi in the northwestern USA. Phytopathology **66**: 657–660.

Fetch, T. G., Jr. 2003. Physiologic specialization of *Puccinia graminis* on wheat, barley, and oat in Canada in 2000**.** Can. J. Plant Pathol. **25**: 174–181.

Long, D. L. and Kolmer, J. A. 1989. A North American system of nomenclature for *Puccinia recondita* f.sp. *tritici*. Phytopathology **79**: 525–529.

McCallum, B. D. and Seto-Goh, P. 2003. Physiologic specialization of wheat leaf rust (*Puccinia triticina*) in Canada in 2000. Can. J. Plant Pathol. **25**: 91–97.

Nielsen, J. 1987. Races of *Ustilago tritici* and techniques for their study. Can. J. Plant Pathol. **9**: 91–105.

Penner, G. A., Clarke, J., Bezte, L. J. and Leisle, D. 1995. Identification of a RAPD marker linked to a gene governing cadmium uptake in durum wheat. Genome **38**: 543–547.

Roelfs, A. P. and Martens, J. W. 1988. An international system of nomenclature for *Puccinia graminis* f. sp. *tritici*. Phytopathology **78**: 525–533.