

Strongfield durum wheat

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Clarke, J. M., McCaig, T. N., DePauw, R. M., Knox, R. E., Clarke, F. R., Fernandez, M. R. and Ames, N. P. 2005. **Strongfield durum wheat**. Can. J. Plant Sci. **85**: 651–654. Strongfield durum wheat (*Triticum turgidum* L. var *durum*) is adapted to the durum production area of the southern Canadian prairies. It combines high yield, high grain protein concentration, and low grain cadmium concentration. Strongfield has shorter, stronger straw than Kyle, and has similar maturity and disease resistance to other currently registered durum cultivars.

Key words: *Triticum turgidum* L. var *durum*, durum wheat, cultivar description, yield, protein, disease resistance

Clarke, J. M., McCaig, T. N., DePauw, R. M., Knox, R. E., Clarke, F. R., Fernandez, M. R. et Ames, N. P. 2005. **Le blé dur Strongfield**. Can. J. Plant Sci. **85**: 651–654. Le cultivar Strongfield de blé dur (*Triticum turgidum* L. var *durum*) est bien adapté à la partie du sud des Prairies canadiennes où l'on cultive le blé dur. Il se caractérise par un rendement élevé, une forte concentration de protéines dans le grain et une faible teneur en cadmium. Strongfield a une paille plus courte et plus robuste que Kyle, ainsi qu'une précocité et une résistance aux maladies similaires à celles d'autres variétés de blé dur.

Mots clés: *Triticum turgidum* L. var *durum*, blé dur, description de variété, rendement, protéine, résistance aux maladies

Strongfield durum wheat (*Triticum turgidum* L. var *durum*) was developed at the Agriculture and Agri-Food Canada Semiarid Prairie Agricultural Research Centre, Swift Current, Saskatchewan. It received registration No.5819 from the Canadian Food Inspection Agency on 2004 May 18.

Pedigree and Breeding Method

Strongfield was selected from the cross AC Avonlea/DT665 made in 1994 at the Semiarid Prairie Agricultural Research Centre, Swift Current, SK. DT665 derives from the cross Kyle/Nile; Nile was obtained from the International Centre for Agricultural Research in the Dry Areas, Aleppo, Syria. AC Avonlea (Clarke et al. 1998) and Kyle (Townley-Smith et al, 1987) were developed at the Semiarid Prairie Agricultural Research Centre. Strongfield was developed using a modified pedigree technique. F₁ plants were grown in an out of season nursery near Brawley, California, from which seed was harvested and bulked. The F₂ was grown as individual plants in a leaf and stem rust epiphytotic nursery near Swift Current in 1995. Individual spikes from selected plants were grown in F₃ single 3-m rows near Swift Current in 1996. Five spikes per selected line were bulk-threshed and sown in individual F₄ rows in an out-of-season nursery near Lincoln, New Zealand, to produce F₅ seed. Unreplicated F₅ yield trials were grown near Swift Current (rainfed and sprinkler irrigated), Regina and Indian Head in 1997. Lines were selected for agronomic performance, disease resistance, and processing quality (protein, pigment, gluten strength), and five spikes per selected line were sown in individual F₆ rows in an out-of-season nursery near Irwell, New Zealand. These rows were screened for straw strength, and selected rows were bulk-harvested and the

seed returned to Canada. The F₇ was grown in a two-replicate yield trial near Swift Current and in unreplicated trials near Regina and Lethbridge in 1998 and selected for agronomic performance, disease resistance, and processing quality (protein, pigment, gluten strength). Leaf and stem rust reactions were assessed in hill plots in the F₅ and F₇ generations in a leaf and stem rust epiphytotic nursery near Glenlea, Manitoba. The stem rust (*Puccinia graminis* Pers.:Pers.) races used were: QFC (C75), QTH (C25), TPM (C53), TMR (C10), TMR (C95), RTH (C57), RRQ (C63) and RKQ (C63). The races of leaf rust used were MCDS, MBDS, MBR, MBRJ, MGB, TJB, TJJ, TGBJ, and 128-1 (74-2) (Kolmer 1999, 2001). Races T26, T32 and T33 of loose smut [*Ustilago tritici* (Pers.) Rostr.] and races L1, L16, T1, T6, T13, and T19 of common bunt [*Tilletia laevis* Kuhn in Rabenh., and *T. tritici* (Bjerk.) G. Wint. in Rabenh.] were used for screening of the Durum Cooperative Test entries. The race designations are those described by Roelfs and Martens (1988) for stem rust, Long and Kolmer (1989) for leaf rust, Hoffmann and Metzger (1976) for common bunt, and Nielsen (1987) for loose smut.

Strongfield was evaluated in the Durum Western A Test (five locations) in 1999, and as DT712 in the Durum Cooperative Test (12 locations) from 2000 to 2002. The 133 breeder lines originate from 144 plant rows grown in 2001, which in turn originate from F₅-derived F₉ plants grown in 2000.

Performance

Strongfield yielded on average significantly ($P < 0.05$) more than the checks, with the exception of AC Morse, in 3 yr of testing in the Durum Cooperative Test (Table 1). Time to

Table 1. Three-year averages for grain yield of Strongfield and check cultivars in the Durum Cooperative Test, 2000 to 2002

	2000			2001			2002			2000–2002 Mean
	Zone 1 ^z	Zone 2	Mean	Zone 1	Zone 2	Mean	Zone 1	Zone 2	Mean	
	(kg ha ⁻¹)									
AC Avonlea	4190	4680	4480	3700	2840	3180	3590	3550	3560	3750
Kyle	3950	4410	4220	3290	2770	2980	3240	3540	3410	3550
AC Melita ^y	–	–	–	3300	2760	2980	3410	3440	3430	3577
AC Morse	4290	4720	4540	3700	2890	3220	3670	3590	3620	3810
AC Navigator	3220	4300	3850	2860	2950	2910	3270	3540	3430	3410
Strongfield	4720	5060	4920	4060	2970	3400	3540	3830	3710	4030
LSD _{0.05}	370	220	220	470	250	280	420	330	260	242 ^x
# tests	5	7	12	4	6	10	5	7	12	34

^zZone 1: Glenlea, Brandon, Souris, Indian Head, Langdon (dropped in 2001 due to high cv). Zone 2: Lethbridge, Regina, Saskatoon, Elrose (abandoned 2001 and 2002), Swift Current, Stewart Valley, Irricana, Lethbridge-irrigated (2002 only).

^yNot in the 2000 trial.

^xLSD_{0.05} 273 kg ha⁻¹ for comparisons with AC Melita.

Table 2. Three-year averages for agronomic characteristics of Strongfield and check cultivars in the Durum Cooperative Test, 2000–2002

	Days to maturity			Test weight (kg hL ⁻¹)			1000- kernel wt (g)	Height (cm)	Lodging (1–9)
	Zone 1 ^z	Zone 2	Mean	Zone 1	Zone 2	Mean			
AC Avonlea	100	110	105	77	80.3	78.9	42.1	86	2.7
Kyle	101	111	106	77.3	79.8	78.7	41.4	97	4.5
AC Melita ^y	98	110	104	76.4	80	78.5	41.7	91	2.6
AC Morse	100	110	105	75.8	79.5	77.9	41	81	2.1
AC Navigator	100	111	106	76	81	78.8	43.1	75	2.9
Strongfield	99	109	105	77.5	80.7	79.3	41.9	85	2.9
LSD _{0.05}	2.3	1	1.2	0.7	1	0.8	0.3	3.2	0.5
LSD _{0.05} ^x	2.6	1.1	1.4	0.8	1.2	0.9	0.4	3.6	0.6
# tests	11	13	24	15	20	35	35	33	12

^zZone 1: Glenlea, Brandon, Souris, Indian Head, Langdon (dropped in 2001 due to high cv). Zone 2: Lethbridge, Regina, Saskatoon, Elrose (abandoned 2001 and 2002), Swift Current, Stewart Valley, Irricana, Lethbridge-irrigated (2002 only).

^yNot in the 2000 trial.

^xFor comparisons with AC Melita.

Table 3. Summary of grain protein concentration (expressed on 13.5% moisture basis) measured on location composites, and grain cadmium concentration, pigment concentration, and gluten index measured on yearly composites of Strongfield and checks from the 2000–2002 Durum Cooperative tests

	Protein concentration (%)						Cadmium ^x (µg g ⁻¹)	Pigment ^x (µg g ⁻¹)	Gluten ^x index (%)	
	2000		2001		2002					
	Zone 1 ^z	Zone 2	Zone 1	Zone 2	Zone 1	Zone 2				Mean
AC Avonlea	14.4	13.8	15.8	15.3	14.4	15.2	14.8	0.023	8.3	25
Kyle	14.1	13.3	15.3	15.3	14.8	15.1	14.6	0.023	7	27
AC Melita ^y	–	–	15.1	14.7	14	14.5	14.2	0.02	7.7	72
AC Morse	14.1	13.5	14.9	14.8	14	14.5	14.3	0.021	8.1	56
AC Navigator	14.2	13.2	15.3	14.7	14.4	13.9	14.2	0.027	9.4	66
Strongfield	14.8	13.6	16.1	15.6	14.6	15.1	14.9	0.011	8.8	62
LSD _{0.05}	0.4	0.4	0.7	0.4	0.7	0.5	0.3 ^w	0.003	0.3	12
# tests	4	7	4	6	4	7	32	3	3	3

^zZone 1: Glenlea, Brandon, Souris, Indian Head. Zone 2: Lethbridge, Regina, Saskatoon, Elrose (abandoned in 2001 and 2002), Swift Current, Stewart Valley, Irricana, Lethbridge-irrigated (2002 only).

^yNot in the 2000 trial.

^xAnalysis performed on composite samples from each year; Kyle quality was determined in 2000 only, and AC Melita in 2001 and 2002.

^wLSD_{0.05} 0.4 for comparisons with AC Melita.

maturity of Strongfield was similar to check cultivars (Table 2). Strongfield has shorter, stronger straw than Kyle, similar to AC Avonlea. Test weight of Strongfield was similar to AC Avonlea, Kyle and AC Navigator, and significantly greater ($P < 0.05$) than AC Morse (Table 2). Average grain protein concentration of Strongfield was similar to AC

Avonlea, and significantly greater than AC Melita, AC Morse and AC Navigator in 3 yr in the Durum Cooperative Test (Table 3). Strongfield has significantly lower grain cadmium concentration than all of the check cultivars, yellow pigment concentration similar to AC Avonlea, and gluten strength, as measured by gluten index, intermediate to AC

Table 4. Summary of disease reactions of Strongfield and check cultivars grown in the Durum Cooperative Test, 2000–2002

Cultivar		Stem rust ^z	Leaf rust ^z	Common bunt ^z	<i>Stagonospora nodorum</i> ^y	Leaf spots ^x	FHB index ^w
AC Avonlea	2000	R	TR	VR	9	8.3	40 S
	2001	R	R	R	10	7	36 MS
	2002	R	R	– ^y	–	9.2	69 S
Kyle	2000	R	TR	VR	8	10.3	37 MS
	2001	R	R	R	10	7	55 S
	2002	R	R	–	–	8.9	64 MS
AC Melita	2000	–	–	–	–	–	–
	2001	R	R	R+	10.7	7.8	51 S
	2002	R	R	–	–	9.3	73 S
AC Morse	2000	R	TR	VR	9	9.3	52 S
	2001	R	R	R+	10	7	51 S
	2002	R	R	–	–	9.8	83 S
AC Navigator	2000	R	TR	VR	9	10.5	36 MS
	2001	R	R	R+	10.7	7.8	76 S
	2002	RMR	R	–	–	9.8	70 S
Strongfield	2000	R	TR	I	8	8.5	49 MS
	2001	R	TR	R	10	6.8	59 S
	2002	R	VR	–	–	9.1	73 S

^zPercent infection and type of reaction: TR, trace resistant; VR, very resistant; R+, highly resistant; R, resistant; MR, moderately resistant; MS, moderately susceptible; S, susceptible.

^y*Stagonospora nodorum* field rating (0 = no symptoms, 10 = severe symptoms).

^xAdult plant, rated mid-grainfill at Swift Current and Indian Head (1 = no symptoms, 11 = severe symptoms).

^wFusarium head blight index: (% infected spikelets × % infected heads)/100 and relative ratings.

^zMissing data; no common bunt and *Stagonospora nodorum* data available for 2002; AC Melita not in the 2000 trial.

Melita and AC Morse (Table 3). Strongfield shows no band for the OPC-20 cadmium marker described by Penner et al. (1995), indicating that it has the low cadmium allele described by Clarke et al. (1997), as do the Canadian cultivars Arcola (Knott 1983) and Napoleon.

Other Characteristics

SPIKES: Tapering, mid-dense to dense, mid-long, erect, white awns; glumes mid-wide, mid-long, glabrous, white; glume shoulders straight to elevated; square, some slightly sloping; glume beak straight to moderately curved.

KERNEL: Colour medium amber; mid-size to small, elliptical; cheeks angular; crease mid-deep to shallow, mid-wide; brush mid-size, short; embryo mid-size to large.

DISEASE REACTION: Resistant to prevalent races of leaf rust and stem rust, moderately resistant to common bunt, highly susceptible to loose smut races prevalent in western Canada, and susceptible to leaf spots [caused mainly by *Pyrenophora tritici-repentis* (Died.) Drechs. and *Stagonospora nodorum* (Berk.) Castellani & E.G. Germano] and fusarium head blight (caused by *Fusarium graminearum* Schwabe.) (Table 4).

END-USE SUITABILITY: Eligible for the Canada Western Amber Durum wheat class.

Maintenance and Distribution of Pedigreed Seed

Breeder seed will be maintained by the Seed Increase Unit, Agriculture and Agri-Food Canada, Indian Head, Saskatchewan, Canada S0G 2K0. A Plant Breeders' Rights application has been filed. Distribution and multiplication of

pedigreed seed stocks will be handled by SeCan, 201-52 Antares Drive, Ottawa, Ontario, Canada K2E 7Z1

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