CULTIVAR DESCRIPTION

Transcend Durum wheat

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Singh, A. K., Clarke, J. M., Knox, R. E., DePauw, R. M., McCaig, T. N., Fernandez, M. R. and Clarke, F. R. 2012. **Transcend durum wheat**. Can. J. Plant Sci. **92**: 809–813. Transcend durum wheat [*Triticum turgidum* L. subsp. *durum* (Desf.) Husn.] is adapted to the durum production area of the Canadian prairies. It combines high grain yield, grain protein concentration, test weight, yellow grain and dough pigment, and low grain cadmium concentration. Transcend has strong straw, slightly more days to maturity, and improved *Fusarium* head blight resistance compared to Strongfield.

Key words: *Triticum turgidum* L. subsp. *durum* (Desf.) Husn., durum wheat, cultivar description, grain yield, yellow pigment, Cadmium, *Fusarium* head blight

Singh, A. K., Clarke, J. M., Knox, R. E., DePauw, R. M., McCaig, T. N., Fernandez, M. R. et Clarke, F. R. 2012. **Le blé dur Transcend**. Can. J. Plant Sci. **92**: 809–813. Transcend est une variété de blé dur (*Triticum turgidum* L. sous-esp. *durum* (Desf.) Husn.) acclimatée à la région des Prairies canadiennes où l'on cultive le blé dur. Cette variété se caractérise par un rendement grainier, une concentration de protéines dans le grain, un poids spécifique, une teneur en pigment jaune dans le grain et dans la pâte élevés, ainsi que par une faible teneur en cadmium dans le grain. Transcend a une paille robuste, prend légèrement plus de jours que Strongfield pour parvenir à maturité et résiste mieux que ce cultivar à la brûlure de l'épi causée par *Fusarium*.

Mots clés: *Triticum turgidum* L. sous-esp. *durum* (Desf.) Husn., blé dur, description de cultivar, rendement grainier, pigment jaune, Cadmium, brûlure de l'épi causée par *Fusarium*

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Transcend durum wheat was developed at the Semiarid Prairie Agricultural Research Centre (SPARC), Agriculture and Agri-Food Canada (AAFC), Swift Current, SK. Filing for Plant Breeders' Rights protection (10-7018) was accepted on 2010 Jun. 30, and Transcend received registration No. 6858 from the Variety Registration Office, Canadian Food Inspection Agency, on 2011 Mar. 28.

Pedigree and Breeding Method

Transcend (experimental name DT801) was selected from the cross DT707/DT696 made in 2001 at Semiarid Prairie Agricultural Research Centre, Swift Current, SK. Line DT707 (also known as 9468-DQ*2) was developed at SPARC and is derived from a two-way cross AC Avonlea/DT 665. DT665 was derived from a cross between Kyle/Nile. Line DT696 (also known as 9366-BS*1) was developed at SPARC and is derived from a three-way cross DT618/DT637//Kyle. Kyle is a registered durum wheat cultivar (Townley-Smith et al. 1987). DT801 was developed through a doubled haploid (DH) technique at SPARC using the wheat-maize pollen system. In 2003, 799 DH genotypes from DT707/DT696 population were grown near Swift Current in 1.5-m rows under irrigation. Of these, 466 genotypes were selected for plant height and lodging and grown in a winter nursery near Leeston, New Zealand, in 2003–2004 as single 2-m long rows. Based on plant height, days to maturity and straw strength, 351 DH genotypes were selected and rows were individually harvested as the seed source for agronomic trials in Canada. In 2004, the 351 DH genotypes were grown in a one replication test (with DH entries, parents and checks) under dryland conditions near Swift Current, Regina, and Indian Head, SK, and Lethbridge, AB. These genotypes were also grown in a *Fusarium* head blight (FHB) screening nursery with *F. graminearum* infested corn seed near Portage la Prairie, MB. Forty-two DH genotypes were selected based on agronomic performance, disease resistance (primarily, FHB, leaf spots and rusts) and quality (protein concentration,

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Abbreviations: **DH**, doubled haploid; **FHB**, Fusarium head blight

Table 1. Grain yield (kg ha^{-1}) of Transcend and check cultivars in the Durum Cooperative Test, 2007 to 2009 in zones Z1 and Z2[z]

	2007			2008			2009			2007–2009
	Z1	Z2	Mean	Z1	Z2	Mean	Z1	Z2	Mean	Mean
AC Avonlea	3093	3285	3236	4515	4270	4359	6211	4279	4922	4163
AC Morse	3304	3478	3422	4690	4256	4413	5961	4172	4771	4189
AC Navigator	3151	3418	3341	4385	4483	4446	5772	4499	4921	4227
Strongfield	3416	3415	3410	4321	4383	4359	6258	4405	5021	4260
Commander	3366	3614	3540	4384	4561	4499	6244	4569	5128	4387
Transcend	3476	3484	3484	5003	4340	4579	6331	4445	5069	4378
$LSD_{0.05}$	319	188	179	430	269	251	526	216	250	197
No. tests	3	8	11	4	7	11	4	8	12	34

[z]Z = zone: Zone 1 (Black Soils): Indian Head, Souris, Brandon, Langdon (2007 excluded due to high cv); Zone 2 (Brown and Dark Brown Soils): Swift Current, Stewart Valley, Saskatoon, Regina, Lethbridge, Bieseker (2007–2008), Vulcan (2009), Vangaurd (2007), Avonlea (2007–2008), Moose Jaw (2009), Pense (2009).

yellow pigment concentration and gluten strength). From these 42 DH genotypes, line A0132&AV044 was grown in the 2005 durum central A-3 (DCA3) test in a two replication alpha-lattice design near Swift Current, Regina, Indian Head, Kernen, SK, and Brandon, MB. DH genotype A0132&AV044 was selected for agronomic performance, disease resistance, grain cadmium concentration and quality (protein concentration, yellow pigment concentration and gluten strength). Disease evaluations included response to loose smut [*Ustilago tritici* (Pers.) Rostr.] assessment with races T26, T32 and T33 under field conditions near Swift Current, SK. Response to leaf rust (*Puccinia triticina* Eriks.) and stem rust (*Puccinia graminis* Pers.:Pers. f. sp. *tritici* Eriks. and E. Henn.) were evaluated in hill plots in a rust nursery near Glenlea, MB, using a mixture of races. Response to leaf spot reaction was assessed from within the yield plots under natural inoculums. Response to FHB was assessed in nurseries near Portage la Prairie, Brandon and Carman, MB. The DH genotype A0132&AV044 was tested in the 2006 Durum-B test in an alpha-lattice design with two replications near Swift Current, Regina, Saskatoon, Goodale, Lethbridge, and Brandon. A0132&AV044 was tested for response to leaf and stem rust near Winnipeg, MB, using a mixture of prevalent races. *Fusarium* head blight was evaluated in a nursery near Glenlea inoculated with *F. graminearum* infested corn seed. Loose smut was assessed with races T26, T32 and T33 near Glenlea. Based on agronomic, quality and disease performance, A0132&AV044 was advanced to the Durum Cooperative Test and tested as DT801 from 2007 to 2009. The durum wheat cooperative test entries were evaluated in inoculated nurseries for response to leaf and stem rust, loose smut and FHB near Glenlea and Carman, MB, and for common bunt near Lethbridge, AB. Stem rust inoculum consisted of races of TPM, TMR, QTH, RKQ, RHT, RTH, whereas leaf rust inoculum consisted of a mixture of prevalent races. The stem rust inoculums was composed of select historical races representing a range of virulence genes (Fetch 2005), whereas the leaf rust inoculums was representative of recently occurring races (McCallum and Seto-Goh 2006). The loose smut inoculum consisted of races T26, T32 and T33. For common bunt [*Tilletia laevis* Kuhn in Rabenh., and *T. tritici* (Bjerk.) G. Wint. in Rabenh.], seed was inoculated with a 1:1 composite of the common bunt species *Tilletia tritici* and *T. laevis* in a 1:1:1:1:2:2

Table 2. Agronomic characteristics of Transcend and check cultivars in the Durum Cooperative Test, 2007–2009[z]

	Days to maturity[y]			Test Weight (kg hL^{-1})[z]			1000-kernel wt (g)[z]	Height (cm)[z]	Lodging (1–9)[x]
	Z1	Z2	Mean	Z1	Z2	Mean			
AC Avonlea	103.4	106.3	105.6	75.3	80.3	78.9	44.1	90.1	2.2
AC Morse	103.7	105.8	105.3	74.6	79.7	78.3	43.3	85.2	1.4
AC Navigator	105.1	107.8	107.1	76.0	81.3	79.8	45.9	79.7	1.9
Strongfield	103.4	105.9	105.3	76.5	81.2	79.9	44.7	87.9	2.1
Commander	103.6	106.9	106.1	74.6	80.6	78.9	46.1	76.5	1.9
Transcend	104.5	107.2	106.5	76.7	81.1	79.9	43.3	95.6	2.2
$LSD_{0.05}$	1.6	0.8	0.6	1.4	0.7	0.7	1.2	2.2	0.7
No. tests	9	20	29	12	23	35	35	35	11

[z]Zone = Z: Z1 = Zone 1 (Black Soils): Indian Head, Souris, Brandon, Langdon; Z2 = Zone 2 (Brown and Dark Brown Soils): Swift Current, Stewart Valley, Saskatoon, Regina, Lethbridge, Bieseker (2007–2008), Vulcan (2009), Vangaurd (2007), Avonlea (2007–2008), Moose Jaw (2009), Pense (2009).
[y]All Zone 1 and Zone 2 locations, except Langdon (in Zone 1) and Stewart Valley (in Zone 2).
[x]Regina, Saskatoon, Souris (2007–2008), Langdon (2007), Avonlea (2008), Brandon (2009).

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Table 3. Grain protein concentration (13.5% moisture basis) of Transcend and check cultivars measured on grain samples bulked across replications at each location of the durum cooperative test, 2007–2009[z]

	Protein concentration (%)									
	2007			2008			2009			
	Z1	Z2	Mean	Z1	Z2	Mean	Z1	Z2	Mean	3-yr mean
AC Avonlea	15.8	14.1	14.6	14.1	13.7	13.8	12.7	14.4	13.9	14.0
AC Morse	15.2	13.5	14.0	13.5	13.4	13.5	12.5	13.8	13.5	13.5
AC Navigator	14.8	13.8	14.1	13.7	13.0	13.2	12.6	13.4	13.2	13.4
Strongfield	16.0	14.2	14.7	14.4	13.7	13.9	13.1	14.1	13.9	14.1
Commander	14.7	13.7	13.9	13.9	13.0	13.3	12.7	13.3	13.1	13.3
Transcend	16.0	141	14.6	13.9	13.9	13.9	12.9	14.4	14.0	14.1
$LSD_{0.05}$	0.6	0.4	0.4	0.6	0.5	0.4	0.5	0.4	0.3	0.2
No. tests	3	8	11	3	7	10	3	8	11	32

[z]Z = zone: Z1 = Zone 1 (Black Soils): Indian Head, Souris, Brandon; Z2 = Zone 2 (Brown and Dark Brown Soils): Swift Current, Stewart Valley, Saskatoon, Regina, Lethbridge, Bieseker (2007–2008), Vulcan (2009),Vangaurd (2007), Avonlea (2007–2008),Moose Jaw (2009), Pense (2009).

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mixture of the races T-1, T-6, T-13, T-19, L-1 and L-16 (Gaudet and Puchalski 1989). This composite represents the virulence spectrum of locally collected bunt isolates. 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. Reaction to FHB caused by *Fusarium graminearum* Schwabe (teleomorph *Gibberella zeae* (Schwein. Petch) was assessed in artificially inoculated field tests near Glenlea and Carman (Gilbert and Woods 2006). Leaf spot reaction was determined with natural infestation at SK and MB locations.

Performance

Transcend yielded significantly greater than AC Avonlea and similar to other checks (Table 1). Days to maturity of Transcend was similar to AC Navigator and Commander and later than the other checks (Table 2). Test weight (kg hL^{-1}) of Transcend was significantly higher than AC Avonlea and AC Morse, and similar to Strongfield (Table 2), while the 1000-kernel weight (g) was significantly lower than Strongfield and similar to AC Avonlea and AC Morse. Transcend was significantly taller than AC Avonlea and Strongfield, but had straw strength similar to AC Avonlea and Strongfield. Grain protein concentration of Transcend was similar to the conventional gluten checks AC Avonlea and Strongfield and significantly higher than AC Morse (Table 3).

Transcend was resistant to leaf and stem rust, and common bunt (Table 4). Transcend was susceptible to loose smut. Three years of testing indicated that Transcend has leaf spot reaction (field rating of natural infection, primarily tan spot tan spot [*Pyrenophora tritici-repentis* (Died.) Drechs., anamorph *Drechslera tritici-repentis* (Died.) Shoemaker], and septoria nodorum blotch [*Phaeosphaeria nodorum* (E. Müll.) Hedjaroude, anamorph *Stagonospora nodorum* (Berk.) Castell. & E.G. Germano] similar to AC Avonlea and Strongfield (Table 4). It had an FHB index lower than Strongfield in all years and both locations, and the overall reaction was better than all checks. DON concentration was also lower than Strongfield and other checks in all tested environments.

Transcend has low grain cadmium concentration similar to Strongfield (Table 5). Falling number of Transcend was higher than all checks, except AC Morse, while the hard vitreous kernel count was highest for Transcend. Semolina yield of Transcend was similar to AC Avonlea, AC Morse and Strongfield. Transcend has a gluten index similar to Strongfield and AC Navigator. Yellow pigment grain concentration of Transcend was greater than AC Avonlea and Strongfield. Transcend had better pasta pigment at both 70 and 90°C cooking temperatures. Pasta cooking quality as indicated by firmness (peak cooking force) was better in Transcend than AC Avonlea and Strongfield.

Other Characteristics

Spikes: Tapering, mid-dense to dense, erect to incline; awned; white awns; glumes mid-wide, mid-long, glabrous.

Kernel: Colour amber; kernel mid-size to large, elliptical; cheeks angular; crease mid-deep, mid-wide; brush short; embryo mid to large; germ shape oval.

End-use suitability: Eligible for the grades of Canada Western Amber Durum wheat market class.

Maintenance and Distribution of Pedigreed Seed

In 2007, 144 single plants were individually harvested and constituted seed source for short rows grown in 2008 near Swift Current, SK. In 2009, 108 lines were grown in 15.2-m paired rows near Indian head by the Seed Increase unit of AAFC. Seed was harvested in bulk from 105 of the original 108 lines to form breeder seed. Breeder seed will be maintained by the Seed Increase Unit, Agriculture and Agri-Food Canada, Indian Head, Saskatchewan, Canada S0G 2K0. Distribution and multiplication of pedigreed seed stocks will be

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Table 4. Summary of disease reactions of Transcend and check cultivars grown in the durum cooperative test, 2007–2009

		Stem rust[z]			Common Bunt[z]		Loose smut		Leaf spot		FHB				DON (ppm)	
											Carman (CM)		Glenlea (GL)			
	Year	Rtn[y]	Rxn[z]	Leaf rust[z]	Rtn[y]	Rxn[z]	Rtn[y]	Rxn[z]	GL	SK[x]	Indx[w]	Rxn[z]	Indx[w]	Rxn[z]	GL	CM
AC Avonlea	2007	10	RMR	R	1	VR	83	S	5.5(I)	8.8(MS)	39.0	MS	30.5	MS	7.1	25.4
	2008	5	R	R	13	MR	44	I	4.9(MR)	7.5(I)	44.2	MS	24.5	S	25.5	–
	2009	5	R	R	1	R	90	S	24.0(MR)	–	25.8	MS	48.8	S	23.9	–
AC Morse	2007	15	RMR	R	0	VR	90	S	7.0(I)	8.3(MS)	37.6	MS	30.0	I	10.2	30.9
	2008	5	R	R	2	VR	60	I	2.5(R)	8.8(MS)	50.1	S	17	MS	20.5	–
	2009	5	R	R	0	R	75	MS	31.7(MR)	–	33.6	MS	54.2	S	36.9	–
AC Navigator	2007	10	RMR	R	0	VR	50	I	5.5(I)	8.5(MS)	36.8	MS	62.6	S	13.3	32.9
	2008	2	R	R	2	VR	–	–	3.1(R)	8.5(MS)	60.7	S	19.7	MS	39.5	–
	2009	10	RMR	R	0	R	67	MS	28.0(MR)	–	35.5	MS	41.3	S	35.6	–
Strongfield	2007	5	R	R	0	VR	21	MR	5.5(I)	7.5(I)	49.1	S	68.4	S	4.3	18.5
	2008	2	R	R	4	VR	75	MS	3.1(R)	7.0(I)	54.0	S	22.7	S	30.5	–
	2009	5	R	R	2	R	70	MS	39.7(I)	–	38.4	MS	59.2	S	27.3	–
Commander	2007	1	R	R	0	VR	100	S	7.0(I)	8.5(MS)	43.3	MS	55.3	S	7.5	35.1
	2008	2	R	R	7	R	66	MS	3.8(R)	7.3(I)	61.8	S	15.8	MS	36.9	–
	2009	1	R	R	1	R	100	S	50.3(MS)	–	28.6	MS	56.9	S	27.2	–
Transcend	2007	1	R	R	0	VR	100	S	5.5(I)	8.5(MS)	24.4	I	41.2	S	2.8	9.3
	2008	2	R	R	6	R	–	–	4.2(MR)	7.3(I)	23.6	I	13.7	I	19.5	–
	2009	1	R	R	3	R	100	S	29.0(MR)	–	15.8	I	36	MS	19.3	–

[z]Reaction type: VR, very resistant; R, resistant; MR, moderately resistant; I, intermediate; MS, moderately susceptible; S, susceptible; Rxn = reaction type; Checks and Transcend had 0% leaf rust infection in all 3 yr.
[y]Rtn = rating as percent infection; Rxn = reaction type.
[x]Adult plant, rated mid-grainfill at Swift Current(2008) and Saskatoon (2007) McFadden scale (0 = no symptoms, 11 = severe symptoms) (McFadden 1991).
[w]Fusarium head blight index: [(mean percent incidence × mean percent severity)/100].

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Table 5. End-use suitability of Transcend and checks from 2007 to 2009 Durum cooperative tests based on testing at Grain Research Laboratory of the Canadian Grain Commission

	FN(s)	Test wt, (kg hL^{-1})	HVK[z] (%)	Cd[z] (mg kg^{-1})	Semo[z] yld (%)	Semo ash (%)	Wht prot (%)	Semo prot (%)	Wet glut (%)	GI[z] (%)	P/L[z]	W[z] (ergs)	Semo YP[z] (ppm)	Colour				Cooking peak force	
														70°C b*	90°C b*	70°C a*	90°C a*	70°C (g)	90°C (g)
AC Avonlea	355	82.6	88	0.22	66.7	0.62	13.7	12.6	32.1	21	0.68	135	8.0	62.2	61.1	1.7	5.2	931	1008
AC Morse	415	81.3	89	0.19	66.6	0.62	13.2	12.1	31.2	54	1.12	198	8.0	59.6	60.0	1.6	4.8	903	979
AC Navigator	402	82.8	87	0.25	67.8	0.64	13.0	12.9	31.3	69	1.44	253	9.1	67.4	66.1	3.7	7.8	897	982
Strongfield	363	82.7	89	0.09	66.9	0.60	13.7	12.7	31.6	66	1.10	231	8.4	60.4	59.7	2.0	5.9	919	1008
Commander	407	82.2	86	0.25	67.6	0.60	12.9	11.8	28.6	95	2.30	319	9.5	69.5	67.2	3.5	7.3	924	961
Mean of checks[y]	388	82.3	88	0.09	67.1	0.62	13.4	12.3	31.5	53	1.09	204	8.6	63.8	62.8	2.5	6.2	915	988
Transcend	413	83.3	90	0.08	66.7	0.64	13.8	12.6	32.7	63	0.88	245	8.8	64.1	63.2	2.7	6.5	984	1014

[z]HVK, hard viterous kernel; Cd, grain cadmium; Semo, semolina; GI, gluten index; P/L and W values determined through alveograph; YP, yellow pigment.
[y]Mean of checks is from 2007 to 2009 durum grain composites. Wht prot, Semo prot, Wet Glut, GI, P/L and W are the mean of AC Avonlea, AC Morse, AC Navigator, Strongfield, while Cd is the Strongfield value. All other traits are the mean of the five checks.

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