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CULTIVAR DESCRIPTION

CDC Dynamic durum wheat

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Abstract: CDC Dynamic durum wheat is adapted to the durum production area of the Canadian prairies. This conventional height durum wheat cultivar combines high grain yield potential and protein concentration with high grain pigment and low grain cadmium. CDC Dynamic is resistant to prevalent races of leaf, stem, and stripe rust, and common bunt and expresses end-use quality suitable for the Canada Western Amber Durum (CWAD) class.

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

Résumé : La variété de blé dur CDC Dynamic est acclimatée à la région des Prairies canadiennes où l'on cultive le blé dur. Cette variété de taille classique combine un rendement grainier potentiel élevé à un grain très protéiné d'une intense pigmentation et à faible teneur en cadmium. CDC Dynamic résiste aux races courantes de rouille de la feuille, de rouille de la tige et de rouille jaune, ainsi qu'à la carie. Sa qualité en fonction de l'usage final permet de le classer dans la catégorie « blé dur ambré de l'Ouest canadien » (CWAD). [Traduit par la Rédaction]

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

Introduction

CDC Dynamic, a spring durum wheat (*Triticum turgidum* L. var. *durum*), was developed at the Crop Development Centre (CDC), University of Saskatchewan, Saskatoon, SK, and received registration No. 7833 from the Canadian Food Inspection Agency (CFIA) on 23 Oct. 2015. A Plant Breeders' Rights protection was filed with the CFIA (No. 15-8658).

Pedigree and Breeding Method

CDC Dynamic is derived from the cross CDC Verona/DT742//Strongfield made at the CDC in the summer of 2005. DT742 derives from the cross DT666/DT665, wherein DT665 is Kyle/Nile and CDC Verona (Pozniak et al. 2009) and Strongfield (Clarke et al. 2005) are registered Canadian cultivars. The F_1 generation was increased at a contra-season nursery in New Zealand and the resulting F_2 plants were grown in a space-planted nursery at Saskatoon, SK. In 2006, over 400 single F_2 spikes were selected and bulk threshed to produce the F_3 generation, which was increased in bulk at a contra-season nursery in New Zealand. In 2007, the F_4 generation was grown in a space-planted nursery of approximately 6000 plants, and just over 400 single spikes were selected. In 2008, $F_{4:5}$ rows were planted at Saskatoon and D05.09.053 was identified as having acceptable plant height, maturity, and straw strength. D05.09.053 was evaluated in un-replicated F_6 yield trials conducted at Saskatoon in 2009. Quality evaluations on F_6 harvested seed indicated appropriate yellow pigment, and acceptable grain protein concentration and gluten strength for the CWAD class. In the same year, resistance to Fusarium head blight (FHB) was evaluated in endemic nurseries at Carman, MB. In 2010, D05.09.053 was evaluated for agronomic traits in replicated yield trials in the Saskatoon area at the University of Saskatchewan Kernen and Goodale farms, Swift Current, SK, Lethbridge, AB, and Elrose, SK. In the same year, resistance to leaf rusts and FHB were evaluated in endemic nurseries at Saskatoon and Carman, respectively. The rust races used in the nursery were representative of those found in disease surveys the previous year (Fetch 2009; McCallum and Seto-Goh 2008, 2009). Leaf spot reaction, primarily caused by tan spot (*Pyrenophora tritici-repentis* Died.) and septoria (*Septoria tritici* Roberge in Desmaz.), was noted in trials from Kernen, Goodale, and Swift Current. DNA marker testing in the F_7 generation with *usw47* (Wiebe et al. 2010) confirmed D05.09.053 carries the allele for low grain cadmium concentration. In 2011, D05.09.053 was evaluated at Swift Current,

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Table 1. Grain yield (kg ha^{-1}) of CDC Dynamic and check cultivars in the Durum Cooperative Registration Trial 2012–2014[a].

	2012			2013			2014			2012–2014			2013–2014		
	Black	Brown	Mean	Black	Brown	Mean	Black	Brown	Mean	Black	Brown	Mean	Black	Brown	Mean
Brigade	—	—	—	4891	5156	5108	5170	4173	4375	—	—	—	5008	4653	4725
AAC Cabri	3070	3822	3595	4619	4951	4891	5078	3874	4113	4243	4240	4219	4874	4415	4509
AC Navigator	2138	3055	2780	3556	4540	4367	4045	3349	3490	3195	3685	3569	3777	3975	3949
Strongfield	2934	3359	3232	4174	4816	4701	4896	3748	3978	3996	3992	3987	4561	4302	4350
CDC Dynamic	3241	4073	3829	4944	5087	5055	5442	3973	4265	4514	4393	4398	5229	4523	4664
$LSD_{0.05}$	472	382	308	668	245	240	761	356	334	249	355	234	553	301	267
No. of tests	3	7	10	2	9	11	2	8	10	7	24	31	4	17	21

[a]Black soils: Indian Head, SK; Brandon and Souris, MB (2012); Brown and Dark Brown soils: Moose Jaw (2012, 2013), Pense (2014), Regina (2012), Scott, Saskatoon, Stewart Valley, Swift Current, Vanguard (2013, 2014), SK; Lethbridge, Vulcan, AB.

Regina, Lethbridge, and Kernen in the Durum Wheat A Test (and associated disease nurseries), and advanced after evaluation of end-use functionality on composite samples. D05.09.053 was evaluated as DT578 in the Durum Wheat Co-operative Registration Trial over 3 yr (2012–2014).

The variables measured and the operating protocols followed in the Durum Wheat Cooperative Registration Trial were those approved each year by the Prairie Recommending Committee for Wheat Rye and Triticale (current operating procedures can be found at http://www.pgdc.ca/committees_wrt.html). In agronomic performance trials, the check cultivars over all 3 yr of trialing were Strongfield (Clarke et al. 2005), AC Navigator (Clarke et al. 2000), and AAC Cabri, and Brigade (Clarke et al. 2009) was added as a check in 2013. In the cooperative trials, the stem rust races were TPMK, TMRT, RHTS, QTHS, RTHJ, RKQS, and MCCF (Roelfs and Martens 1988; Fetch et al. 2011). The leaf rust inoculum comprised a mixture of prevalent races isolated from the western Canadian prairies as determined from yearly survey studies (McCallum et al. 2010, 2011, 2013). 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* Kühn in Rabenh., and *T. tritici* (Bjerk.) G. Winter in Rabenh.] (Hoffman and Metzger 1976), FHB reaction, and stripe rust (*Puccinia striiformis* Westend.) were evaluated in the Durum Cooperative Registration Trial. End-use quality was assessed at the Grain Research Laboratory, Canadian Grain Commission using approved methods (AACC 2000) each year on composite grain samples from all locations with acceptable physical condition (grade Canada Western Amber Durum #3 or better) to give a target grain protein concentration of 13%.

Data presented here were analyzed using SAS PROC MIXED (Littell et al. 2006), with replications, sub-blocks, zones, locations, and years considered as random effects, and entries considered fixed. The *diff* command was used to estimate the standard error of the difference between entries, which in turn was used to estimate an F-protected least significant difference (LSD) at a significance level of 5% ($LSD_{0.05}$). For end-use quality data, years were considered as replications.

Performance

Agronomy: Averaged over 31 station-years, CDC Dynamic yielded 10% more than Strongfield, 23% more than AC Navigator, and 4% more than AAC Cabri (Table 1). CDC Dynamic yielded approximately 1% less than Brigade in 2013–2014. CDC Dynamic expresses conventional height similar to AAC Cabri, with lodging resistance similar to Brigade and AC Navigator (Table 2). Maturity of CDC Dynamic was similar to Strongfield and test weight was similar to the highest checks Brigade and AAC Cabri. Kernel weight was within the

Table 2. Maturity, test weight, 1000-kernel weight, height, and lodging of CDC Dynamic and check cultivars in the Durum Cooperative Registration Trial 2012–2014[a].

	Maturity (d)			Test weight (kg hL^{-1})			1000-kernel		
	Black	Brown	Mean	Black	Brown	Mean	weight (g)	Height (cm)	Lodging (1–9)
Brigade	98	106	105	75.3	79.6	78.7	41.4	103	2.1
AAC Cabri	97	105	105	75.9	79.5	78.6	39.3	97	3.0
AC Navigator	97	105	103	72.9	78.4	77.2	42.3	81	1.8
Strongfield	97	104	102	75.4	78.5	77.7	39.8	93	2.9
CDC Dynamic	96	104	102	76.0	79.5	78.7	39.7	96	2.2
$LSD_{0.05}$	2	1	1	1.2	0.8	0.7	1.1	2	0.9
No. of tests	6	19	25	6	24	30	30	30	15

[a]Black soils: Indian Head, SK; Brandon and Souris, MB (2012); Brown and Dark Brown soils: Moose Jaw (2012, 2013), Pense (2014), Regina (2012), Scott, Saskatoon, Stewart Valley, Swift Current, Vanguard (2013, 2014), SK; Lethbridge, Vulcan, AB.

Table 3. Grain protein concentration (%) of CDC Dynamic compared with check cultivars in the Durum Cooperative Registration Trial 2012–2014[a].

	2012			2013			2014			2012–2014	2013–2014
	Black	Brown	Mean	Black	Brown	Mean	Black	Brown	Mean	Mean	Mean
Brigade	—	—	—	12.7	12.7	12.7	12.8	13.0	12.9	—	12.9
AAC Cabri	16.0	14.2	14.8	13.9	13.1	13.3	13.5	13.9	13.8	14.1	13.5
AC Navigator	15.3	14.3	14.6	13.5	12.9	13.0	12.8	13.3	13.2	13.8	13.1
Strongfield	16.2	14.9	15.3	14.7	13.6	13.8	13.5	13.9	13.8	14.5	13.9
CDC Dynamic	16.4	14.4	15.0	14.0	13.6	13.6	13.8	14.1	14.1	14.4	13.9
$LSD_{0.05}$	0.9	0.6	0.5	1.2	0.4	0.4	—	0.6	0.6	0.3	0.3
No. of tests	3	7	10	2	9	11	1	8	9	30	20

[a]Black soils: Indian Head, SK; Brandon and Souris, MB (2012); Brown and Dark Brown soils: Moose Jaw (2012, 2013), Pense (2014), Regina (2012), Scott, Saskatoon, Stewart Valley, Swift Current, Vanguard (2013, 2014), SK; Lethbridge, Vulcan, AB.

range of the checks. Grain protein concentration of CDC Dynamic was similar to Strongfield over the 3 yr, and higher than the other checks (Table 3).

Disease: CDC Dynamic was resistant to prevalent races of leaf and stem rust, and has excellent common bunt resistance,similar to the checks. Leaf spot reaction was better than the checks, and loose smut reaction was similar to the checks (Table 4). FHB reaction of CDC Dynamic was within the range of the check cultivars, and DON concentration was generally lower than the checks (Table 4).

End-use Suitability: Grain protein concentration of CDC Dynamic was similar to Strongfield in the field (Table 3) and composite samples (Table 5). CDC Dynamic has low cadmium concentration like Strongfield, but expresses yellow pigment higher than all of the check cultivars. The high yellow pigment was reflected in significantly greater pasta b* values than all of the checks except AAC Cabri. The average falling number of CDC Dynamic was within the range of the check cultivars, and higher than Strongfield. CDC Dynamic is a conventional gluten strength type, with gluten index and alveograph parameters similar to Strongfield. The semolina yield of CDC Dynamic was greater than all of the checks except AC Navigator, and semolina ash content was within the range of the check cultivars.

Other Characteristics

SPIKES: Spikes of CDC Dynamic are tapered, dense, long and erect, with a waxy bloom similar to Strongfield. Spikes express white awns that are longer than the spike; the width of the lower glumes is medium in width, while glumes are medium long and glabrous; glume shoulders are slightly sloped to elevated and are narrow; the glume beak is slightly curved; the lemma beak is straight.

KERNELS: Kernels are amber in color, medium-large in size, and elliptical; cheeks are slightly angular; crease is mid-deep, and mid-wide; brush is short; embryo is medium sized.

END-USE SUITABILITY: CDC Dynamic is eligible for grades of the Canada Western Amber Durum wheat class.

Maintenance and Distribution of Pedigreed Seed

Approximately 190 single spikes of CDC Dynamic were selected from a F_9 increase grown at Saskatoon in 2012. The $F_{9:10}$ spikes were threshed and grown as single 1 m

Table 4. Disease reactions of CDC Dynamic and check cultivars grown in the Durum Cooperative Registration Trial 2012–2014.

Year	Entry	Stem rust	Leaf rust	Stripe rust	Common bunt	Loose smut	Leaf spots[a]	FHB index[b]		DON[c] (mg kg^{-1})
								Carman	Glenlea	
2012	Brigade	—	—	—	—	—	—	—	—	—
	AAC Cabri	25MR	0R	0VR	R	MR	8.0	56.5S	27.5MS	10.3
	AC Navigator	30I	0R	1VR	R	I	10.0	65.5S	10.2I	33.7
	Strongfield	15MR	0R	2R	R	MR	7.8	54.5MS	11.7I	12.5
	CDC Dynamic	20MR	0R	0VR	R	I	8.0	51.2MS	18.7MS	11.5
2013	Brigade	1R	0R	15R	R	R	8.3	22.7MR	7.0	—
	AAC Cabri	1R	0R	10R	R	R	7.8	33.8I	15.3	—
	AC Navigator	5MR	0R	60S	R	MR	9.3	50.5S	8.7	—
	Strongfield	1R	0R	15R	R	R	8.3	30.0I	10.3	—
	CDC Dynamic	10MR	0R	25MR	R	MR	7.0	27.5I	7.7	—
2014	Brigade	1R	0R	25MR	R	R	8.5	18.8I	—	30
	AAC Cabri	1R	0R	10MR	R	R	8.5	32.3MS	—	32
	AC Navigator	1R	0R	5R	R	R	9.8	56.2S	—	42
	Strongfield	1R	0R	1R	R	MR	8.8	39.8MS	—	35
	CDC Dynamic	1R	0R	25MR	R	MR	7.0	34.0MS	—	23

Note: VR, very resistant; R, resistant; MR, moderately resistant; I, intermediate resistance; MS, moderately susceptible; S, susceptible.
[a]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.
[b]Fusarium head blight index: (% infected spikelets × % infected heads)/100. Indices are averages from replicated trials at Carman and Glenlea, MB.
[c]Deoxynivalenol measured on composites of replications at Glenlea in 2012 and Carman in 2014.

Table 5. Average values for quality traits measured on yearly composite samples of CDC Dynamic and check cultivars evaluated in the 2012–2014 Durum Cooperative Registration Trial.

	Grain protein (%)	FN[a] (Sec)	Semolina						Pasta b*	Alveograph				Grain Cd (ppm)
			Yellow pigment	Protein (%)	b*	Yield (%)	Ash (%)	GI[b] (%)		P	W	L	P/L	
Brigade	12.9	393	10.2	11.8	32.4	66.1	0.68	89	63.7	82	248	94	0.88	0.070
AAC Cabri	13.5	393	10.3	12.4	33.1	66.7	0.65	67	65.5	79	205	89	0.52	0.064
AC Navigator	13.0	412	10.2	12.1	32.3	67.8	0.70	78	64.0	57	162	111	0.91	0.224
Strongfield	13.8	365	9.2	12.8	31.1	66.3	0.63	70	62.9	67	183	90	0.76	0.078
CDC Dynamic	13.8	388	11.8	12.9	34.5	67.2	0.66	70	66.2	65	179	93	0.71	0.091
$LSD_{0.05}$	0.3	43	0.3	0.3	0.7	0.6	0.02	8	1.0	8	24	13	0.15	0.012

[a]FN, falling number.
[b]GI, gluten index.

row plots in 2013 and off-type rows discarded. The remaining head rows were harvested individually and used to establish one hundred and seventy-three 27 m rows in 2014. Again, off type rows were discarded and the remaining rows bulk harvested to produce Breeder Seed. In total, 134 $F_{9:11}$ breeder lines were composited to form the Breeder Seed. Breeder seed will be maintained by the Crop Development Centre, University of Saskatchewan, Saskatoon, SK S7N 5A8, Canada. CDC Dynamic will be added to the Organisation for Economic Co-operation and Development list of cultivars. Distribution and multiplication of pedigreed seed stocks will be handled by Proven Seed/CPS Canada, PO Box 5234, High River, AB T1V 1M4, Canada. Commercial launch of CDC Dynamic is anticipated in 2018–2019.

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