CULTIVAR DESCRIPTION

Unity hard red spring wheat

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Fox, S. L., McKenzie, R. I. H., Lamb, R. J., Wise, I. L., Smith, M. A. H., Humphreys, D. G., Brown, P. D., Townley-Smith, T. F., McCallum, B. D., Fetch, T. G., Menzies, J. G., Gilbert, J. A. Fernandez, M. R., Despins, T., Lukow, O. and Niziol, D. 2010**. Unity hard red spring wheat.** Can. J. Plant Sci. **90**: 71–78. Unity is a hard red spring wheat that meets the end-use quality specifications of the Canada Western Red Spring class. Unity is the first spring wheat cultivar registered in Canada that contains the antibiosis resistance gene *Sm1*, which produces a product that reduces the palatability of developing seeds to wheat midge larvae (*Sitodiplosis mosellana* Géhin). Unity is a partial backcross derivative of McKenzie, using Clark as the donor of the *Sm1* gene for midge resistance. Unity was found to be adapted to the eastern wheat growing regions of the Canadian prairies as represented in the Central Bread Wheat Cooperative Registration Test in 2004, 2005 and 2006. For registration testing, the performance of Unity was estimated using the varietal blend Unity VB, which consisted of 90% Unity and 10% Waskada. In comparison to the check cultivars (Katepwa, McKenzie, CDC Teal, AC Barrie, and Superb), Unity was the highest yielding cultivar overall; although not significant, Unity was 5% higher yielding than McKenzie. Unity matured significantly later than Katepwa and significantly earlier than Superb. Unity had significantly shorter plant stature than Katepwa and significantly taller stature than Superb. Unity had significantly greater lodging scores than AC Barrie and Superb. The test weight of Unity was significantly higher than the best check: 0.9 kg hL^{-1} higher than McKenzie. Unity expressed resistance to leaf rust, stem rust and common bunt, intermediate resistance to loose smut, and susceptibility to fusarium head blight. Unity had preharvest sprouting resistance with an overall sprouting score similar to the best checks McKenzie and Superb. Unity also maintained its falling numbers following natural or artificial weathering of spikes. The end-use suitability attributes of Unity were similar to the recurrent parent McKenzie for all traits except amylograph viscosity which was significantly higher than all checks except Superb.

Key words: *Triticum aestivum* L., cultivar description, red spring wheat, test weight, preharvest sprouting, wheat midge antibiosis

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Mots clés: *Triticum aestivum* L., description de cultivar, blé roux vitreux de printemps, poids spécifique, germination sur pied, antibiose à la cécidomye du blé

Unity is a hard red spring wheat (*Triticum aestivum* L.) developed by Agriculture and Agri-Food Canada (AAFC), Cereal Research Centre, Winnipeg, Manitoba and released in 2006. This cultivar is the first wheat midge resistant spring wheat to be registered in Canada. It was given the registration number 6328 by the Plant Variety Registration Office, Plant Production Division, Seed Section, Canadian Food Inspection Agency (CFIA), Agriculture and Agri-Food Canada, on 24 August 2007. The cultivar is named after Unity, a town in western Saskatchewan.

Pedigree and Breeding Method

Unity was selected from the partial backcross McKenzie*3//BW174*2/Clark made in 1997 at the Agriculture and Agri-Food Canada Cereal Research Centre, Winnipeg. BW174 has the pedigree Columbus*2//Saric 70/Neepawa/3/Columbus*5//Saric 70/Neepawa, and Clark is a soft red winter wheat (Ohm et al. 1988). Twelve BC_2F_2 families were grown from which 20 spikes/per family were selected to grow in a 240 hill winter nursery (Table 1). Of these hills, 86 were advanced by selecting 5 spikes/hill. These spikes were grown in a 1 m row nursery near Glenlea, MB, which was inoculated to allow for selection for disease resistance to leaf and stem rust caused by *Puccinia triticina* Eriks. and *P. graminis* Pers.:Pers. f. sp. *tritici* Eriks. & E. Henn., respectively. Selection for kernel appearance, grain protein concentration, flour yield and dough strength were carried out on lines retained from the field nursery. After a New Zealand winter nursery increase in 1999–2000, 123 $BC_2F_{3:6}$ lines were yield tested resulting in 67 lines being advanced with five spike selections per line; these spikes were increased in a single row nursery in the winter of 2000–2001. The line 97B64-F9A3 was tested in an unreplicated trial grown at four locations in 2001 followed by evaluation in the preregistration tests CBWA4 and CBWB in 2002 and 2003, respectively, before being entered into the Central Bread Wheat Cooperative (CBWC) test in 2004. For registration testing, the performance of 97B64-F9A3 was estimated using the varietal blend BW362, which consisted of 90% 97B64-F9A3 and 10% Waskada (Fox et al. 2009). The addition of Waskada was done to provide an interspersed refuge for wheat midge (Smith et al 2004). For registration, CFIA agreed that the data collected for BW362 adequately described 97B64-F9A3. Thus, 97B64-F9A3 was registered as Unity and the commercially available form of this cultivar is in a varietal blend (VB) called Unity VB, which is equivalent to BW362.

In the CBWC, agronomic performance was evaluated in a 30-entry yield test grown using a rectangular lattice design with three replications at each of 10 locations/year [Manitoba: Glenlea, Portage La Prairie, Elgin, Morden, Brandon, Dauphin (2006 only); Saskatchewan: Regina, Indian Head, Kelvington (2004 and 2005 only), Saskatoon, Melfort] operated by Agriculture and Agri-Food Canada, Agricore United, and the University of Saskatchewan. For registration decisions regarding cultivar value for cultivation and end-use suitability, Unity was compared with five check cultivars: Katepwa (Campbell and Czarnecki 1987), McKenzie (Graf et al. 2003), CDC Teal (Hughes and Hucl 1993), AC Barrie (McCaig et al. 1996) and Superb. At the Cereal Research Centre, response to diseases in artificially inoculated field nurseries was assessed for leaf rust and stem rust using the modified Cobb scale (Peterson et al. 1948). Several greenhouse seedling evaluations were conducted to observe infection type reactions to *P. triticina* races MBDS (12-3), MGBJ (74-2), TJBJ (77-2) and MBRJ (128-1) (McCallum and Seto-Goh 2006) and to *P. graminis* f. sp. *tritici* races TMRTK (C10), RKQSR (C63), TPMKR (C53) RTHJT (C57), QTHST (C25) and RHTSK (C20) (Fetch 2005; Roelfs and Martens 1988). Fusarium head blight caused by *Fusarium graminearum* Schwabe [teleomorph *Gibberella zeae* (Schwein.) Petch] was evaluated in a field nursery that was spray inoculated with a macroconidial suspension and evaluated using a visual index (% incidence × % severity/100) (Gilbert and Woods 2006). Resistance to loose smut caused by *Ustilago tritici* (Pers.) Rostr. was assessed using multiple races (Menzies et al. 2003). Evaluation for response to common bunt was conducted at the Lethbridge Research Centre of AAFC using multiple races of *Tilletia tritici* (Bjerk.) R. and *T. laevis* Kuhn in Rabenh (Gaudet and Puchalski 1989; Gaudet et al. 1993). Assessment of kernel feeding damage by wheat midge was done by dissecting spikes using a stereomicroscope with 6 × magnification. The spikes were collected from field experiments where midge larvae were detected on susceptible cultivars. End-use quality was evaluated by the Grain Research Laboratory, Canadian Grain Commission, Winnipeg, MB, based on composite samples for each test entry that were prepared from test locations selected based on grade and protein concentration of the check cultivars. Grain from locations where the checks produced poor quality grain was not included in quality composites. Annual statistical analysis of experiments was conducted using Agrobase Generation II (Agronomix Software Inc. 2009). The SAS MIXED procedure (SAS Institute, Inc. 2006) was used to perform a multiyear analysis: for agronomic data, a mixed model was used with years, locations and replications set as random variables and cultivars set as a fixed variable. For end-use quality data, the analysis was similar except that there were no replicated observations within years.

Breeder Seed of Unity was produced by randomly selecting approximately 250 spikes from a 97B64-F9A3 seed increase plot in 2004 that was rogued for uniformity. Of these spikes, 229 were grown as an isolated group of 1 m head rows in 2005 at Morden, MB. Due to difficult growing conditions, only 114 lines produced sufficient seed for use the following year. In 2006, a 15-m row was grown from each of the remaining isolation

Table 1. Population size and activities at each generation leading to the registration of Unity hard red spring wheat

Name	Gen.	Year	Activity – Number of lines-Locations
	F_0	1997	Crosses were made in a growth cabinet.
97B64	F_1	1997	12 BC_2F_1 plants grown in a field nursery near Glenlea, MB.
97B64-F	F_2	1998	One plot of about 100 seeds for each family was grown. Selection of spikes based on agronomic appearance and resistance to leaf and stem rust.
97B64-F9	$F_{2:3}$	1998	Approximately 20 spikes per family were grown as a group of 240 hills in a winter nursery near Palmerston North (PN), New Zealand. Selection for agronomics and leaf rust resistance.
97B64-F9A	$F_{3:4}$	1999	430 lines (5 spikes from 86 selected F3 hills) were grown in a 1-m row nursery near Glenlea, MB. Selection for agronomics, seed appearance, resistance to rusts and common bunt, protein concentration, flour yield, and dough strength measured by mixograph.
97B64-F9A	$F_{3:5}$	1999	213 lines were grown near PN in 1.5-m rows. Selection for agronomics and leaf rust resistance.
97B64-F9A	$F_{3:6}$	2000	123 lines tested in an unreplicated yield test at four locations (MB: Brandon, Glenlea, Morden, Portage la Prairie). Based on agronomics, disease and quality, 67 lines were advanced with 5 spikes per line.
97B64-F9A3	$F_{6:7}$	2000	335 lines were grown near PN in 1.5-m rows. Selection for agronomics and leaf rust resistance.
97B64-F9A3	$F_{6:8}$	2001	255 lines tested in an unreplicated yield test at two to four locations (MB: Brandon, Glenlea, Morden, Portage la Prairie). Selections based on agronomics, disease resistance and quality performance.
97B64-F9A3	$F_{6:9}$	2002	23 lines in the Central Bread Wheat "A4" test. Yield test, 2 replicates at 5 locations (MB: Glenlea, Brandon: SK: Indian Head, Regina and Melfort).
97B64-F9A3	$F_{6:10}$	2003	12 lines in the Central Bread Wheat "B" test. Yield test, 3 replicates at 8 locations (MB: Glenlea, Brandon, Morden; SK: Indian Head, Regina, Melfort, Saskatoon; AB: Beaverlodge).
BW362	F_{11}–F_{13}	2004–6	Central Bread Wheat "C" registration test. Yield test, 3 replicates at 10 locations/year (MB: Glenlea, Portage la Prairie, Brandon, Morden, Souris, Dauphin; SK: Indian Head, Regina, Melfort, Kelvington, Saskatoon). Dauphin replaced Kelvington as a test location in 2006. 97B64-F9A3 was tested as a varietal blend: BW362 = 90% 97B64-F9A3 and 10% Waskada (Fox et al. 2009).
Breeder seed production			
97B64-F9A3	F_{11}	2003	Breeder seed spikes: 250 random spikes were selected from a rogued increase plot grown at Indian Head, SK. Of these spikes, 21 spikes were discarded due to shrivelled seed.
97B64-F9A3	F_{12}	2004	Breeder seed isolation rows: 229 lines were grown in 1 m rows grown at Morden, MB with a 10 m isolation distance from any other wheat. Of these lines, 115 lines were discarded due to low seed production caused by droughty field conditions.
97B64-F9A3	F_{13}	2006	Breeder seed rows: 15 m rows grown at Indian Head, SK with 10 m isolation distance from other wheat. One-hundred and fourteen lines were grown with 14 discarded due to lack of uniformity leaving 100 lines that were harvested in bulk.

rows at the Indian Head Seed Increase Unit. Fourteen lines were discarded prior to harvest due to presence of awnless plants (12 lines) or tall plants (2 lines). The remaining uniform plots were inspected and harvested in bulk producing a minimum of 155 kg of breeder seed.

Performance

The grain yield of Unity was 5% higher (not significant) than the best check, McKenzie, over 3 yr of testing in the Central Bread Wheat Cooperative test (Table 2). Unity exhibited the same maturity as AC Barrie, but

Table 2. Yield (kg ha^{-1}) of Unity VB and five checks in the Central Bread Wheat Coop, 2004–2006

	Manitoba[z]				Saskatchewan				All sites			
Cultivar	2004	2005	2006	Mean	2004	2005	2006	Mean	2004	2005	2006	Mean
Katepwa	4497	3476	3765	3876	5537	3933	3339	4028	4887	3761	3594	4024
McKenzie	5085	4173	4292	4428	6143	4252	3716	4450	5482	4222	4061	4514
CDC Teal	5030	3707	3927	4178	5404	4263	3686	4228	5170	4054	3831	4287
AC Barrie	4796	3357	3714	3940	5506	4112	3469	4129	5062	3829	3616	4110
Superb	5125	3591	4236	4378	5804	4469	3953	4511	5379	4140	4123	4503
Unity VB	5398	4603	4254	4609	5702	4984	4004	4690	5512	4841	4154	4754
LSD ($P = 0.05$)[y]	665	574	341	409	628	291	447	380	461	283	255	265
No. of tests	5	3	6	14	3	5	4	12	8	8	10	26

[z]Manitoba test locations: Glenlea, Portage la Prairie, Brandon, Morden, Souris, Dauphin; Saskatchewan test locations: Indian Head, Regina, Melfort, Kelvington, Saskatoon. In 2006, the Dauphin site was added and the Kelvington site was discontinued. Yield data from Morden, MB, in 2005 were excluded due to variable soil conditions exacerbated by persistent wet weather in May and June of that year.
[y]LSD of means was based on the checks and Unity VB and calculated using the MIXED procedure of SAS (SAS institute, Inc. 2006).

Table 3. Summary of agronomic traits of Unity VB and five checks in the Central Bread Wheat Coop, 2004–2006

	Maturity (d)				Height (cm)				Lodging[z] (1–9 scale)				Test weight (kg hL^{-1})				Kernel weight (mg kernel^{-1})			
Cultivar	2004	2005	2006	Mean	2004	2005	2006	Mean	2004	2005	2006	Mean	2004	2005	2006	Mean	2004	2005	2006	Mean
Katepwa	109.8	98.2	86.2	98.2	101	97	100	99	3.6	2.4	2.5	2.7	75.9	76.3	78.3	76.9	33.6	32.3	30.8	32.2
McKenzie	110.4	100.3	86.1	99.3	97	97	97	97	3.3	3.1	2.3	2.8	78.1	78.1	78.2	78.2	33.3	32.5	30.1	31.9
CDC Teal	111.3	99.6	86.0	99.0	94	92	95	94	2.7	2.0	1.9	2.0	76.5	77.6	77.7	77.3	35.5	33.2	31.0	33.1
AC Barrie	112.8	100.6	86.7	100.1	96	95	96	95	2.2	2.3	1.6	1.9	77.1	78.2	78.6	78.0	35.4	33.3	31.9	33.5
Superb	117.0	101.9	88.5	102.4	90	86	89	88	1.5	2.1	1.8	1.6	76.5	78.1	78.7	77.8	37.5	34.9	35.8	36.1
Unity VB	113.0	100.2	86.9	100.1	99	96	96	96	3.6	2.7	2.2	2.7	78.8	78.9	79.3	79.1	35.0	32.5	31.4	32.9
LSD ($P=0.05$)[y]	1.8	1.6	1.4	1.7	2.1	2.1	2.3	2.1	0.8	1.0	0.7	0.8	1.0	0.6	0.8	1.0	1.9	1.6	1.2	1.3
No. of tests	8	9	10	27	8	9	10	27	7	6	4	17	8	9	10	27	8	9	10	27

[z]Lodging scale: 1 = vertical, 9 = flat.
[y]LSD of means was based on the checks and Unity VB and calculated using the MIXED procedure of SAS (SAS Institute, Inc. 2006).

Table 4. Disease severities and ratings[z] of Unity VB and five checks in the Central Bread Wheat Coop, 2004–2006

	Stem rust[y] (% severity, rating)			Leaf rust[x] (% severity, rating)			Fusarium head blight index[w] (% incidence × % severity/100, rating)				Loose smut[v] (% infection, rating)			Common bunt[u] (% infection, rating)		
Cultivar	2004	2005	2006	2004	2005	2006	2004 Carman	2005 Carman	2006 Glenlea	2006 Carman	2004	2005	2006	2004	2005	2006
Katepwa	3 R	15 MRMS	7 RMS	45 MSS	65 S	42 MS	29 MS	25 MS	24 MR	31 MS	11 MR	16 MR	16 MR	32 I	40 I	18 I
McKenzie	5 RMR	10 RMR	5 MS	<1 R	1 R	0 R	43 S	38 S	30 MR	17 I	30 MR	58 MS	49 I	2 R	5 MR	2 VR
CDC Teal	15 MR	15 MRMS	15 I	7 MR	29 MR	20 MR	76 S	63 S	61 S	63 S	19 MR	25 MR	41 I	70 S	36 I	15 MR-I
AC Barrie	15 MR	10 MRMS	10 RMS	40 MRMS	55 MS	57 MS	23 I	20 I	36 I	26 I	48 I	43 I	68 MS	46 S	28 I	17 I
Superb	trace R	17 MR	10 RMR	13 MR	78 S	63 S	43 S	12 MR	33 I	29 I	36 I	40 I	13 MR	29 I	14 MR	4 VR
Unity VB	5 R	15 RMR	5 RMR	2 R	3 R	4 R	55 S	27 MS	50 MS	13 MR	39 I	51 MS	21 MR	6 R	3 R	1 VR

[z]Disease rating class: VR = very resistant, R = resistant, RMR = resistant to moderately resistant, MR = moderately resistant; I = intermediate rating; MRMS = moderately resistant to moderately susceptible, MSS = moderately susceptible to susceptible, S = susceptible.
[y]Caused by *Puccinia graminis* Pers.:Pers. f. sp. *tritici* Eriks. E. Henn. Races used include TMRTK, RKQSR, TPMKR, QTHST, RHTSK and MCCFR.
[x]Caused by *P. triticina* Eriks. Inoculum was a composite of all leaf rust disease survey collections made the previous year from Manitoba and Saskatchewan (McCallum and Seto-Goh 2006).
[w]Caused by *Fusarium graminearum* Schwabe [teleomorph *Gibberella zeae* (Schwein.) Petch]. Fusarium head blight index = (% infected spikelets × % infected spikes)/100.
[v]Caused by *Ustilago tritici* (Pers.) Rostr. Races used include T2, T9, T10 and T39. Rating based on previous and current tests after artificial inoculation.
[u]Caused by *Tilletia tritici* (Bjerk.) R. Wolff and *T. laevis* Kuhn in Rabenh. The inoculum used was a composite of races T-1, T-6, T-13, and T-19 of *T. tritici* and L–7 and L-16 of *T. laevis* mixed in a 1:1:1:1:2:2 ratio (vol/vol).

Table 5. Frequency of spikes with larvae present or absent for Unity (97B64-F9A3) or Unity VB and check cultivars in two preregistration tests (CBWA4, CBWB) and 3 yr of registration testing (CBWC)

			number of spikes		
Test	Year	Cultivar	larvae present	larvae absent	%
CBWA4	2002	Katepwa	18	6	75
		McKenzie	15	9	63
		CDC Teal	19	5	79
		AC Barrie	19	5	79
		Superb	14	9	61
		Unity	1	19	5
CBWB	2003	Katepwa	13	8	62
		McKenzie	11	7	61
		AC Barrie	12	4	75
		Unity	0	16	0
CBWC	2004	Superb	22	8	73
		Unity VB	1	29	3
CBWC	2005	CDC Teal	4	0	100
		AC Barrie	4	0	100
		Unity VB	0	30	0
CBWC	2006	CDC Teal	24	0	100
		AC Barrie	24	1	96
		Superb	24	1	96
		Unity VB	4	20	17
Grand mean		Katepwa	31	14	69
		McKenzie	26	16	62
		CDC Teal	47	5	90
		AC Barrie	59	10	86
		Superb	60	18	77
		All checks	223	63	77
		Unity/Unity VB	6	114	5

was significantly earlier maturing (2.5 d) than Superb (Table 3). Unity was significantly shorter (3 cm) than Katepwa and was significantly taller (8 cm) than Superb, the shortest check in this test. Unity exhibited lodging scores similar to Katepwa and McKenzie, and significantly higher than AC Barrie and Superb. Unity showed significantly higher test weight than any of the checks and had kernel weight significantly lower (3.2 mg) than Superb (Table 3).

Unity has resistance to the prevalent races of leaf rust, stem rust and common bunt (Table 4). Resistance to loose smut was intermediate, being most similar to Superb. Unity is susceptible to Fusarium head blight (FHB), being similar to its recurrent parent, McKenzie.Unity appears to have the antibiotic midge resistance gene *Sm1* (McKenzie et al. 2002; Thomas et al. 2005) based on the approximately 15 times reduction in the presence of wheat midge larvae compared with the mean of the midge-susceptible check cultivars (Table 5). Resistance is assessed in two ways during the breeding process: (1) early generation material is screened in the field for presence of 3rd instar larvae and (2) F_6 and later generation lines are assessed by dissecting spikes to detect seed damage. The type of feeding damage observed on resistant lines can be distinguished from damage observed on susceptible lines. On midge-resistant lines expressing antibiotic resistance, surface scarification and mottling from multiple feeding attempts can be observed along with distorted seed shape and the absence of cast second instar skins from larvae. On midge-susceptible lines, seed damage is broader in area, more pronounced in level of seed damage, distortion and size reduction, and cast skins from midge larvae can be observed.

Assessments of preharvest sprouting resistance by exposure of spikes in a rain simulator and field weathering (Humphreys and Noll 2002) demonstrated that Unity was not different from any of the checks for falling number values from the wheat quality composite samples, but had significantly larger falling number values and significantly lower sprouting scores than Katepwa and CDC Teal in artificial weathering trials (Table 6), and was most similar to McKenzie.

The end-use quality of Unity was deemed suitable for the CWRS class, exhibiting milling and baking performance similar to McKenzie for all attributes except volume weight and amylograph viscosity (Table 7). Unity had significantly higher amylograph viscosity than all checks except Superb.

Other Characteristics

The observations of plant characteristics were made using four-replicate, randomized complete block experiments grown in 2006 and 2007 at Portage La Prairie, MB, for collection of data for Plant Breeders Rights.

Table 6. Falling numbers and sprouting scores of Unity VB and five checks from yield tests grown in 2003–2006. Quality composite samples were created from grain harvested from 4, 5 and 8 locations for respective years of the Central Bread Wheat Coop

	Falling number (s)								Sprouting score[z] (1–9 scale)				
	Quality composite				Field weathered[y]	Artificially weathered[x]			CBWB[w]	CBWC			
Cultivar	2004	2005	2006	Mean	2006	2004	2006	Mean	2003	2004	2005	2006	Mean
Katepwa	330	385	380	365	226	324	151	238	7.3	1.9	8.4	6.5	6.0
McKenzie	375	410	365	383	382	381	343	362	2.8	1.3	6.3	1.4	3.0
CDC Teal	355	360	380	365	240	218	116	167	4.7	4.9	8.5	4.4	5.6
AC Barrie	385	355	410	383	361	352	252	302	6.0	3.8	5.9	2.8	4.6
Superb	355	375	380	370	315	388	259	324	5.4	2.3	4.7	2.5	3.7
Unity VB	405	390	370	388	340	517	253	385	4.4	1.2	3.2	3.2	2.6
LSD ($P=0.05$)[v]				39				133					2.0
Replicates	1	1	1	3	1	1	1	2	1	1	1	1	4

[z][(No. spikes with 0 sprouts) $\times$ 1 + (no. spikes with 1 sprout) $\times$ 2 + (no. spikes with 2 sprouts) $\times$ 3 + (no. spikes with 3–5 sprouts) $\times$ 5 + (no. spikes with > 5 sprouts) $\times$ 9]/ total number of spikes evaluated. Spikes were collected at maturity and stored at -20°C until they were evaluated. The mean was calculated over the 5 yr of tests using SAS PROC MIXED procedure.
[y]Field weathered samples were harvested when declines in falling number were observed for the sprouting susceptible cultivar Roblin.
[x]Collected at maturity, this material is placed in a rain simulator at 15°C for 48 h, dried and then seed is ground into meal for falling number determination.
[w]The CBWB is a preregistration test.
[v]LSD of means was based on the checks and Unity VB and calculated using the MIXED procedure of SAS (SAS Institute, Inc. 2006).

Observations for Unity were made using pure seed of 97B64-F9A3.

SEEDLING CHARACTERISTICS
Coleoptile colour. Reddish-purple anthocyanin colouration.
Juvenile growth habit. Semi-erect.
Seedling leaves. Slightly pubescent leaf sheaths and glabrous blades of lower leaves.

ADULT PLANT CHARACTERISTICS
Growth habit. Semi-erect.
Leaves. Moderately recurved.
Flag leaf. Dark green with glabrous sheath and blade. The auricle colouration is absent, and auricle margins are slightly pubescent. Leaf sheath has a slightly waxy bloom.
Flag leaf attitude. Upright.
Upper culm internode: Slight curvature at maturity and slightly waxy. It exhibits partial stem solidness similar to McKenzie and Fieldstar.
Culm colour. Medium glaucousity.

SPIKE CHARACTERISTICS
Shape. Oblong (parallel-sided).
Size. Similar to McKenzie and Waskada; slightly shorter than Superb and Fieldstar.
Density. Medium dense.
Attitude. Erect.
Rachis. Sparse hairiness of convex surface of apical segment and strong pubescence of margins.
Colour. Medium to strong glaucosity; white colour at maturity.
Awns. Awned.

SPIKELET CHARACTERISTICS
Glumes. Medium length; narrow to medium width; lower glume is slightly pubescent; glume shoulders are square; narrow to medium shoulder width; glume beak is acuminate and of medium length; sparse internal glume hairs. Glumes are white in colour at maturity.
Lemma. Slightly curved beak shape.

KERNEL CHARACTERISTICS
Shape. CWRS; ovate in shape with rounded to slightly angular cheeks.
Size: Small to medium-sized with short to medium length and medium width.
Brush. Medium-sized with mid-long brush hairs.
Embryo. Small to medium-sized, round shape; crease is narrow and mid-deep.

Maintenance and Distribution of Pedigreed Seed Stocks

The Agriculture and Agri-Food Canada Research Farm, Indian Head, Saskatchewan, will maintain the Breeder Seed of Unity. Multiplication and distribution

Table 7. Wheat and flour analytical data for Unity VB and five checks in the Central Bread Wheat Coop, 2004–2006. End-use quality testing was conducted by the Grain Research Lab of the Canadian Grain Commission on composite samples created from grain harvested from 4, 5 and 8 locations for respective years of the Central Bread Wheat Coop

											Farinograph 54–21[z]				Canadian Short Process (150 ppm ascorbic acid)[y]						
Cultivar	Test Weight (kg hL^{-1})	Kernel weight (mg $kernel^{-1}$)	Wheat protein[x] (%)	Flour protein[x] (%)	Amylograph (BU) 22–10	Flour yield[w] (%)	Flour ash (%) 08–01	Agtron colour (%) 14–30	Starch damage (%) 76–31	Particle size index × 55–30	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)
Katepwa	80.8	33.6	13.6	12.9	462	74.5	0.46	78	8.1	54	66.6	5.4	23	9.2	1112	7.4	6.1	7.8	70	5.9	3.6
McKenzie	81.6	34.6	13.8	13.1	557	75.8	0.45	81	8.4	52	68.0	5.6	32	8.2	1085	7.6	6.1	7.7	71	6.3	3.8
CDC Teal	80.8	34.7	14.2	13.7	473	75.0	0.43	78	7.3	56	66.7	7.3	22	16.4	1157	7.7	6.1	7.8	70	6.4	3.9
AC Barrie	81.4	35.1	13.8	13.1	530	75.6	0.44	80	7.5	55	65.2	5.3	18	13.7	1127	7.6	6.1	7.7	70	7.5	4.6
Superb	81.3	38.5	12.9	12.2	587	75.7	0.45	76	8.3	53	67.0	6.3	27	15.3	1077	7.5	6.0	7.7	71	7.0	4.5
Unity VB	82.6	35.0	13.8	13.2	750	76.0	0.45	81	8.5	52	67.8	5.7	32	8.5	1103	7.5	6.0	7.8	71	6.5	3.7
LSD ($P = 0.05$)[v]	0.8	2.0	0.4	0.3	147	0.5	0.03	3	0.6	1.8	1.1	1.8	11	9.6	46	0.2	0.3	0.2	2	1.1	0.3

[z]American Association of Cereal Chemists (AACC). Approved Methods of the AACC, 10th Ed., The Association, St. Paul, MN, 2002.
[y]Preston et al. (1982).
[x]Williams et al. (1998).
[w]Dexter and Tipples (1987). All millings at the Canadian Grain Commission's Grain Research Laboratory (GRL) are performed in rooms with environmental control maintained at 21°C and at 60% relative humidity. Common wheat is milled on an Allis-Chalmers laboratory mill using the GRL sifter flow as described by Black et al. (1980). Flour yield is expressed as a percentage of cleaned wheat on a constant moisture basis.
[v]LSD of means was based on the checks and Unity VB and calculated using the MIXED procedure of SAS (SAS Instiute Inc. 2006). Data consist of single measurements in each of the 3 yr of testing.

of other classes of pedigreed seed will be handled by Secan, 501-300 March Road, Kanata, Ontario, Canada K2K 2E2.

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