

## AC Navigator durum wheat

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Clarke, J. M., McLeod, J. G., DePauw, R. M., Marchylo, B. A., McCaig, T. N., Knox, R. E., Fernandez, M. R. and Ames, N. 2000. **AC Navigator durum wheat**. Can. J. Plant Sci. **80**: 343–345. AC Navigator durum wheat is adapted to the Brown and Dark Brown soil zones of the Canadian prairies. It combines high yield with strong gluten properties. It is a semidwarf with shorter straw than all other registered cultivars in Canada, and has similar maturity to Kyle.

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

Clarke, J. M., McLeod, J. G., DePauw, R. M., Marchylo, B. A., McCaig, T. N., Knox, R. E., Fernandez, M. R. et Ames, N. 2000. **Nouveau cultivar de blé dur AC Navigator**. Can. J. Plant Sci. **80**: 343–345. Le cultivar de blé dur AC Navigator convient pour les zones de sol bruns et brun foncé des Prairies canadiennes. Son rendement élevé est assorti d'un gluten ferme. La paille deminaire est la plus courte de tous les autres cultivars homologués au Canada. Le degré de précocité est le même que chez Kyle.

**Mots clés:** *Triticum turgidum* L. var *durum*, blé dur, description de cultivar, rendement, protéine, comportement à l'égard des maladies

AC Navigator durum wheat (*Triticum turgidum* L. var. *durum*) was developed at the Agriculture and Agri-Food Canada Semiarid Prairie Agricultural Research Centre, Swift Current, Saskatchewan, by the Arid Prairie Wheat Program. It received 1-yr interim registration No. I-243 from the Canadian Food Inspection Agency on 30 July 1998 and extended for a further 3 yr on 1 August 1999. AC Navigator was granted Plant Breeder's Rights by the Canadian Food Inspection Agency, certificate no. 0645, on 14 June 1999.

### Pedigree and Breeding Method

AC Navigator was selected from the cross Kyle/Westbred 881 made in 1989. Kyle (Townley-Smith et al. 1987) is currently the predominant Canadian cultivar, and Westbred 881 (PI483458) was developed by Western Plant Breeders Ltd. AC Navigator was developed using a modified pedigree breeding method. The F<sub>2</sub> was grown as individual plants in a leaf rust [caused by *Puccinia recondita* f.sp. *tritici* Roberge ex Desmaz] and stem rust [caused by *P. graminis* f.sp. *tritici* Pers.: Pers.] epiphytic nursery near Swift Current in 1990. F<sub>3</sub> head rows derived from selected F<sub>2</sub> plants, and F<sub>5</sub> and F<sub>7</sub> head rows grown from heads selected from yield plots, were grown in a winter nursery near Brawley, California and bulk harvested to produce seed for yield tests. Yield trials of 83 F<sub>4</sub>, 63 F<sub>6</sub> and 21 F<sub>8</sub> lines were grown near Swift Current and Regina, each with two replications, in 1991 through 1993 and selected for agronomic performance, disease resistance, and quality (protein, pig-

ment, and gluten strength). Leaf and stem rust reactions were assessed in hill plots in the F<sub>4</sub>, F<sub>6</sub>, and F<sub>8</sub> generations in a leaf and stem rust epiphytic nursery near Glenlea, Manitoba. The stem rust races used included QTH, TPM, TMR, RHT, and RKQ. The races of leaf rust used were those multiplied from collections made the previous year (Kolmer 1994). Races T26, T32 and T33 of loose smut [caused by *Ustilago tritici* (Pers.)Rostr.] and races L1, L16, T1, T6, T13, and T19 of common bunt [caused by *Tilletia laevis* Kuhn in Rabenh., and *T. caries* (DC.) Tul.& C. Tul.] 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.

AC Navigator was evaluated for agronomic and quality traits, and for resistance to leaf rust, stem rust, and loose in the Durum Western 'A' Test (five locations) in 1994 and in the Durum 'B' Test (six locations) in 1995. It was evaluated under the designation DT 673 in the Durum Cooperative Test in 1996–1998 for agronomic and quality traits, and for resistance to leaf rust, stem rust, loose smut, common bunt, leaf spot [caused by *Septoria nodorum* and *Pyrenophora tritici-repentis* (Died.) Drechs] and fusarium head blight [caused by *Fusarium* spp.]. The 117 breeder lines grown in 3-m rows near Swift Current in 1995, and in 15-m rows near Indian Head, SK, in 1996, originate from random plants from an F<sub>6</sub>-derived F<sub>11</sub> single plant progeny row.

**Table 1. Grain yield (t ha<sup>-1</sup>) of AC Navigator and check cultivars in the Durum Cooperative Test, 1996, 1997 and 1998**

Cultivar	1996			1997			1998			3 yr mean	
	Zone 1 <sup>z</sup>	Zone 2	Mean	Zone 1	Zone 2	Mean	Zone 1	Zone 2	Mean	Zone 1	Zone 2
Hercules	3.90	3.62	3.73	3.83	3.53	3.65	4.27	3.95	4.08	3.99	3.67
AC Avonlea	4.26	3.96	4.08	4.30	4.03	4.14	4.82	4.47	4.61	4.43	4.14
Kyle	3.91	4.09	4.02	3.86	4.01	3.95	4.16	4.39	4.30	3.93	4.17
AC Morse	4.26	3.88	4.04	4.14	4.00	4.06	4.55	4.38	4.45	4.28	4.08
AC Navigator	3.90	4.00	3.96	3.56	4.12	3.89	4.14	4.44	4.32	3.81	4.15
LSD <sub>0.05</sub>	0.49	0.31	0.28	0.49	0.21	0.26	0.47	0.23	0.24	0.47	0.39
No. tests	5	5	10	5	7	12	4	6	10	14	18

<sup>z</sup>Zone 1 (1996): Elgin, Brandon, Indian Head, Glenlea, Morden; (1997): Elgin, Brandon, Indian Head, Langdon (North Dakota), Portage La Prairie; (1998): Elgin, Brandon, Indian Head, Glenlea. Zone 2 (1996): Lethbridge, Saskatoon, Elrose, Swift Current, Stewart Valley; (1997): Lethbridge, Saskatoon, Elrose, Swift Current, Stewart Valley, Regina, Irricana; (1998): Lethbridge, Saskatoon, Elrose, Swift Current, Stewart Valley, Regina.

**Table 2. Average agronomic performance of AC Navigator and check cultivars in the Durum Cooperative Test, 1996, 1997 and 1998**

Cultivar	Maturity (d)			Lodging (1-9) <sup>y</sup>	Height (cm)	Test weight (kg hL <sup>-1</sup> )	1000-kernel wt (g)
	Zone 1 <sup>z</sup>	Zone 2	Mean				
Hercules	92	100	96	3.2	97	79.5	41.1
Kyle	95	103	99	5.1	102	79.6	40.1
AC Avonlea	94	102	98	2.3	92	79.4	41.6
AC Morse	94	102	98	1.9	86	78.5	41.3
AC Navigator	94	103	98	2.7	78	79.6	42.3
LSD <sub>0.05</sub>	3	2	2	1.2	4	1.0	1.9
No. tests	13	13	26	18	30	34	34

<sup>z</sup>Zone 1 (1996): Elgin, Brandon, Indian Head, Glenlea, Morden; (1997): Elgin, Brandon, Indian Head, Langdon, Portage La Prairie; (1998): Elgin, Brandon, Indian Head, Glenlea. Zone 2 (1996): Lethbridge, Saskatoon, Elrose, Swift Current, Stewart Valley; (1997): Lethbridge, Saskatoon, Elrose, Swift Current, Stewart Valley, Regina, Irricana; (1998): Lethbridge, Saskatoon, Elrose, Swift Current, Stewart Valley, Regina.

<sup>y</sup>1 = all plants vertical, 9 = all plants horizontal.

**Table 3. Summary of disease reactions of AC Navigator and check cultivars grown in the Durum Cooperative Tests, 1996, 1997 and 1998, one test per year except leaf spots**

Cultivar	Year	Stem rust <sup>z</sup>	Leaf rust <sup>z</sup>	Loose smut <sup>z</sup>	Common bunt <sup>z</sup>	<i>Septoria nodorum</i> <sup>y</sup>	Leaf spots <sup>x</sup>	FHB index <sup>w</sup>	Common root rot (%) <sup>v</sup>
Hercules	1996	1R	TR-R	MR	R+	7.7	8.4	—	11
	1997	1R	TR	MS	R+	—	9.3	64	12
	1998	1R	VR	HS	R+	10	8.6	34	16
AC Avonlea	1996	1R	TR-R	HS	R+	7.7	8.3	—	8
	1997	1R	TR	HS	R+	—	8.6	69	13
	1998	1R	VR	R	R+	9	8.3	53	36
Kyle	1996	1R	TR-R	MR	R+	6.5	9.2	—	7
	1997	1R	TR	R	R+	—	9.4	74	12
	1998	1R	VR	S	R+	9.7	8.8	30	25
AC Morse	1996	1R	TR-R	HS	R	6.8	9.8	—	3
	1997	1R	TR	HS	R+	—	10.7	82	9
	1998	1R	VR	—	R+	10	9.4	42	28
AC Navigator	1996	1R	TR-R	MS	R+	8	9.6	—	4
	1997	1R	TR	S	R+	—	10.6	87	19
	1998	1R	VR	—	R	10	9.9	53	16

<sup>z</sup>Percent infection and type of reaction: TR, trace resistant; VR, very resistant; R+, highly resistant; MR, moderately resistant; R, resistant; MS, moderately susceptible; S, susceptible; HS, highly susceptible.

<sup>y</sup>*Septoria nodorum* field rating (0 = no symptoms, 10 = severe symptoms).

<sup>x</sup>Adult plant, rated mid-grainfill at two locations (1 = no symptoms, 11 = severe symptoms).

<sup>w</sup>Fusarium head blight index: (% infected spikelets × % infected heads)/100.

<sup>v</sup>Percent root infected, mean of three replications.

## Performance

AC Navigator yielded about 1% less than Kyle, averaged over all sites in 1996 to 1998 (Table 1). AC Navigator yielded approximately 2% more than AC Morse, and about the

same as Kyle and AC Avonlea in the main durum growing area (Brown and Dark Brown soil zones, Zone 2). In Zone 1 (non-durum area), AC Navigator yielded 3% less than Kyle, 14% less than AC Avonlea, and 11% less than AC Morse.

**Table 4.** Mean grain protein concentration of AC Navigator and check cultivars in the 1996, 1997 and 1998 Durum Cooperative Test (determined on individual locations by near infrared reflectance) and mean grain yellow pigment, Alveograph work input (W) and pressure/length ratio (P/L) for the 1996, 1997 and 1998 Durum Cooperative Test quality composites

	% protein			Mean	Yellow pigment <sup>z</sup> (ppm) mean	Alveograph <sup>z</sup>	
	1996	1997	1998			W (joules × 10 <sup>-4</sup> ) mean	P/L mean
Hercules	13.3	13.2	13.9	13.4	7.5	111	0.26
AC Avonlea	14.4	13.7	14.6	14.2	9.0	120	0.35
Kyle	13.7	13.1	14.1	13.6	7.8	115	0.39
AC Morse	13.9	13.0	14.4	13.7	8.9	181	0.65
AC Navigator	13.8	13.2	14.0	13.7	10.1	219	0.98
LSD <sub>0.05</sub>	0.5	0.4	0.4	0.4	0.3	29	0.18
No. tests	10	11	11	32	3	3	3

<sup>z</sup>Data from Wheat, Rye and Triticale Subcommittee Quality Evaluation Team minutes, 1996–1998.

Maturity of AC Navigator is similar to AC Avonlea and AC Morse, and 1d earlier than Kyle (Table 2). AC Navigator has shorter straw than all the checks, and stronger straw than Kyle. AC Navigator has high test weight, similar to Kyle and AC Avonlea, and greater than AC Morse.

#### Other Characteristics

**SPIKES.** Fusiform to oblong, dense, mid-long, erect, awned (black); glumes narrow to mid-wide, mid-long, glabrous, white; glume shoulders oblique to square, some slightly elevated; glume beak medium, acuminate.

**KERNEL.** Colour medium amber, mid size, mid-wide, mid-long, elliptical; cheeks rounded to slightly angular; brush mid-size short; embryo mid-size.

**DISEASE REACTION.** Resistant to prevalent races of common bunt, leaf rust and stem rust, highly susceptible to loose smut races prevalent in western Canada, and susceptible to leaf spots and fusarium head blight (Table 3).

**PHOTOPERIOD RESPONSE.** Insensitive.

**END-USE SUITABILITY.** AC Navigator has grain protein concentration similar to Kyle, and has significantly higher yellow pigment concentration and stronger, less-extensible gluten as measured by the Alveograph, than the checks (Table 4). AC Navigator is eligible for grades of the Canada Western Amber Durum wheat class.

#### Maintenance and Distribution of Pedigreed Seed

Breeder seed will be maintained by the Agriculture and Agri-Food Canada Seed Increase Unit, Indian Head, Saskatchewan S0G 2K0. Distribution and multiplication of pedigreed seed stocks will be handled by Saskatchewan Wheat Pool, 2625 Victoria Ave., Regina, Saskatchewan S4T 7T9.

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