CULTIVAR DESCRIPTION

AC Intrepid hard red spring wheat

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DePauw, R. M., Clarke, J. M., Knox, R. E., Fernandez, M. R., McCaig, T. N. and McLeod, J. G. 1999. **AC Intrepid hard red spring wheat**. Can. J. Plant Sci. **79**: 375–378. AC Intrepid, a hard red spring wheat (*Triticum aestivum* L.), is adapted to the Canadian prairies. It expressed high grain yield, early maturity, and heavy kernels. It has resistance to prevalent races of leaf rust, stem rust, and common bunt. AC Intrepid is eligible for grades of Canada Western Red Spring wheat.

Key words: *Triticum aestivum* L., red spring wheat, yield, maturity, disease resistance, seed size

DePauw, R. M., Clarke, J. M., Knox, R. E., Fernandez, M. R., McCaig, T. N. et McLeod, J. G. 1999. **Cultivar de blé de printemps roux vitreux AC Intrepid**. Can. J. Plant Sci. **79**: 375–378. AC Intrepid est un nouveau cultivar de blé de printemps roux vitreux (*Triticum aestivum* L.) adapté aux conditions de culture des Prairies canadiennes. Il a fait montre d'un rendement grainier élevé, en plus d'être précoce et de produire un grain lourd. Il possède la résistance aux races prévalentes de rouilles des feuilles et de la tige et de carie commune. Le nouveau cultivar est admissible aux grades de blé de printemps roux vitreux de l'Ouest canadien (BPRVOC).

Mots clés: *Triticum aestivum* L., blé de printemps roux, rendement, précocité de maturité, résistance aux maladies, grosseur du grain

AC Intrepid hard red spring wheat (*Triticum aestivum* L.) was developed at the Semiarid Prairie Agricultural Research Centre, Agriculture and Agri-Food Canada, Swift Current, SK. AC Intrepid received restricted registration No. 4627 from the Variety Registration Office, Food Production and Inspection Branch, Canadian Food Inspection Agency on 29 August 1997.

Pedigree and Breeding Method

AC Intrepid derives from the cross Laura/RL4596//CDC Teal made in 1987 at the Semiarid Prairie Agricultural Research Centre, Agriculture and Agri-Food Canada (AAFC), Swift Current. CDC Teal and Laura are CWRS wheat cultivars that express high grain yield and/or high protein concentration (DePauw et al. 1988, 1998; Hughes and Hucl 1993). RL4596 derives from the cross Columbus/BW63//BW47/BW553 (Townley-Smith and Czarnecki 1996). The F_2 seed was inoculated with common bunt races L1, L16, T1, T6, T13, and T19 [caused by *Tilletia laevis* Kuhn in Rabenh., and *T. caries* (DC.) Tul.& C. Tul.] and grown as individual plants in a leaf rust (caused by *Puccinia recondita* Roberge ex Desmaz.) and stem rust (caused by *P. graminis* Pers.:Pers. f.sp. *tritici* Eriks. & E. Henn.) epiphytotic nursery near Swift Current. The rust races were representative of those found the year previous (Kolmer 1996). The F_3, F_5, and F_7 generations were grown as head rows in a winter nursery near Brawley, California, to multiply seed for early generation tests. In the F_4, F_6, and F_8 generations, we screened for quantitative and qualitative traits using early generation screening procedures. We selected simultaneously for time to maturity, grain yield potential and grain protein concentration. Time to maturity and grain yield potential were measured in replicated trials at two locations; grain protein concentration was assessed on a composite of the two replications from each location using near infrared reflectance spectroscopy (Williams 1979). In the same generations, reaction to leaf and stem rust was scored in an epiphytotic nursery near Glenlea, Manitoba. Remnant seed from the yield trials was used to assess grain quality and kernel characteristics. Selected F_8 lines were screened for reaction to loose smut [caused by *Ustilago tritici* (Pers.) Rostr.] using a mixture of races T2, T10, and T39 and common bunt using the same races as in the F_2 . An experimental line, 8707-BU1C, was evaluated in the Western Bread Wheat 'AII' test in 1992, the Western Bread Wheat 'B' test in 1993, in the Western Bread Wheat Cooperative (WBWC) test from 1994 to 1996 and in the Central Bread Wheat Cooperative (CBWC) test in 1996 as BW693, and in the Parkland Cooperative test 1994 to 1996 as PT401.

While in the Cooperative tests, leaf and stem rust seedling infection types were assessed by pathologists at the Cereal Research Centre, AAFC, Winnipeg, MB. Stem rust races used for one or more years were: QTH (C25), RTH (C57), RRQ (C63), TMR (C10), TMR (C95), and TPM (C53). Leaf rust races used for one or more years were: Race 1, Race 15, KBG, MBR, (39-2), MCR, MFM (56-1), MJB (10-3), TBD (U3-1), TDG (36-3), TDT (Kolmer 1996). Field leaf and stem rust reactions, using the same races as for the seedling tests, were measured in an epiphytotic nursery near Glenlea, MB. To determine loose smut reaction type, prevalent races T2, T9, T10 and T39 were mixed and artificially injected

Table 1. Grain yield of AC Intrepid compared with check cultivars, based on data from the Western Bread Wheat Cooperative test, 1994–1996

	Yield (kg ha^{-1})								
	Zone 1[z]				Zone 2				Grand
Name	1994	1995	1996	Mean[y]	1994	1995	1996	Mean	mean
Neepawa	2750	3690	3570	3340	3610	4140	4200	4010	3900
Laura	2780	3990	3760	3510	3890	4340	4290	4200	4080
AC Elsa	2850	4180	4000	3680	3970	4370	4600	4340	4230
AC Eatonia	2660	3750	3230	3210	3420	3920	3950	3790	3690
AC Intrepid	3070	4010	4010	3700	3910	4330	4470	4260	4170
LSD[x]	410	340	500	290	230	230	230	170	120
No. tests	2	2	2	6	8	11	10	29	35

[z]Zone 1, locations in the Brown soil zone of southern Saskatchewan and south western Alberta; zone 2, locations in the Dark Brown and Black soil zones of Saskatchewan and Alberta.
[y]All means are weighted by the number of tests within a zone.
[x]Least significant difference, $P \leq 0.05$, based on mixed model using means squares genotype-by-test interaction as denominator.

Table 2. Agronomic performance of AC Intrepid compared with check cultivars, based on data from the Parkland Cooperative test, 1994–1996

	Yield		Head	Maturity	Height	Lodging	Test weight	Kernel wt
Name	(kg ha^{-1})	(%Np)	(d)	(d)	(cm)	(1–9)[z]	(kg hL^{-1})	(mg)
Neepawa	4090	100	58	105	99	2.3	76.9	35.7
Roblin	4040	99	55	104	92	1.7	76.4	37.1
AC Splendor	4100	100	54	103	94	2.2	76.7	38.8
AC Intrepid	4390	107	56	104	95	1.8	77.1	40.1
SE[y]	53		0.3	0.3	0.4	0.2	0.1	0.2
No. tests	32		24	22	35	21	35	35

[z]Rated as 1 = all plants vertical; 9 = all plants horizontal.
[y]Standard error of a mean using the cultivar-by-test interaction mean square.

Table 3. Agronomic performance of AC Intrepid compared with check cultivars, based on data from the Central Bread Wheat Cooperative test, 1996

	Yield (kg ha^{-1})			Maturity	Height	Lodging	Test wt.	Kernel wt.
Name	Zone 1[z]	Zone 2	Mean	(d)	(cm)	(1–9)[y]	(kg hL^{-1})	(mg)
Neepawa	3620	3910	3770	97.3	101	3.0	77.4	32.6
Katepwa	3660	3860	3760	96.7	102	2.8	77.9	33.2
Roblin	3290	3590	3440	95.0	93	1.4	76.1	34.6
AC Majestic	3700	3400	3550	99.0	98	1.9	78.2	35.1
AC Intrepid	3750	4080	3910	95.0	95	1.8	78.1	38.9
SE[x]			56	0.3	0.4	0.2	0.1	0.2
No. tests	5	5	10	9	9	8	10	10

[z]Zones 1 and 2 consist of locations in Manitoba and eastern Saskatchewan, respectively.
[y]Rated as 1 = all plants vertical; 9 = all plants horizontal.
[x]Standard error of a mean using the cultivar-by-test interaction mean square.

into florets at anthesis. Common bunt races L1, L16, T1, T6, T13, and T19 were used to inoculate the seed which was planted early into cold soil near Lethbridge. The race designations are those described by Green (1965) and Roelfs and Martens (1988) for stem rust, Hoffmann and Metzger (1976) for common bunt and Nielsen (1987) for loose smut. Response to leaf spots was scored in tests grown near Swift Current, Indian Head, Kernen, and Regina following the procedures described by Fernandez et al. (1996).

Performance

In the WBWC test 1994–1996, AC Intrepid yielded, on average, significantly more than Neepawa or AC Eatonia (Table 1). In Zone 1, AC Intrepid averaged 10.8% more grain than Neepawa, 5.4% more than Laura, and the same as AC Elsa. In Zone 2, AC Intrepid averaged 6.2% more than Neepawa, 1.4% more than Laura, and 1.8% less than AC Elsa. In the Parkland Cooperative test, AC Intrepid yielded significantly more than any of the checks (Table 2). It averaged 7% more grain yield than Neepawa or AC Splendor (PT402) and 8% more than Roblin. In the 1996 CBWC test, grain yield of AC Intrepid averaged 3.7% more than Neepawa, 4.0% more than Katepwa, 13.7% more than Roblin, and 10.1% more than AC Majestic (Table 3). In the WBWC test, AC Intrepid matured earlier than all of the checks (Table 4). In the Parkland C test, AC Intrepid averaged earlier than Neepawa, the same time as Roblin, and 1 d later than AC Splendor (Table 2). In the CBWC test, AC Intrepid matured earlier than Neepawa, Katepwa, and AC Majestic, and the same as Roblin (Table 3). In the WBWC

Table 4. Agronomic performance of AC Intrepid compared with check cultivars, based on data from the Western Bread Wheat Cooperative test, 1994–1996

Name	Maturity (d)			Height (cm)	Lodging (1–9)[x]	Test weight (kg hL^{-1})	Kernel weight (mg)
	Zone 1[z]	Zone 2	Mean[y]				
Neepawa	99.8	102.1	101.8	99	2.1	80.2	32.8
Laura	100.4	104.6	104.1	97	3.0	80.4	33.3
AC Elsa	99.4	102.6	102.3	94	2.2	80.4	33.6
AC Eatonia	100.2	103.6	103.2	97	3.5	80.9	33.6
AC Intrepid	99.4	100.7	100.5	94	1.6	80.1	38.4
LSD			0.8	1.4	0.6	0.4	0.6
No. tests	3	25	28	32	17	34	34

[z]Zone 1, locations in the Brown soil zone of southern Saskatchewan and south western Alberta; zone 2, locations in the Dark Brown and Black soil zones of Saskatchewan and Alberta.
[y]All means are weighted by the number of tests within a zone.
[x]Rated as 1 = all plants vertical; 9 = all plants horizontal.

Table 5. Disease reactions of AC Intrepid and check cultivars, based on data from Western Bread Wheat Cooperative tests 1994–1996

Cultivar	Year	Leaf rust[z]	Stem rust[z]	Common bunt[z]	Loose smut[z,y]	Common root rot[x]	Leaf spots[w]				FHB[u]
							SC[v]	IH	Kn	Reg	
Neepawa	1994	30MR	10RMR	14I	6R	22	7.5	–	8.5	–	–
	1995	70MRMS	40RMR-5MS	12I	8R	0	8.2	–	–	9.3	52
	1996	50MRMS	5RMR	4R	0R	5	7.8	8.0	–	–	27 20
Laura	1994	10M	5R	43S	52S	10	9	–	3.5	–	–
	1995	TR	20RMR	24S	82HS	0	9.3	–	–	9.3	57
	1996	5M	1R	23I	36HS	0	9.0	9.8	–	–	–
AC Elsa	1994	30M	5R	8I–	17MR	19	7.3	–	2.0	–	75
	1995	TR	30RMR	6I-	6R	0	7.0	–	–	7.3	–
	1996	5M	4R	27I	24MR	3	8.0	7.0	–	–	–
AC Eatonia	1994	30MR	15RMR	2R	0MS	14	7.5	–	5	–	57
	1995	30M	40MRMS	1R	19MR	0	7.8	–	–	9.3	–
	1996	20M	1R	3R	0S	12	7.8	7.5	–	–	–
AC Intrepid	1994	5R	5R	3R	9MS	21	8.8	–	8.0	–	–
	1995	TR	30RMR	0R	31MS	0	8.3	–	–	10	62
	1996	5M	3RMR	10R	18MS	5	7.8	8.0	–	–	45 35

[z]Percent infection and type of reaction: T, trace; VR, very resistant; R, resistant; MR, moderately resistant; I, intermediate resistant; MS, moderately susceptible; S, susceptible; HS, highly susceptible.
[y]Ratings are based on data from current and previous years, some of which are not shown.
[x]Percentage of plants with moderate to large lesions on the subcrown internode.
[w]Rated at the milk dough stage, using a scale of 0–11 except Kernen 1994 where a 0–11 scale was used. 0 = no symptoms and 9 or 11 = all leaves heavily infected.
[v]SC = Swift Current, SK; IH = Indian Head, SK; Kn = Kernen, SK; and Reg = Regina, SK.
[u]Fusarium Head Blight index = (% infected spikelets × % infected spikes)/100. First value for 1996 was scored near Glenlea, MB, second value scored near Charlottetown, PEI.

test, AC Intrepid was 5 cm shorter than Neepawa, 2 cm shorter than Laura, and the same as AC Elsa (Table 4). It also had stronger straw than any of the checks, as measured by lodging scores. In the Parkland test, AC Intrepid was 4 cm shorter than Neepawa and taller than Roblin and AC Splendor (Table 2), had stronger straw than Neepawa or AC Splendor, and slightly weaker straw than Roblin. In the CBWC test, AC Intrepid was shorter than all of the checks except Roblin (Table 3), and had stronger straw than Neepawa or Katepwa, but similar to Roblin and AC Majestic. In the WBWC test, AC Intrepid had a slightly lighter test weight and a heavier kernel than the checks (Table 4). In the Parkland test, AC Intrepid had a heavier test weight and heavier kernels than the checks (Table 2). Similarly, in the CBWC test, AC Intrepid had a heavier test weight than Neepawa or Katepwa, and a heavier kernel than any of the checks (Table 3).

Other Characteristics

SPIKES. Oblong to fusiform, mid-dense, mid-long, erect to slightly inclined, apically awnletted; glumes mid-wide, mid-long, glabrous, white; glume shoulders primarily square, some tending to elevated and some tending to rounded, mid-wide; glume beak short and acute.

KERNEL. Red colour, medium to large size, mid-wide to wide, mid-long, ovate; cheeks angular to slightly rounded; brush hairs mid-size, mid-long to short; embryo mid-size to small, oval.

SHATTERING. Resistant, similar to Neepawa.

DISEASE REACTION. Resistant to prevalent races of leaf rust and stem rust, and common bunt; moderately resistant to common root rot [caused primarily by *Bipolaris sorokiniana*

Table 6. End-use suitability[z] traits of AC Intrepid and check cultivars, averages for the Western Bread Wheat Cooperative test 1994–1996

	Wheat protein (%)	Flour				Wheat amylase (EU)	Amylograph viscosity (B.U.)	Hagberg falling no. (sec)
		Protein (%)	Yield (%)	Color (KJ)	Ash (%)			
Neepawa	13.9	13.3	75.6	–2.0	0.42	5.5	633	392
Laura	13.9	13.4	75.6	–2.7	0.41	5.5	668	372
AC Eatonia	14.3	13.8	76.9	–1.7	0.41	8.5	675	353
AC Elsa	14.3	13.6	76.8	–2.5	0.43	4.3	670	400
AC Intrepid	13.7	13.1	76.2	–2.6	0.41	7.8	590	387

	Starch damage Farrand units	Farinograph				Baking: Canadian Short Process		
		Absorption (%)	Dough development time (min)	Mixing tolerance index (B.U.)	Stability (min)	Loaf volume (cm^3)	Mixing time (min)	Absorption (%)
Neepawa	33	65.9	5.00	27	9.3	1463	7.1	70.3
Laura	26	65.7	7.92	17	19.8	1501	9.3	69.3
AC Eatonia	30	64.5	4.17	28	8.5	1474	6.0	68.7
AC Elsa	31	66.5	7.00	17	17.0	1476	8.4	70.7
AC Intrepid	28	66.0	6.08	23	12.5	1498	7.4	70.0

[z]American Association of Cereal Chemists methods were followed by the Grain Research Laboratory, Canadian Grain Commission for determining the various end-use suitability traits on a composite of 6 to 10 locations each year.

(Sacc.) Shoemaker]; and moderately susceptible to leaf spots [caused by *Pyrenophora tritici-repentis*. (Died.) Drechs., Stagonospora blotch caused by *Phaeosphaeria nodorum* (E. Muller) Hedjaroude and Septoria blotch caused by *Mycosphaerella graminicola* (Fuckel) J. Schrot. in Cohn], and loose smut; and susceptible to fusarium head blight (caused by *Fusarium* spp.) (Table 5).

PHOTOPERIOD RESPONSE: Insensitive.

END-USE SUITABILITY: Based on 3 yr of testing in the Western Bread Wheat Cooperative Test, AC Intrepid was rated equal to Neepawa for grain quality (Table 6) and it is eligible for grades of Canada Western Red Spring.

Maintenance and Distribution of Pedigreed Seed

Breeder Seed consists of 129 Breeder Lines. They were selected from F_6-derived F_{11} random single plants, and were grown in isolation near Swift Current in 1995 and again as 15-m rows near Indian Head in 1996. Breeder Seed will be maintained by the Seed Increase Unit, Research Farm, Indian Head, Saskatchewan S0G 2K0. Plant Breeders' Rights have been filed. AC Intrepid has been released for distribution and multiplication to Canterra Seeds Ltd., 43 Scurfield Blvd., Winnipeg, Manitoba, Canada R3Y 1G4.

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DePauw, R. M., Clarke, J. M., McCaig, T. N. and Townley-Smith, T. F. 1998. Opportunities for the improvement of grain yield and quality through plant breeding. Pages 75–93 *in* D.B. Fowler, W.E. Geddes, A.M. Johnston, and K.R. Preston, eds. Wheat protein, production and marketing. University of Saskatchewan, Saskatoon, SK.

DePauw, R. M., Townley-Smith, T. F., McCaig, T. N. and Clarke, J. M. 1988. Laura hard red spring wheat. Can. J. Plant Sci. **68**: 203–206.

Fernandez, M. R., Clarke, J. M., DePauw, R. M. and Lefkovitch, L. P. 1996. Comparison of durum and common wheat cultivars for reaction to leaf spotting fungi in the field. Plant Dis. **80**: 793–797.

Green, G. J. 1965. Stem rust of wheat, rye, and barley in Canada in 1964. Can. Plant Dis. Surv. **45**: 23–29.

Hoffmann, J. A. and Metzger, R. J. 1976. Current status of virulence genes and pathogenic races of the wheat bunt fungi in the northwestern USA. Phytopathology **66**: 657–660.

Hughes, G. R. and Hucl, P. 1993. CDC Teal hard red spring wheat. Can. J. Plant Sci. **73**: 193–197.

Kolmer, J. A. 1996. Physiologic specialization of *Puccinia recondita* f. sp. *tritici* in Canada in 1994. Can. J. Plant Pathol. **18**: 300–302.

Nielsen, J. 1987. Races of *Ustilago tritici* and techniques for their study. Can. J. Plant Pathol. **9**: 91–105.

Roelfs, A. P. and Martens, J. W. 1988. An international system of nomenclature for *Puccinia graminis* f. sp. *tritici*. Phytopathology **78**: 525–533.

Townley-Smith, T. F and Czarnecki, E. 1996. Report on the Central Bread Wheat Cooperative Tests 1995. *In* Minutes 7th Meeting of Prairie Registration Recommending Committee for Grain, Winnipeg, MB.

Williams, P. C. 1979. Screening wheat for protein and hardness by near infrared reflectance spectroscopy. Cereal Chem. **56**: 169–172.