CULTIVAR DESCRIPTION

AC Crystal red spring wheat

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Fernandez, M. R., DePauw, R. M., Knox, R. E., Clarke, J. M., McCaig, T. N. and McLeod, J. G. 1998. **AC Crystal red spring wheat**. Can. J. Plant Sci. **78**: 307–310. AC Crystal is a red-seeded spring wheat (*Triticum aestivum* L.). In combining high grain yield and resistance to prevalent races of common bunt in a semidwarf, photoperiod-insensitive background it is similar to AC Taber. It has improvements relative to AC Taber: resistance to prevalent races of loose smut, except race T9, and stronger gluten properties. AC Crystal has improved resistance to leaf spots compared to Neepawa, AC Karma, and AC Foremost. It is eligible for grades of the Canada Prairie Spring (Red) wheat class.

Key words: *Triticum aestivum* L., cultivar description, loose smut resistance, common bunt resistance, high yield, red spring wheat

Fernandez, M. R., DePauw, R. M., Knox, R. E., Clarke, J. M., McCaig, T. N. et McLeod, J. G. 1998. **Blé de printemps roux AC Crystal**. Can. J. Plant sci. **78**: 307–310. A.C. Crystal est un nouveau cultivar de printemps (*Triticum aestivum* L.) à grain roux. Comme A.C. Taber, c'est un cultivar photo-apériodique, doté à la fois d'un rendement grainier élevé et de résistance aux principales races courantes de carie commune. Il s'en distingue toutefois par une meilleure résistance aux races dominantes de charbon nu, la race T9 exceptée, et par un gluten plus ferme. Il possède en outre une meilleure résistance aux taches foliaires que Nepawa, AC Karma et AC Foremost. Il est admissible aux grades de la catégorie des blés roux de printemps des Prairies canadiennes.

Mots clés: *Triticum aestivum* L., description de cultivar, résistance au charbon nu, carie commune, rendement élevé, blé de printemps roux

AC Crystal, red spring wheat (*Triticum aestivum* L.), was developed at the Semiarid Prairie Agricultural Research Centre, Agriculture and Agri-Food Canada, Swift Current, Saskatchewan. It received registration No. 4378 from the Food Production and Inspection Branch of Agriculture and Agri-Food Canada on 22 July 1996.

Pedigree and Breeding Method

AC Crystal derives from a cross between HY377 and L8474-D1 made in 1988. HY377 (DePauw et al. 1989) has resistance to loose smut (caused by *Ustilago tritici* [Pers.] Rostr.) from 7424-BW5B4 backcrossed into HY320 (DePauw et al. 1987). L8474-D1 is a sib of AC Taber (L8474-D2) (Knox et al. 1992). F_2 seed was inoculated with common bunt (caused by *Tilletia laevis* Kuhn in Rabenh. and *T. caries* [DC.] Tul. & C. Tul.) and grown as individual plants in a disease nursery of leaf rust (caused by *Puccinia recondita* Roberge ex Desmaz.) and stem rust (caused by *P. graminis* Pers.:Pers. f.sp. *tritici* Eriks. & E. Henn.). Individual plants were selected for maturity, height, straw strength, and disease resistance. The F_3 and F_5 generations were grown as head rows in a winter nursery near Brawley, California, to multiply seed for early generation tests. In the F_4 and F_6 generations, 258 and 146 lines were screened for quantitative and qualitative traits using early generation screening procedures. Reaction to leaf and stem rust was measured in an epiphytotic disease nursery near Glenlea, Manitoba. Remnant seed from the yield trails was used to assess grain quality and kernel characteristics. Selected F_6 lines were screened for reaction to loose smut and common bunt. An experimental line, designated as 8828-BG2 , was evaluated in the High Yield Wheat 'B' Test in 1992. It was designated as HY417 and evaluated in the High Yielding Wheat Cooperative Test from 1993 to 1995.

While in the cooperative tests, reaction to leaf and stem rust was measured in a disease nursery near Glenlea, MB. The stem rust races used were: QTH (C25), TPM (C53), TMR (C10), TMR (C95), RHT (C57), and RKQ (C63). The races of leaf rust used were CGB, KBG, MCR, MFB, MFM, TBD,TBG,and TDT (Kolmer 1996). Races T2, T9, T10 and T39 of loose smut and races L1, L16, T1, T6, T13, and T19 of common bunt were used for screening. 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 following the procedures described by Fernandez et al. (1996).

Performance and Adaptation

During 3 yr of testing in the High Yielding Wheat Cooperative Test, AC Crystal yielded 33 to 50% more than Neepawa (Table 1); equal to AC Taber in Zone 1 and 2%

Table 1. Agronomic performance of AC Crystal compared with the check cultivars, based on data from the High Yielding Wheat Cooperative Tests (1993–1995)

Cultivar	Yield (t ha^{-1}) Zone 1[z]	Zone 2	Zone 3	Mean[y]	Maturity (d)	Plant height (cm)	Lodging[x] (1-9)	Test weight (kg hL^{-1})	Kernel weight (mg)
Neepawa	3.22	3.89	3.44	3.58	104.5	100	2.8	78.5	32.1
AC Taber	4.56	5.24	5.05	4.98	109.5	85	2.1	78.5	39.7
AC Foremost	4.22	4.99	4.71	4.68	107.7	79	1.5	77.9	40.2
AC Karma	4.25	5.13	4.80	4.77	107.8	86	1.9	79.0	37.8
AC Crystal	4.56	5.16	5.16	4.96	109.0	85	1.8	78.9	40.1
LSD ($P < 0.05$)				0.16	0.8	1	0.5	0.5	0.9
No. of tests	15	21	9	45	37	45	18	45	45

[z]Zone 1, locations in Manitoba and southeastern Saskatchewan; Zone 2, locations in southern Alberta and western Saskatchewan; Zone 3, locations in Peace River and Parkland area.
[y]All means are weighted by the number of tests within a zone.
[x]1, all plants vertical; 9, all plants horizontal.

Table 2. Agronomic performance of AC Crystal compared with check cultivars, based on data from the High Yielding Wheat Irrigated Cooperative Tests (1993–1995)

Cultivar	Yield (t ha^{-1})	Maturity (d)	Height (cm)	Lodging (1–9)[z]
Neepawa	3.46	110.5	104	3.4
AC Taber	4.81	115.4	88	1.7
AC Foremost	4.71	113.6	82	1.5
AC Karma	4.64	114.0	89	1.6
AC Crystal	4.70	114.2	87	1.6
LSD ($P < 0.05$)	0.42	2.8	2	2.1
No. of tests	10	9	10	4

[z]1, all plants vertical; 9, all plants horizontal.

less in Zone 2 and Zone 3; 8% more than AC Foremost in Zone 1, 3% more in Zone 2, and 9% more in Zone 3; and 7% more than AC Karma in Zone 1, equal in Zone 2 and 7% more in Zone 3. AC Crystal matured slightly earlier than AC Taber and about 1 d later than AC Foremost and AC Karma. It has a semidwarf stature with strong straw. It had heavier test weight than AC Foremost, AC Taber, and Neepawa, and heavier kernel weight than AC Karma and Neepawa. It was suitable for production under irrigation (Table 2). AC Crystal expressed resistance to prevalent races of leaf rust, stem rust, and common bunt (Table 3). It had leaf spot resistance similar to AC Taber, similar to or better than AC Foremost, and better than Neepawa and AC Karma. In some cases it had lower fusarium head blight indices than all the checks. In subsequent testing, AC Crystal has expressed high variation in FHB indices between years and locations (Annonymous 1996). It is resistant to loose smut races T2, T10, and T39 but susceptible to a new race T9 as is AC Foremost, AC Taber, and AC Karma (data not shown). AC Crystal displayed stronger gluten properties than AC Foremost and AC Taber (Table 4).

Other Characteristics

SPIKES. Oblong to fusiform, mid-dense, mid-long to long, inclined to erect, awned; glumes mid-wide, long, glabrous,

Table 3. Disease reactions of AC Crystal and check cultivars, based on data from High Yielding Wheat Cooperative Tests (1993–1995)

Cultivar	Year	Leaf rust[z]	Stem rust[z]	Common bunt[z]	Loose smut[z,y]	Common root rot[x]	Leaf spots[w] GL[v]	IH	SC	FHB[u] (%)
Neepawa	1993	40MR	10R	16 I	9 R	4	7.0	8.0	7.0	–
	1994	40MR	5RMR	16 I	6 R	19	5.0	7.9	7.5	2
	1995	40MR	30RMR	4 I	8 R	0	–	8.8	9.2	53
AC Taber	1993	5R	10RMR	0 R	0 HS	15	4.7	4.0	6.0	–
	1994	5RMR	20MR	0 R	20 HS	14	3.5	3.8	6.5	11
	1995	5R	30RMR	0 R	100 HS	1	–	9.2	7.8	64
AC Foremost	1993	5R	20RMR	0 R	82 R	11	5.3	3.8	5.8	–
	1994	10RMR	10R	0 R	0 R	19	4.0	4.3	7.0	33
	1995	20RMR	30RMR	0 R	43 HS	1	–	9.3	7.5	58
AC Karma	1993	5R	10R	3 R	0 MR	9	6.0	5.0	6.0	–
	1994	5R	10R	0 R	22 MR	23	4.0	5.6	8.0	13
	1995	TR	20RMR	3 R	44 S	1	–	10.0	9.7	54
AC Crystal	1993	5R	20RMR	2 R	0 R	12	5.0	4.0	6.0	–
	1994	5R	10R	2 R	7 R	17	2.5	3.7	6.5	13
	1995	10RMR	30RMR	1 R	76 HS	3	–	8.0	7.3	35

[z]Percent infection and type of reaction: T, trace; R, resistant; MR, moderately resistant; I, intermediate resistant; S, susceptible; HS, highly susceptible.
[y]Ratings are based on data from current and previous years.
[x]Percentage of plants with moderate to large lesions on the subcrown internode.
[w]Rated at the milk dough stage, using a scale of 0–9 (all locations in 1993) and 0–11 (all locations in 1994 and 1995).
[v]GL = Glenlea, MB in 1993 and Portage la Prairie, MB in 1994; IH = Indian Head, SK in 1993 and 1994, and Regina, SK in 1995; SC = Swift Current, SK.
[u]Fusarium head blight index = (% infected spikelets × % infected spikes)/100.

Table 4. Measurements of flour milling properties, gluten strength, and bread-loaf volume for AC Crystal and check cultivars from High Yielding Wheat Cooperative Tests (1993–1995)[z]

	Starch damage (Farrand units)			Flour yield (%)			Flour ash (%)			Flour colour (Kent-Jones)		
	1993	1994	1995	1993	1994	1995	1993	1994	1995	1993	1994	1995
Neepawa	32	26	37	75.9	77.3	75.6	0.47	0.47	0.44	-1.1	-0.3	-1.3
AC Taber	31	27	32	76.7	77.8	77.7	0.51	0.46	0.46	0.6	-0.5	-0.8
AC Foremost	27	20	28	75.3	77.4	77.2	0.51	0.47	0.48	-0.7	-0.5	-0.9
AC Karma	29	21	27	77.3	79.2	78.9	0.50	0.48	0.51	-1.2	-1.8	-2.3
AC Crystal	29	23	28	75.9	77.6	77.1	0.49	0.48	0.47	0.0	-0.5	-1.0

	Farinograph								
	Absorption (%)			Dough development (Min.)			Stability (Min.)		
	1993	1994	1995	1993	1994	1995	1993	1994	1995
Neepawa	64.3	64.0	66.4	4.50	4.50	4.25	8.5	8.0	8.0
AC Taber	61.9	58.8	60.0	5.00	5.50	4.25	6.5	8.0	5.0
AC Foremost	61.2	60.2	61.7	4.25	4.25	4.00	5.5	6.5	4.5
AC Karma	62.2	60.1	61.4	2.75	2.75	3.00	3.0	3.5	2.5
AC Crystal	62.0	59.0	60.7	5.50	6.50	6.00	8.0	10.0	7.5

	Flour protein (%)			Baking strength index			Remix loaf volume (cm)		
	1993	1994	1995	1993	1994	1995	1993	1994	1995
Neepawa	12.2	13.2	13.4	95.5	97.6	97.2	760	845	855
AC Taber	10.8	10.9	10.9	101.7	100.7	105.7	710	710	745
AC Foremost	10.7	11.1	11.3	103.5	103.6	103.7	715	745	760
AC Karma	10.8	11.0	11.0	92.4	99.0	91.3	645	705	650
AC Crystal	10.8	10.8	11.1	103.9	103.9	107.8	725	725	775

[z]Data provided by the Grain Research Laboratory of the Canada Grain Commission. American Association of Cereal Chemists methods were followed for determining the various end-use suitability traits.

white; glume shoulders are variable some square, some elevated, some rounded, narrow to mid-wide; glume beak mid-long, tending to acuminate.

KERNEL. Colour red; large; mid-long to long; mid-wide to wide; elliptical; cheeks angular to rounded; brush hairs mid-long; crease mid-wide, mid-deep; germ mid-size, elliptical.

SHATTERING. Resistant, similar to AC Taber.

DROUGHT RESPONSE. Tolerant to heat and drought, similar to AC Taber.

DISEASE REACTION. Resistant to prevalent races of stem rust, leaf rust, common bunt and loose smut except the new race T9; moderately resistant to leaf spots [tan spot caused by *Pyrenophora tritici-repe*ntis (Died.) Drechs., Stagonospora blotch caused by *Phaeosphaeria nodorum* (E. Muller) Hedjaroude and Septoria blotch caused by *Mycosphaerella graminicola* (Fuckel) J. Schrot. in Cohn]; moderately resistant to moderately susceptible to common root rot (caused primarily by *Bipolaris sorokiniana* (Sacc.) Shoemaker).

PHOTOPERIOD RESPONSE. Day length insensitive.

END-USE SUITABILITY. Eligible for grades of the Canada Prairie Spring (red) wheat class.

Maintenance and Distribution of Pedigreed Seed

Breeder Seed consists of 134 Breeder Lines. They were selected from F_4 -derived F_6 random single plants, which were grown in isolation near Swift Current in 1994 and again as 15m rows near Indian Head in 1995. Breeder Seed will be maintained by the Seed Increase Unit of the Research Farm, Indian Head, Saskatchewan, Canada S0G 2K0. Plant Breeders' Rights have been filed. AC Crystal has been released for distribution and multiplication of pedigreed seed stocks to SECAN Association, 200-57 Auriga Drive, Nepean, Ontario, Canada, K2E 8B2.

Appreciation is expressed to K. R. Preston and J. E. Kruger, Grain Research Laboratory, Canadian Grain Commission, Winnipeg, Manitoba, for providing end-use suitability analysis; to J. S. Noll for providing end-use suitability analysis, to P. L Thomas and J. G Menzies for determining reaction to loose smut, and to D.E Harder and J. A. Kolmer Agriculture and Agri-Food Canada (AAFC), Cereal Research Centre, Winnipeg, Manitoba, for assessing reaction to stem and leaf rust; to K. L Bailey, Research Centre, AAFC, Saskatoon, Saskatchewan, for providing reaction to common root rot; to D. A. Gaudet, and B. J Puchalski, Research Centre, AAFC, Lethbridge, Alberta, for assessing reaction to common bunt; to C. W. B. Lendrum, G. McClare, and H. L. Campbell, Semiarid Agricultural Research Centre, AAFC, Swift Current, Saskatchewan, R. A Ferguson, Research Farm, AAFC, Regina, Saskatchewan, and D. A. Green, and D. T. Gehl, Research Farm, AAFC, Indian Head, Saskatchewan, for their expert technical assistance in developing AC Crystal.

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