

AC Vista hard white spring wheat

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Key words: *Triticum aestivum* L., cultivar description, white spring wheat, preharvest sprouting resistance, common bunt resistance, high grain yield

DePauw, R. M., McCaig, T. N., Knox, R. E., Clarke, J. M., Fernandez, M. R. et McLeod, J. G. 1998. **Nouveau cultivar de blé de printemps blanc vitreux AC Vista**. Can. J. Plant Sci. **78**: 617–620. AC Vista est un nouveau cultivar de blé de printemps blanc vitreux (*Triticum aestivum* L.) doté de résistance à la germination sur pied. A un rendement grainier élevé, il allie une forte résistance aux races courantes de la rouille des feuilles, de la rouille noire, de la carie commune et du charbon nu, sauf la race T9. La réaction à la photopériode est du type indifférent et la paille est demi-naine. Les grains sont plus vitreux et le gluten plus ferme que chez AC Karma. Il est admissible dans la grille de classification des blés de printemps (blanc) des Prairies canadiennes.

Mots clés: *Triticum aestivum* L., description de cultivar, blé de printemps blanc, résistance à la germination sur pied, résistance à la carie commune, rendement grainier élevé

AC Vista, hard white spring wheat (*Triticum aestivum* L.), was developed at the Semiarid Prairie Agricultural Research Centre, Agriculture and Agri-Food Canada, Swift Current, Saskatchewan. It received an interim registration for a period of 3 yr from the Canadian Food Inspection Agency of Agriculture and Agri-Food Canada on 7 October 1996 to facilitate market evaluation by the Canadian Wheat Board.

Pedigree and Breeding Method

AC Vista derives from the cross HY344/Losprout 'S'//HY358*3/BW553. The last cross was made in 1987 at the Semiarid Prairie Agricultural Research Centre, AAFC, Swift Current. Losprout 'S', a sprouting resistant white-kernelled wheat (DePauw et al. 1985), was hybridized with HY344, a sprouting-susceptible white wheat with semidwarf stature and high grain yield potential (DePauw and Townley-Smith 1982). The resulting F₁ was top-crossed with HY358*3/BW553. BW553 was developed by H. McKenzie (DePauw and Townley-Smith 1981) and has the Bt10 gene, which confers resistance to common bunt (*Tilletia laevis* Kuhn in Rabenh. and *T. caries* [DC.] Tul. & C. Tul.). B.J. Puchalski of the Lethbridge Research Centre, AAFC, Lethbridge, Alberta, made the backcross of BW553 with HY358, a sprouting-susceptible white wheat with resistance to loose smut (*Ustilago tritici* [Pers.] Rostr.), leaf rust (*Puccinia recondita* Roberge ex Desmaz.), and stem rust (*P. graminis* Pers.:Pers. f.sp. *tritici* Eriks. & E. Henn.), possessing high grain yield potential, and semidwarf stature (DePauw and Townley-Smith 1985). F₂ seed of the final cross was inoculated with common bunt and grown as individual plants in a leaf and stem rust disease nursery.

Individual plants were selected for maturity, height, straw strength, and resistance to diseases. The F₃, F₅, and F₇ generations were grown as head rows in a winter nursery near Brawley, California, to multiply seed for early generation tests. In the F₄, F₆, and F₈ generations, 74, 44, and 42 lines, respectively, were evaluated for quantitative and qualitative traits using early generation screening procedures (DePauw et al. 1989). Reaction to leaf and stem rust was measured in an epiphytotic nursery near Glenlea, Manitoba. Preharvest sprouting response was measured on intact spikes using the protocol described by DePauw and McCaig (1991). Remnant seed from the yield trials was used to assess grain quality and kernel characteristics. Selected F₈ lines were screened for reaction to loose smut and common bunt. An experimental line, designated 8716-CB01C, was evaluated in the High Yielding Wheat 'B' test in 1992. It was designated as HY413 and evaluated in the High Yielding Wheat Cooperative Test from 1993 to 1995. The controls were Neepawa, eligible for grades of Canada Western Red Spring, AC Taber and AC Foremost, eligible for grades of Canada Prairie Spring – Red, and AC Karma, eligible for grades of Canada Prairie Spring – White.

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

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

Cultivar	Yield (t ha ⁻¹)				Maturity (d)	Plant height (cm)	Lodging ^x (1-9)	Test weight (kg hL ⁻¹)	Kernel weight (mg)
	Zone 1 ^z	Zone 2	Zone 3	Mean ^y					
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 Vista	4.24	5.12	4.62	4.74	106.4	87	2.4	76.9	41.9
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

^zZone 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.

^yAll means are weighted by the number of tests within a zone.

^x1, all plants vertical; 9, all plants horizontal.

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. Response to leaf spots (tan spot *Pyrenophora tritici-repentis* [Died.] Drechs., Stagonospora blotch *Phaeosphaeria nodorum* [E. Muller] Hedjaroude and *Septoria tritici* blotch *Mycosphaerella graminicola* [Fuckel] J. Schrot. in Cohn) 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 Vista yielded on average 32% more than Neepawa, and similar to the CPS checks (Table 1). AC Vista matures about 1 d earlier than AC Karma and AC Foremost, 3 d earlier than AC Taber, and about 2 d later than Neepawa. AC Vista has straw strength intermediate to Neepawa and the Canada Prairie Spring wheat checks. Its test weight is about 2 kg hL⁻¹ lighter than AC Karma, about 1.6 kg hL⁻¹ lighter than AC Taber and Neepawa, and about 1 kg hL⁻¹ lighter than AC Foremost. AC Vista has a larger kernel than any of the checks. It appears suitable for production under irrigation (Table 2).

AC Vista expresses resistance to prevalent races of common bunt, leaf rust, and stem rust (Table 3). It has resistance to loose smut except the new race T9 (data not shown). It has a higher fusarium head blight rating than the checks. AC Vista has harder kernels than the checks as indicated by the higher starch damage and Farinograph absorption (Table 4). Because all experimental lines are tempered to a standard 16% moisture content, flour yield might have been under estimated for AC Vista, which has harder kernels than the checks. AC Vista has stronger gluten than AC Karma and is similar to Neepawa, Canada Western Red Spring wheat, as indicated by Farinograph dough development time, Farinograph stability, and baking strength index. AC Vista has improved preharvest sprouting resistance compared with Genesis and AC Karma, and is similar to the white-seeded sprouting resistant checks like Losprout 'S' and Kenya 321 (Table 5). It was not significantly different from the three gene red check, Neepawa, for 9 of 14 indices of pre-harvest sprouting.

Table 2. Agronomic performance of AC Vista compared with check cultivars, based on data from the High Yielding Wheat Irrigated Cooperative Tests (1993–95)

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 Vista	4.70	113.3	90	2.3
LSD (P < 0.05)	0.42	2.8	2	2.1
No. of tests	10	9	10	4

^z1, all plants vertical; 9, all plants horizontal.

Other Characteristics

SPIKES. Oblong to fusiform, mid-dense, mid-long to long, inclined to nodding, awned; glumes mid-wide, long, glabrous, white; glume shoulders primarily square, some elevated, some rounded, some oblique and some wanting, narrow to mid-wide; glume beak mid-long, tending to acuminate.

KERNEL. Colour white; large, long, mid-wide to wide, elliptical to ovate; cheeks angular to rounded; brush hairs long to mid-long; crease mid-wide to wide, mid-deep to shallow; germ small to mid-size, elliptical to round.

SHATTERING. Resistant, similar to AC Karma.

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

DISEASE REACTION. Resistant to prevalent races of stem rust, leaf rust, common bunt, and loose smut except the new race T9; moderately susceptible to leaf spots; intermediate resistance 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 (White) wheat class.

Table 3. Disease reactions of AC Vista 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	GL ^y	Leaf spots ^w		FHB ^u (%)
								IH	SC	
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 Vista	1993	5R	10R	8 R	0 R	5	5.8	4.3	6.5	–
	1994	20VR	10R	4 R	0 R	13	3.5	3.6	7.3	20
	1995	10R	30RMR	1 R	17 MR	0	–	10.0	9.5	85

^zPercent infection and type of reaction: T, trace; R, resistant; VR, very resistant, MR, moderately resistant; I, intermediate resistant; S, susceptible; HS, highly susceptible.

^yRatings are based on data from current and previous years.

^wPercentage of plants with moderate to large lesions on the subcrown internode.

^xRated at the milk dough stage, using a scale of 0–9 (all locations in 1993) and 0–11 (all locations in 1994 and 1995).

^yGL = 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.

^uFusarium Head Blight index = (% infected spikelets × % infected spikes)/100.

Table 4. Measurements of flour-milling properties, gluten strength, and bread-loaf volume for AC Vista 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 Vista	40	36	43	75.5	76.6	76.3	0.49	0.47	0.46	–0.7	–0.9	–1.3
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 Vista	68.0	66.4	67.7	5.25	5.25	4.25	6.5	6.0	6.0			
	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 Vista	10.7	11.2	11.5	102.7	100.6	101.1	710	730	755			

^zData provided by the Grain Research Laboratory of the Canada Grain Commission. Methods of the American Association of Cereal Chemists were followed for determining the various end-use suitability traits.

Maintenance and Distribution of Pedigreed Seed

Breeder Seed consists of 136 Breeder Lines that were developed from F₆-derived F₁₀ random single plants. They were grown in plant-to-row plots 3 m long near Swift Current in 1994 and again as 15-m rows near Indian

Head in 1995. Breeder Seed will be maintained by the Seed Increase Unit of the Research Farm, AAFC, Indian Head, Saskatchewan, Canada S0G 2K0. Plant Breeders' Rights have been filed. AC Vista has been released for distribution and multiplication of pedigreed seed stocks to Value-Added

Table 5. Response to sprouting conditions of AC Vista, parents, and checks

Entry	1993		1994						1995					
	T1HS ^a	T2HS	T1HS	T2HS	T1KS	T2KS	T1AA	T2AA	T1HS	T2HS	T1KS	T2KS	T1AA	T2AA
AC Vista	37	44	53	67	47	68	0.6	1.6	80	30	35	16	1.6	0.9
Losprout	17	33	47	67	37	55	1.6	1.3	47	37	17	24	0.6	1.9
HY344	100	100	100	100	100	100	4.3	5.3	–	–	–	–	–	–
HY358 'S'	–	–	97	100	81	96	3.6	5.2	–	–	–	–	–	–
Kenya 321	37	50	43	90	43	68	1.7	1.9	50	50	22	37	0.7	1.9
8021V2	0	0	23	20	25	20	0.5	0.3	7	27	11	35	0.1	0.4
Genesis	73	91	100	100	98	100	4.7	5.5	100	100	95	95	4.9	5.1
AC Karma	87	100	–	–	–	–	–	–	93	90	59	70	4.2	3.0
Neepawa	10	37	40	60	14	39	0.6	2.5	20	37	8	13	0.6	0.6
RL4137	0	–	0	–	1	5	0.2	0.1	0	0	0	4	0.1	0.4
LSD	26	23	35	21	13	10	1.9	1.5	32	54	14	39	1.3	2.4

^aT1HS = percentage of spikes with visible sprouts from heads collected at about 16% moisture on a wet weight basis = Time 1, T2HS = percentage of spikes with visible sprouts collected 10 days after Time 1, T1KS = percentage of kernels sprouted at Time 1, T2KS = percentage of kernels sprouted at Time 2, T1AA = alpha amylase activity (EUg⁻¹) at Time 1, T2AA = alpha amylase activity (EUg⁻¹) at Time 2.

Seeds, P.O. Box 2000, Lumsden, Saskatchewan, Canada SOG 3C0.

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