

AC Karma white spring wheat

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Knox, R. E., De Pauw, R. M., McCaig, T. N., Clarke, J. M., McLeod, J. G. and Fernandez, M. R. 1995. **AC Karma white spring wheat**. Can. J. Plant Sci. 75: 899–901. AC Karma, white seeded spring wheat (*Triticum aestivum* L.), combines high grain yield with resistance to common bunt [caused by *Tilletia laevis* Kuhn in Rabenh. and *T. caries* (DC.) Tul. & C. Tul.] and loose smut [caused by *Ustilago tritici* (Pers.) Rostr.] in a semidwarf, photoperiod insensitive background. AC Karma has improved leaf rust (caused by *Puccinia recondita* Roberg ex Desmaz.) and stem rust (caused by *P. graminis* Pers.:Pers.) resistance, stronger straw and earlier maturity compared to Genesis. AC Karma is eligible for grades of the Canada Prairie Spring (white) wheat class.

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

Knox, R. E., De Pauw, R. M., McCaig, T. N., Clarke, J. M., McLeod, J. G. et Fernandez, M. R. 1995. **Blé blanc de printemps AC Karma**. Can. J. Plant Sci. 75: 899–901. AC Karma, nouveau cultivar de blé de printemps à grain blanc (*Triticum aestivum* L.), allie un haut rendement grainier à la résistance à la carie commune [*Tilletia laevis* Kuhn in Rabenh et *T. caries* (DC) Tul & C. Tul.] et au charbon nu [*Ustilago tritici* (Pers.) Rostr.]. C'est une variété demi-naine et photo-apériodique. Par comparaison avec Genesis, elle démontre en outre une meilleure résistance à la rouille des feuilles (*Puccinia recondita* Roberg ex Desmaz.) à la rouille de la tige (*P. graminis* Pers.: Pers.) et à la verse ainsi qu'une plus grande précocité. Le nouveau cultivar est admissible dans la classe des blés blancs de printemps des Prairies canadiennes.

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

AC Karma, white-kernelled spring wheat (*Triticum aestivum* L.), was developed at the Agriculture and Agri-Food Canada Research Centre, Swift Current, Saskatchewan, by the Arid Prairie Wheat Program. On 11 October 1994 the Food Production and Inspection Branch of Agriculture and Agri-Food Canada issued registration no. 3991 for AC Karma.

Pedigree and Breeding Method

AC Karma was selected from the descendants of a cross HY320*5/BW553//HY358 by HY358/7915-QX76B2 (7915-QX76B2=NB320/NB402//RL4137). Both the F₁ and F₂ of HY320*5/BW553//HY358 were screened for reaction to common bunt [*Tilletia laevis* Kuhn in Rabenh. and *Tilletia caries* (DC.) Tul. & C. Tul.]. Five resistant F₂ plants from each of nine F₁-derived families were crossed to the F₁ of HY358/7915-QX76B2. The final cross was made in 1985. The F₁ seed was inoculated with common bunt and grown as individual plants in a growthroom. Resistant plants were selected to produce F₂ plant-to-row plots that were grown in a winter nursery near Brawley, California. In 1987, F₃ head-rows were established in a leaf and stem rust epiphytotic nursery near Swift Current. Grain yield potential and other agronomic traits were assessed in the F₅ and F₇ by growing replicated trials at two locations. Seed from the yield trials was used to assess grain quality and kernel characteristics. Reaction to leaf and stem rust was measured in an epiphytotic nursery near Glenlea, Manitoba. The stem

rust races used were: QCC (1991 only), QTH, RHT, RKQ, TMR, and TPM. The races of leaf rust used were those derived from collections made in the previous year (Kolmer 1993, 1994a,b). The F₇ was screened for reaction to both loose smut and common bunt. Races T2, T10 and T39 of loose smut and T19 of common bunt were used for screening. The race designations are those described by Roelfs and Martens (1988) for stem rust, Hoffmann and Metzger (1976) for common bunt and Nielsen (1987) for loose smut. The F₄ and F₆ generations were grown as head rows in a winter nursery near Brawley, California, to multiply seed for early generation tests. In 1990, a line, designated as 8628-VC2E, was evaluated in the High Yield Wheat 'B' test, and in 1991-93 in the High Yield Wheat Cooperative test as HY395. The 111 breeder lines, grown in isolation near Swift Current in 1992 and again as 15-m rows near Indian Head in 1993, derive from random plants from an F₅ derived F₁₀ single-plant progeny row.

Performance

Between 1991 and 1993 in the High Yield Wheat Cooperative test, AC Karma yielded 25–29% more than Neepawa (Table 1). AC Karma yielded 22% more than Genesis in the Eastern Prairies. It yielded 2.7% less than Genesis in the Brown and Dark Brown Soil Zone in Saskatchewan and Alberta and yielded similarly to Genesis in the Peace River and Parkland area. AC Karma yielded

Table 1. Agronomic performance of AC Karma compared with Neepawa, Genesis, Biggar and AC Taber, based on data from the High Yielding Wheat Cooperative tests (1991–1993)

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	3.49	3.94	3.72	3.76	105.8	102	2.5	77.9	31.4
Genesis	3.58	5.22	4.66	4.63	110.4	98	4.7	76.1	34.6
Biggar	3.83	5.11	4.61	4.64	109.8	83	2.2	76.2	34.9
AC Taber	4.47	5.17	4.68	4.87	111.3	87	2.1	77.0	36.3
AC Karma	4.36	5.08	4.65	4.78	109.4	88	2.4	78.0	36.3
LSD (<i>P</i> < 0.05)				0.2	0.7	1	0.4	0.6	1.1
No. of tests	12	21	9	42	33	53	24	50	50

^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.

Table 2. Agronomic performance of AC Karma compared to check cultivars, based on data from the High Yield Wheat Irrigated Co-operative tests (1991–1993)

Cultivar	Yield (t ha ⁻¹)	Maturity (d)	Height (cm)	Lodging (1-9) ^z
Neepawa	4.76	110.0	110	4.1
Biggar	6.10	113.4	88	3.0
Genesis	5.79	113.4	104	5.6
AC Taber	6.41	114.4	94	1.8
AC Karma	5.87	113.8	93	2.1
LSD (<i>P</i> < 0.05)	0.42	2.8	2	2.1
No. of tests	7	7	7	4

^z 1, all plants vertical; 9, all plants horizontal.

Table 3. Disease reactions of AC Karma and check cultivars, based on data from High Yielding Wheat Co-operative tests (1991–1993)

Cultivar	Year	Leaf rust ^z (%)	Stem rust ^{z,y} (%)	Common bunt ^z (%)	Loose smut ^{z,x} (%)	Common root rot ^w (%)
Neepawa	1991	30MR		22 I	7 R	39
	1992	50MR	20MR	16 I	– R	16
	1993	40MR	10R	16 I	9 R	4
Genesis	1991	40MR		56 S	67 S	40
	1992	30R-MR	20RMR	58 S	83 HS	21
	1993	20MR	20RMR	43 S	67 HS	9
Biggar	1991	20MR		56 S	83 HS	43
	1992	30R	30RMR	65 S	43 HS	22
	1993	5R	10R	38 S	88 HS	10
AC Taber	1991	10R		3 R	93 HS	38
	1992	10R	30RMR	6 R	85 HS	25
	1993	5R	10RMR	0 R	0 HS	15
AC Karma	1991	5R		6 R	0 R	66**
	1992	10VR	20RMR	14 I	25 MR	31
	1993	5R	10R	3 R	0 MR	9

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

^yNo stem rust data available for 1991.

^xLoose smut percent infection is based on artificial inoculation; Loose smut descriptive reaction based on data from all years.

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

^{**}, Value for the same year is significantly different from Neepawa at the 1% level.

– No data.

similarly to Biggar and slightly less than AC Taber in the various zones. Other features of AC Karma are as follows: (i) it matures 1 d earlier than Genesis, 2 d earlier than AC Taber, and has a similar time to maturity as Biggar (Table 1); (ii) it is a semidwarf with shorter and stronger straw than Genesis (Table 1); and (iii) it has larger seed size and greater test weight than Genesis (Table 1). AC Karma appears suitable for production under irrigated conditions (Table 2). AC Karma is resistant to prevalent races of common bunt, loose smut, leaf rust, and stem rust (Table 3). AC Karma has greater disease index scores to common root rot than the checks.

AC Karma is eligible for grades of the Canada Prairie Spring (white) wheat class. Compared to Genesis, AC Karma has a higher flour yield, farinograph absorption, flour protein, baking strength index and loaf volume (Table 4). Noodle quality characteristics of AC Karma are superior to Genesis, particularly for colour (J.E. Kruger, personal communication).

Other Characteristics

SPIKES. Fusiform to oblong, mid-dense, mid-long, inclined to erect, awned; glumes mid-wide, mid-long, glabrous, white; glume shoulders rounded to elevated, narrow to mid-wide; glume beak mid-long, acute to acuminate.

KERNEL. Color white; mid-size to large; mid-long to long; mid-wide to wide; elliptical; cheeks angular to rounded; brush hairs short to mid-long; crease mid-wide to wide, mid-deep to deep; germ small to mid-size, oval to ovate.

MATURITY. One day earlier than Genesis and two days earlier than AC Taber.

STRAW. Semidwarf stature; 5 cm taller than Biggar, 10 cm shorter than Genesis and Neepawa.

LODGING. Strong straw similar to Biggar and Neepawa.

SHATTERING. Resistant, similar to AC Taber.

DROUGHT RESPONSE. Tolerant to heat and drought.

Table 4. Measurements of kernel hardness, flour attributes, gluten strength, and bread-loaf volume for AC Karma and Canada Prairie Spring check cultivars from High Yielding Wheat Co-operative tests (1992-1993)

	Starch damage (Farrand units)		Flour yield (%)		Flour ash (%)		Flour colour (Kent-Jones)	
	1992	1993	1992	1993	1992	1993	1992	1993
Genesis	24	20	75.3	76.4	0.44	0.53	-1.0	0.1
Neepawa	32	32	74.5	75.9	0.46	0.47	-2.0	-1.1
AC Karma	25	29	77.1	77.3	0.49	0.50	-2.1	-1.2
AC Taber	28	31	76.2	76.7	0.45	0.51	-1.3	0.6
Biggar	25	27	76.0	74.2	0.47	0.51	-1.5	-0.7

	Farinograph					
	Absorption (%)		Dough development (min)		Stability (min)	
	1992	1993	1992	1993	1992	1993
Genesis	60.4	59.8	3.25	2.75	4.50	3.50
Neepawa	63.1	64.3	3.75	4.50	8.00	8.50
AC Karma	62.1	62.2	3.00	2.75	5.00	3.00
AC Taber	60.4	61.9	6.00	5.00	9.00	6.50
Biggar	59.8	60.1	3.75	4.00	5.00	5.50

	Flour protein (%)		Baking strength index		Remix loaf volume (cm ³)	
	1992	1993	1992	1993	1992	1993
Genesis	10.2	10.1	84.6	88.6	555	575
Neepawa	11.1	12.2	98.3	95.5	700	760
AC Karma	10.4	10.8	92.5	92.4	605	645
AC Taber	10.9	10.8	99.3	101.7	700	710
Biggar	9.9	10.6	100.8	103.1	640	705

American Association of Cereal Chemists methods were followed for determining the various end-use suitability traits.

DISEASE REACTION. Resistant to prevalent races of stem rust (caused by *Puccinia graminis* Pers.: Pers.), leaf rust (caused by *P. recondita* Roberge ex Desmaz.), common bunt [caused by *Tilletia laevis* Kuhn in Rabenh and *T. caries* (DC. Tul. & C. Tul.)] and loose smut (caused by *Ustilago tritici* (Pers.) Rostr.); moderately resistant to moderately susceptible to common root rot [caused primarily by *Bipolaris sorokiniana* (Sacc.) Shoemaker].

PHOTOPERIOD RESPONSE. Daylength insensitive.

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

Maintenance and Distribution of Pedigreed Seed

Breeder seed originating from 111 breeder lines will be maintained by the Seed Increase Unit of the Indian Head Experimental Farm, Indian Head, Saskatchewan, Canada S0G 2K0. Distribution and multiplication of pedigreed seed stocks will be handled by SECAN Association, 200-57 Auriga Drive, Nepean, Ontario, Canada K2E 8B2.

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