CULTIVAR DESCRIPTION

Prodigy hard red spring wheat

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Graf, R. J., Potts, D. A., Hucl, P. and Hanson, K. M. 2003. **Prodigy hard red spring wheat.** Can. J. Plant Sci. **83**: 813–816. Prodigy hard red spring wheat (*Triticum aestivum* L.) is adapted to the wheat growing regions of western Canada. Evaluation in the Central Bread Wheat Cooperative registration tests from 1995 to 1997 was relative to Neepawa, Roblin, AC Majestic and McKenzie. Prodigy displayed high grain yield, mid-season maturity, strong straw, high protein content and high test weight. It exhibited resistance to the prevalent races of stem rust, leaf rust, and common bunt, moderate susceptibility to loose smut and susceptibility to Fusarium head blight. Prodigy is eligible for all grades of Canada Western Red Spring (CWRS) wheat.

Key words: *Triticum aestivum* L., cultivar description, red spring wheat, grain protein, test weight, disease resistance

Graf, R. J., Potts, D. A., Hucl, P. et Hanson, K. M. 2003. **Le blé de printemps roux vitreux Prodigy**. Can. J. Plant Sci. **83**: 813–816. Le blé (*Triticum aestivum* L.) de printemps roux vitreux Prodigy est une variété bien acclimatée aux zones de culture du blé de l'Ouest canadien. Ce cultivar a été évalué aux essais centraux coopératifs du blé panifiable de 1995 à 1997, et comparé à Neepawa, Roblin, AC Majestic et McKenzie. Prodigy se démarque par un rendement grainier élevé, une maturité moyenne, une paille robuste, une forte teneur en protéines et un poids spécifique élevé. Prodigy résiste bien aux races courantes de rouille de la tige, de rouille des feuilles et de carie, mais est modérément sensible au charbon nu et à la fusariose de l'épi. Ce cultivar entre dans toutes les catégories de blé roux de printemps de l'Ouest canadien.

Mots clés: *Triticum aestivum* L., description de variété, blé roux de printemps, protéines du grain, poids spécifique, résistance à la maladie

Prodigy hard red spring wheat (*Triticum aestivum* L.) was developed by Saskatchewan Wheat Pool (SWP), Agricultural Research and Development. It received registration No. 4735 from the Variety Registration Office, Canadian Food Inspection Agency on 17 April 1998.

The name "Prodigy" was given to this cultivar in reference to its exceptional combination of high grain yield and protein content.

Breeding Method and Pedigree

Prodigy wheat is derived from the cross SWP 2242/Stoa made in 1988 at the SWP Agricultural Research and Development Farm at Watrous, SK. The expanded pedigree of SWP 2242 is Columbus/BW85 (BW85 = Neepawa*5/Buck Manantial); Stoa is a Dark Northern Spring wheat cultivar developed and released by North Dakota State University in 1984.

Following greenhouse increase of the F_1 seed, approximately 200 F_2 plants were selected from space planted nurseries at Watrous and Portage la Prairie, MB in 1989. The F_3, F_4 and F_5 generations were grown as head rows in an artificially inoculated stem rust (*Puccinia graminis* Pers.: Pers. f. sp. *tritici* Eriks. & E. Henn.) and leaf rust (*P. triticina* Eriks. = *P. recondita* Roberge ex Desmaz.) screening nursery near Portage la Prairie. Selection and advancement of one head per row was based on maturity, plant height, straw strength, plant vigour, resistance to stem and leaf rust, and a progressively stringent early generation quality screening protocol. Selection for protein content began at the F_3 generation, with SDS sedimentation and mixograph tests added at the F_4 and F_5 generations, respectively. In 1993, three F_5-derived F_6 head rows were harvested in Chile and subsequently evaluated in an irrigated, single replicate trial with repeated checks, near Outlook, SK. Based on excellent agronomic performance, continued resistance to stem and leaf rust, and favourable end-use quality results, a line designated SWP 930-705 was evaluated at several sites in Alberta, Saskatchewan and Manitoba in 1994, through the cooperation of the Alberta Wheat Pool and Manitoba Pool

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Table 1. Grain yield of Prodigy compared with check cultivars, Central Bread Wheat Cooperative registration test, 1995–1997

	Grain yield (kg ha^{-1})											
	Zone 1[z]					Zone 2					Grand	
Cultivar	1995	1996	1997	Mean	% Np[y]	1995	1996	1997	Mean	% Np	Mean	% Np
Neepawa	2800	3620	3220	3210	100	3440	3910	3080	3480	100	3350	100
Roblin	2460	3290	2630	2790	87	3380	3590	2970	3310	95	3050	91
AC Majestic	2550	3700	3110	3120	97	3500	3400	3230	3380	97	3250	97
McKenzie	3310	4390	3960	3890	121	3770	4210	3340	3770	108	3830	114
Prodigy	3170	3860	3890	3640	113	3970	3930	3210	3700	106	3670	110
LSD[x]	370	390	510	240		360	320	330	200		160	
Tests	5	5	5	15		5	5	5	15		30	

[z]Zone 1, locations in Manitoba; zone 2, locations in eastern Saskatchewan.
[y]Percent of Neepawa.
[x]Least significant difference, $P \leq 0.05$, based on the mean squares genotype-by-environment interaction.

Elevators. The reactions to stem and leaf rust were verified in artificially inoculated nurseries at Portage la Prairie and Glenlea, MB; reactions to common bunt [*Tilletia laevis* Kuhn in Rabenh., and *T. tritici* (Bjerk.) G. Wint. in Rabehn.], loose smut [*Ustilago tritici* (Pers.) Rostr.] and root rot [caused primarily by *Bipolaris sorokiniana* (Sacc.) Shoemaker] were assessed at Watrous.

Suitability for registration based on agronomic performance, disease resistance, and end-use quality was determined in the Central Bread Wheat Cooperative (CBWC) registration tests from 1995 to 1997, under the designation of BW220. Agronomic performance was measured relative to Neepawa (Campbell 1970), Roblin (Campbell and Czarnecki 1987), AC Majestic and McKenzie (Graf et al. 2003), through the collaborative efforts of AAFC, the University of Saskatchewan and United Grain Growers. Disease resistance was assessed by AAFC; end-use quality analysis was performed by the Canadian Grain Commission. The MINITAB GLM procedure was used for the combined statistical analysis of the data presented, in which the effects of environment were considered to be random and genotypes were fixed (MINITAB Inc. 2000).

During the 3 yr of registration testing, resistance to the major wheat diseases in western Canada was determined. The stem rust races used for 1 or more years were: QTH (C25), RTH (C57), RRQ (C63), TMR (C10), TMR (C95) and TPM (C53) (Harder et al. 1996; Harder 1997, 1999). The leaf rust races used for 1 or more years were: Race 15, MBDS, MBR, MBRJ, MCDS, MCR, MFM, MJB, TBD, TDG, TGBJ and TJB (Kolmer 1996, 1998; Kolmer and Lui 1997). Field reactions to stem and leaf rust were determined near Glenlea, using races similar to those used for the seedling tests. Reaction to common bunt was determined by inoculating the seed with races L1, L16, T1, T6, T13 and T19, and planting into cold soil at Lethbridge, AB. Loose smut reaction was assessed using the prevalent races T2, T9, T10 and T39, which were mixed and artificially injected into florets at anthesis. Fusarium head blight and leaf spot reactions were assessed in artificially inoculated nurseries near Winnipeg. The race designations are those described by Green (1965) and Roelfs and Martens (1988) for stem rust, Long and Kolmer (1989) for leaf rust, Hoffman and Metzger (1976) for common bunt, and Nielsen (1987) for loose smut.

Performance

Evaluation in the CBWC test from 1995 to 1997 established that Prodigy had significantly higher grain yield than all of the check cultivars except McKenzie (Table 1). The mean yield of Prodigy was 9.6% higher than Neepawa, 20.3% higher than Roblin, 12.9% higher than AC Majestic, but 4.2% lower than McKenzie. Prodigy exhibited higher yield potential in Zone 1 (Manitoba), where it yielded 13.4% more than Neepawa, 30.5% more than Roblin, 16.7% more than AC Majestic, but 6.4% less than McKenzie. In Zone 2 (eastern Saskatchewan), Prodigy yielded 6.3% more than Neepawa, 11.8% more than Roblin, 9.5% more than AC Majestic, and 1.9% less than McKenzie. The maturity of Prodigy was similar to AC Majestic, being 1.9 d later than Neepawa, 3.9 d later than Roblin, and 1.8 d later than McKenzie (Table 2). Zonal comparisons showed that Prodigy matured 0.4 d later than AC Majestic in Zone 1, but 0.4 d earlier in Zone 2. Prodigy was 1 cm taller than Neepawa, 10 cm taller than Roblin, and 6 cm taller than AC Majestic and McKenzie, with better straw strength than Neepawa and McKenzie, but weaker than Roblin and AC Majestic. Prodigy had significantly higher test weight than all of the check cultivars; seed weight was similar to Neepawa and McKenzie, but lighter than that of the other checks. Prodigy maintained a Hagberg falling number similar to Neepawa following 48-49 h of artificial weathering in a rainfall simulator.

Prodigy showed resistance to the prevalent races of stem rust, leaf rust, and common bunt during registration testing (Table 3). It was moderately susceptible to loose smut and moderately resistant to common root rot. Based on registration test data and other data collected since registration (not presented), Prodigy has been rated susceptible to Fusarium head blight (caused by *Fusarium* spp.).

Prodigy exhibited higher wheat (grain) and flour protein content than all of the checks cultivars except Roblin (Table 4). The milling and baking performance fell within the limits set by the check cultivars. Prodigy had slightly weaker gluten than Roblin, but stronger than the other check cultivars, as indicated by the farinograph and Canadian Short Process baking parameters. The farinograph and baking absorption of Prodigy were higher than those of the check cultivars.

Table 2. Mean agronomic performance of Prodigy and check cultivars, Central Bread Wheat Cooperative registration test, 1995–1997

Cultivar	Maturity (d)			Height (cm)	Lodging[y] (1–9)	Test weight (kg hL^{-1})	Kernel weight (mg)	Hagberg falling number (s)[x]
	Zone 1[z]	Zone 2	Mean					
Neepawa	90.3	96.4	93.5	99	2.7	78.6	32.1	181
Roblin	88.2	94.1	91.3	90	1.4	77.2	33.9	138
AC Majestic	92.1	98.1	95.2	94	1.7	79.2	33.5	248
McKenzie	91.2	95.5	93.4	94	2.7	80.1	32.1	227
Prodigy	92.5	97.7	95.2	100	2.1	80.8	32.0	181
LSD[w]	0.8	1.2	0.7	1.6	0.5	0.4	0.7	56
Tests	14	15	29	28	21	30	30	3

[z]Zone 1, locations in Manitoba; zone 2, locations in eastern Saskatchewan.
[y]Lodging rated as 1 = all plants vertical; 9 = all plants horizontal.
[x]Hagberg falling number determined following 48–49 h in a rainfall simulator.
[w]Least significant difference, $P \leq 0.05$, based on the mean squares genotype-by-environment interaction.

Table 3. Disease reactions of Prodigy and check cultivars, Central Bread Wheat Cooperative registration test, 1995–1997

Cultivar	Year	Stem rust[z]	Leaf rust[z]	Common bunt[z]	Loose smut[z,y]	Common root rot[x]	FHB[w]	
							Wpg	Char
Neepawa	1995	20RMR	50MR	10I	8R	1.3	41	19
	1996	10MR/MS	50MR/MS	12R	0R	9	27	20
	1997	3MR	30MR-S	25I	0R	6.7	23	–
Roblin	1995	20R	5M	26S	25MR	0	74	28
	1996	1R	10M	16I	5MR	7	74	48
	1997	1R	10M	38S	24MR	5.3	35	–
AC Majestic	1995	20RMR	10R	0R	61S	0	35	17
	1996	1R	20R	3R	38S	4	39	26
	1997	1R	5R	21I	65S	2.7	33	–
McKenzie	1995	50RMR-MS	tR	1R	81HS	0	38	21
	1996	3R	tR	2R	90HS	13	41	23
	1997	1R	tR	3R	45HS	6.7	20	–
Prodigy	1995	40RMR	tR	0R	46MS	0	–	28
	1996	20MR/MS/S	5R	4R	10MS	4	40	26
	1997	1R	tR	14R	18MS	6.7	46	–

[z]Percent infection and type of reaction: t = trace; VR = very resistant; R = resistant; MR = moderately resistant; I, M = intermediate resistant; MS = moderately susceptible; S = susceptible; HS = highly susceptible.
[y]Ratings for the checks are based on reported data and previous screening results.
[x]Percentage of plants with moderate to large lesions on the subcrown internode.
[w]Fusarium head blight index = (% infected spikelets × % infected spikes)/100. Wpg = Winnipeg, MB; Char = Charlottetown, PE.

Other Characteristics

SEEDLING: Coleoptile anthocyanin pigmentation absent.

SPIKES: Fusiform, slightly inclined at maturity, lax to medium density, medium to medium long, white at maturity, awned; awns mid-spreading, white; glumes medium wide, mid-short, glabrous, white; glume shoulders square to elevated, medium width; glume beak mid-short and acuminate.

KERNEL: Medium red colour, mid-size, mid-long, mid-wide, oval to ovate; cheeks angular to slightly rounded; crease mid-wide, mid-deep; brush mid-size, hairs short; embryo mid-size to small, oval to round.

SHATTERING: Resistant, similar to Neepawa.

END-USE QUALITY: Based on 3 yr of testing in the Central Bread Wheat Cooperative registration tests, Prodigy was rated as equal to Neepawa for grain quality (Table 4) and eligible for all grades of Canada Western Red Spring wheat.

Availability of Propagating Material

Breeder Seed of Prodigy was a composite of 36 breeder lines developed from F_5-derived F_9 single head selections taken from an increase plot grown at Watrous in 1995. Following head row increase in Chile, seed derived from each head was grown in isolated small plots. Plots revealing off-types or contamination were discarded prior to harvest of the remaining plots in bulk. Breeder Seed derived from this bulk was grown in isolation and inspected by the Canadian Food Inspection Agency in 1997.

Breeder Seed is maintained by Saskatchewan Wheat Pool, Agricultural Research and Development, Watrous, SK, Canada S0K 4T0. Multiplication and distribution of pedigreed seed stock is handled by Saskatchewan Wheat Pool, Seed Marketing, 2625 Victoria Avenue, Regina, Saskatchewan, Canada S4T 7T9.

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Table 4. Mean end-use quality[z] of Prodigy and check cultivars, Central Bread Wheat Cooperative registration test, 1995–1997

Cultivar	Wheat: Protein (%)	Wheat: Ash (%)	Wheat: Amylase (EU)	Hagberg falling no. (s)	Kernel hardness (PSI)	Starch damage (Ferrand units)	Amylograph peak viscosity (B.U.)
Neepawa	14.3	1.57	4.8	383	57.2	37	625
Roblin	15.3	1.59	8.0	353	59.8	28	460
AC Majestic	14.6	1.56	2.8	418	57.2	39	1052
McKenzie	14.2	1.53	3.5	395	53.7	43	690
Prodigy	14.9	1.53	7.8	367	55.5	38	675
Tests	3	2	2	3	3	1	3

Cultivar	Flour: Yield (%)	Flour: Protein (%)	Flour: Ash (%)	Flour: Colour (KJ)	Flour: Amylase (EU)	Farinograph: Absorption (%)	Farinograph: Dough development time (min)	Farinograph: Mixing tolerance index (B.U.)	Farinograph: Stability (min)
Neepawa	75.2	13.7	0.45	–1.7	1.5	65.7	4.3	31.7	7.5
Roblin	75.5	14.7	0.44	–1.4	3.0	66.4	7.6	20.0	14.0
AC Majestic	76.1	14.1	0.44	–1.8	0.8	66.5	4.8	33.3	7.7
McKenzie	76.6	13.4	0.45	–1.5	1.3	66.8	5.1	35.0	7.7
Prodigy	75.8	14.3	0.45	–1.6	1.5	68.3	6.0	18.3	11.5
Tests	3	3	3	3	3	3	3	3	3

Cultivar	Extensigraph: Length	Extensigraph: Height	Extensigraph: Area	Extensigraph: L/T	Baking: Canadian Short Process (150 ppm AA): Loaf volume (cm^3)	Baking: Absorption (%)	Baking: Mixing energy (Whr kg^{-1})	Baking: Mixing time (min)
Neepawa	22	408	120	5.49	1086	70	9.2	7.0
Roblin	26	603	210	4.28	1123	70	14.1	11.0
AC Majestic	25	380	130	6.58	1088	71	11.6	9.2
McKenzie	24	375	125	6.40	1076	71	10.6	8.3
Prodigy	24	583	190	4.13	1093	72	13.9	10.9
Tests	2	2	2	2	3	3	3	3

[z]American Association of Cereal Chemists (AACC) methods were followed by the Grain Research Laboratory, Canadian Grain Commission for determining the end-use quality characteristics on a composite of six to eight locations per year.

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