

CDC Ptarmigan soft white winter wheat

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Fowler D. B. 2010. **CDC Ptarmigan soft white winter wheat**. *Can. J. Plant Sci.* **90**: 857–861. CDC Ptarmigan is a soft white winter wheat (*Triticum aestivum* L.) cultivar that is eligible for grades of the Canada Western General Purpose (CWGP) wheat class. The CWGP class was introduced in 2007 to encourage the development and production of cultivars for the biofuel and livestock feed markets in western Canada. CDC Ptarmigan is an intermediate height, very high-yielding, stem and leaf rust susceptible, low protein concentration, soft kernel texture winter wheat cultivar that is adapted to the low rust hazard area of western Canada. A high yield potential of low protein concentration grain make CDC Ptarmigan a good fit for the CWGP class.

Key words: *Triticum aestivum* L., cultivar description, soft white, wheat (winter)

Fowler D. B. 2010. **Le blé tendre blanc d'hiver CDC Ptarmigan**. *Can. J. Plant Sci.* **90**: 857–861. CDC Ptarmigan est un cultivar de blé tendre blanc d'hiver (*Triticum aestivum* L.) susceptible d'accéder à la classe « blé à des fins générales de l'Ouest canadien » (CWGP). La classe CWGP a été créée en 2007 pour favoriser la création et la production de variétés destinées aux marchés des biocarburants et des aliments pour bétail dans l'Ouest canadien. CDC Ptarmigan se caractérise par une taille moyenne, un très haut rendement, la sensibilité à la rouille de la tige et des feuilles, une faible concentration de protéines et une amande à texture tendre. La variété est acclimatée aux régions de l'ouest du Canada peu affectées par la rouille. Un rendement élevé associé à une faible concentration de protéines font de CDC Ptarmigan un bon candidat pour la classe CWGP.

Mots clés: *Triticum aestivum* L., description de cultivar, tendre blanc, blé (d'hiver)

CDC Ptarmigan soft white winter wheat (*Triticum aestivum* L.) was developed at the Crop Development Centre, University of Saskatchewan, Saskatoon, SK. Support for a 3-yr interim registration to allow time for pedigreed seed production and market evaluation by the Canadian Wheat Board was received in February of 1999. A subsequent request to extend the interim registration to January 2005 was denied. In 2007, the Canada Western General Purpose (CWGP) Wheat class was introduced to encourage the development and production of new cultivars to fill the high energy demands of the biofuel and livestock feed markets in western Canada. The developing ethanol market had a preference for cultivars with high starch yield, and the livestock industry indicated a desire for wheat with a protein concentration of 10% or less to supply high levels of energy in animal diets (Davidson 2007). Low grain protein concentration and a very high grain yield potential made CDC Ptarmigan a good fit for the CWGP wheat class. On 2007 Feb. 22, CDC Ptarmigan received support for full registration by the Prairie Recommending Committee for Wheat, Rye and Triticale. The Variety Registration Office, Plant Production Division, Canadian Food Inspection Agency issued registration no. 6305 for CDC Ptarmigan on 2007 Jul. 24.

Pedigree and Breeding Method

CDC Ptarmigan was selected from the progeny of a Yorkstar/Norstar cross (Jensen 1968; Grant 1980) made in 1981. The F₁ and F₂ were produced in a greenhouse. F₂-derived F₃ lines and F₃-derived F₄ lines were grown in a field nursery in Saskatoon in 1982 and 1983 where winter hardiness, height, straw strength, disease reaction, plant type, and kernel type were evaluated. Single plant selections were made in the fall of 1983. These selections were grown as head rows in the field at Saskatoon in 1983–1984, 1984–1985 and 1985–1986 where single plant selections were made. Single rows, one of which was later designated S86-375, were selected in 1987. S86-375 was grown in advanced yield trials in western Canada between 1987 and 1990, where winter hardiness, plant height, straw strength, plant type, and disease reactions were evaluated. It was grown in the Central Hard Red Winter Wheat Cooperative Registration trials in 1990–1991, but was dropped from this trial in 1991–1992 due to inappropriate quality comparisons. It was re-entered in the 1996–1997 to 2001–2002 Central Winter Wheat Cooperative Registration trials. S86-375 was also grown in regional trials in Saskatchewan from 1993 to 1997. AC Reed (Sadasivaiah et al. 1993), which was a check cultivar in the Western Soft White Spring Wheat

Cooperative Registration trials, was included in the regional trials to provide a soft white wheat grain quality comparison. Single plants selected from the F₈ of S86-375 were grown out to produce breeder lines. Final selection of breeder seed lines was made in F₁₀ where 25 lines were bulked to form the initial breeder seed.

Analyses of variance were conducted to determine the level of significance of differences due to cultivars and location years. The least significant difference (LSD) test was used to identify significance differences in the mean value of CDC Ptarmigan compared with the check cultivars.

Performance

CDC Ptarmigan was grown in the Central Hard Red Winter Wheat Cooperative Registration trial in 1990–1991, but it was dropped from this trial after 1 yr due to inappropriate quality comparisons. However, these trials established that CDC Ptarmigan had shorter, stronger straw and a grain yield that was higher than Norstar (data not shown), the registration trial check and the dominant cultivar grown in western Canada from ca. 1980 to 1995.

CDC Ptarmigan was grown in regional trials in Saskatchewan from 1993 to 1997 (Fowler 2003). The hard red winter wheat cultivar CDC Kestrel (Fowler 1997), which accounted for more than 80% of the western Canadian winter wheat acreage in 1998 (Canadian Wheat Board 2009), Norstar, and AC Reed (soft white spring wheat registration trial quality check) were included in these trials for comparative purposes. Recommended management practices for winter and spring wheat were followed for all plots included in these comparisons. CDC Ptarmigan had a significantly ($P < 0.05$) higher grain yield than CDC Kestrel, Norstar, and AC Reed (Table 1). It headed and matured within 2 d of the other winter wheat cultivars and was 18 d earlier heading and 16 d earlier maturing than AC Reed. CDC Ptarmigan was intermediate in height and had relatively low kernel weight,

and a grain protein concentration that was significantly ($P < 0.05$) lower than Norstar and AC Reed. High grain yield more than compensated for low protein concentration with the result that the protein yield of CDC Ptarmigan was not significantly ($P > 0.05$) different from the other cultivars. Detailed wheat and flour analytical data from these trials (Table 2) indicated that CDC Ptarmigan also had a significantly ($P < 0.05$) softer kernel texture and lower test weight, kernel weight, protein concentration, falling number, starch damage, cookie spread and Farinogram absorption, and mixing tolerance index than AC Reed.

CDC Ptarmigan was further evaluated in the 1996–1997 to 2001–2002 Central Winter Wheat Cooperative Registration trials. These trials included CDC Kestrel (Fowler 1997a) and CDC Clair (Fowler 1997b), which were the dominant cultivars accounting for between 90 and 100% of the 1999 and 2000 winter wheat acreage in Manitoba and Saskatchewan (Canadian Wheat Board 2009), and CDC Osprey (Fowler 1997c), which was the hard red winter wheat quality standard. CDC Falcon (Fowler 1999a), CDC Harrier (Fowler 1999b) and CDC Raptor (Fowler 2002) were more recent releases that were included as agronomic checks. With the exception of CDC Harrier in southwest Alberta, and CDC Clair and CDC Kestrel in the parkland region of Saskatchewan, the grain yield of CDC Ptarmigan was significantly ($P < 0.05$) higher (average = 12%) than all members of this group when grown in dryland conditions in Alberta and Saskatchewan (Table 3). The high grain yield potential of CDC Ptarmigan has been confirmed in subsequent agronomic trials (Beres et al. 2010). These trials also demonstrated that CDC Ptarmigan has an exceptional ability to compete with weeds, suggesting that it has a role to play in organic production systems.

CDC Ptarmigan had MS/VS stem and leaf rust reactions, was rated very susceptible to common bunt [*Tilletia laevis* Kuhn in Rabenh. and *T. caries* (DC.) Tul. & C. Tul.], and had a powdery mildew (*Blumeria graminis*) reaction that was intermediate to the other cultivars (Table 4). The susceptible rust reaction of CDC Ptarmigan was reflected in reduced grain yield in the rust hazard region of southeast Manitoba and in the rust nursery under irrigation at Saskatoon, Saskatchewan (Table 3). The heading date of CDC Ptarmigan was later, and its time to maturity was similar to the later-maturing check cultivars in the Central Winter Wheat Co-operative Registration trials (Table 5). Only CDC Harrier and CDC Kestrel were significantly ($P < 0.05$) taller than CDC Ptarmigan, while the straw strength of CDC Ptarmigan was similar to the more lodging susceptible cultivar CDC Clair. When the 49 station-years of data from replicated trials were considered, a higher grain yield did not compensate for the very low protein concentration with the result that the grain protein yield of CDC Ptarmigan was significantly ($P < 0.05$) lower than all the other cultivars except CDC Kestrel. Wheat

Table 1. CDC Ptarmigan compared with Norstar, CDC Kestrel winter wheat and AC Reed spring wheat. Mean values for five trials grown in Saskatchewan (1993–1997)

Character	CDC Kestrel	Norstar	AC Reed	CDC Ptarmigan	LSD ($P = 0.05$)
Grain yield (kg ha ⁻¹)	5061	4909	5137	5480	322.8
Heading date (DOY) [‡]	173	175	192	174	0.8
Maturity (DOY)	215	217	233	217	1.8
Plant height (cm)	88	106	82	87	2.5
Kernel weight (mg)	34	36	38	35	1.2
Protein (%)	10.3	10.9	11.2	9.8	0.52
Protein (kg ha ⁻¹)	521	535	571	539	38.7

[‡]Day of year.

Table 2. Wheat and flour analytical data² for AC Reed spring wheat and CDC Ptarmigan, CDC Osprey, and CDC Clair winter wheat. Data supplied by the Grain Research Laboratory, Canadian Grain Commission

Character	Saskatoon regional trials (1993–1995)			Central Cooperative winter wheat trials (1997)		
	AC Reed	CDC Ptarmigan	LSD (<i>P</i> = 0.05)	CDC Osprey	CDC Clair	CDC Ptarmigan
Test weight (kg hL ⁻¹)	82.0	77.0	1.50	81.4	81.7	78.3
Kernel weight (mg)	39.3	35.3	1.77	31.8	34.3	32.8
Wheat protein (%)	9.9	9.2	0.69	10.7	10.8	9.7
Flour protein (%)	8.9	8.0	0.70	9.7	9.6	8.4
Protein loss (%)	0.9	1.0	NS ^w	1.0	1.2	1.3
Falling number (sec)	393	354	34.5	320	300	305
Flour yield (%)	77.0	76.5	NS	76.3	75.1	74.0
Flour ash (%)	0.52	0.50	NS	0.41	0.42	0.43
Flour Agtron colour (%)				80	74	80
Starch damage (%)	3.0	2.6	0.26	4.3	4.3	2.6
Particle size index (%)	70	73	2.0	62	62	71
Farinogram absorption (%)	53.1	49.9	1.14	56.4	58.2	51.6
Farinogram DDT ^y (min)	1.16	0.92	NS	5.33	4.6	2.07
Farinogram MTI ^x (BU)	159	113	7.2	36	44	75
Farinogram stability (min)	1.51	1.69	NS	11.73	7.2	4.27
Cookie spread (mm)	77.9	76.9	0.95			
Cookie ratio (s:t)	7.8	7.7	NS			

²End-use quality testing was conducted on composite samples.

^yDough development time.

^xMixing tolerance index.

^wNS, non-significant differences.

and flour analytical comparisons with cultivars from the Canada Western hard red winter wheat class in the 1997 Central Winter Wheat Co-operative Registration trial further defined the soft wheat quality characteristics of CDC Ptarmigan (Table 2).

Best management practices are employed in the Central Winter Wheat Co-operative Registration trials with the result that the level of winter damage experienced is normally very low. Norstar and CDC Ptarmigan were also included in regional trials planted on summerfallow and on stubble fields with minimal snow

trapping potential. The average winter survival of Norstar (88%) was significantly higher (*P* < 0.05) than CDC Ptarmigan (80%) in 14 of these trials where winter damage was recorded.

Other Characteristics

Plant

Winter growth habit; coleoptile colour purple; juvenile growth prostrate; leaves dark green; flag leaf dark green to blue-green, wide, mid-long to long, intermediate to

Table 3. Grain yield (kg ha⁻¹) of CDC Ptarmigan compared with CDC Clair, CDC Falcon, CDC Harrier, CDC Kestrel, CDC Osprey, and CDC Raptor. Data from the Central Winter Wheat Co-operative Registration Trials (1997–2002)²

Cultivar	Alberta		Saskatchewan			Southeast	All-site	No rust ^x
	Southwest	Central	Brown soils	Parkland	Irrigation ^y	Manitoba	mean	mean
CDC Clair	4400	7580	3809	3928	5919	5556	4858	4556
CDC Falcon	4558	7807	3755	3538	6968	5995	4939	4423
CDC Harrier	4630	7270	3830	3775	6528	5953	4921	4468
CDC Kestrel	4508	7455	3743	3879	6232	5788	4892	4507
CDC Osprey	4297	7274	3739	3772	5600	5303	4673	4405
CDC Raptor	4465	7509	3771	3822	6690	5766	4925	4494
CDC Ptarmigan	4998	8720	4349	4061	5447	5322	5114	5022
LSD (<i>P</i> = 0.05)	398.9	609.5	147.9	210.3	570.7	468.3	175.8	159.5
No. of tests	4	6	10	16	5	8	49	36

²All means are weighted by the number of tests within a zone. Alberta locations included Lethbridge (Southwest), Olds and Lacombe (Central). Saskatchewan locations included Elrose and Saskatoon (Brown soils); Clair, Indian Head, Melfort, and Yorkton (Parkland); and Saskatoon (Irrigation). The Manitoba locations were Winnipeg and Carman.

^yRust nursery.

^xAll trials except those in the high rust hazard area of southeast Manitoba and the irrigation trials in Saskatchewan.

Table 4. Disease reactions of CDC Ptarmigan compared with CDC Clair, CDC Falcon, CDC Harrier, CDC Kestrel, CDC Osprey, and CDC Raptor. Data from artificial rust infections at the University of Saskatchewan, Saskatoon (a and b) and the Plant Science Dept. University of Manitoba (W) using epidemic mixtures supplied by Agriculture and Agri-Food Canada in Winnipeg, and from a natural leaf rust epidemic at Clair, SK (C). Common bunt data are from trials inoculated by Agriculture and Agri-Food Canada staff at Lethbridge, AB. Powdery mildew ratings were supplied by the Field Crop Development Centre, Alberta Agriculture

	CDC Clair	CDC Falcon	CDC Harrier	CDC Kestrel	CDC Osprey	CDC Raptor	CDC Ptarmigan
<i>(a) Stem rust</i>							
1997a	60MS ^z	20MR	4MR	60M	40MS	20R/MR	40MS
1997b	40S	0R	10M	60MS	50S	0R	80S
1997W	45S	0R	5MR	40S	45S	0R	55S
1998a	60M	10MR	40MR	40MS	60MS	5M	60MS
1998b	65S	0R	5MR	20MS	65S	0R	80S
1998W	20MS/S	10MR/MS	20R/MR	10MS	50S	5R	30S
1999a	60MS	10R/MR	20MR	40MS	40MS	5R	60S
1999b	80S	10MR	5R/MR	5MS	70S	10R/MR	90VS
1999W	40S	10MR	30MR/MS	30MS/40S	50S	10MR	60S/VS
2000a	60MS	10M	10MR	40MS	40MS	10MR	60MS
2000b	35MS/S	0R	0R	30M	60S	0R	70VS
2000W	70S	10MS	5MS	10MS/S	70S	5MR	70VS
2001a	65S	15MR	30MS	55S	60S	15MR	75VS
2001b	50S	0R	0R	10MS/S	35S	0R	75VS
2001W	80MS/S	50MR/MS	50MS/S	70MS/S	70S	50MR/MS	80S
2002W	80S	20MR	30MR/MS	60MS/S	60S	10R/MR	80S
<i>(b) Leaf rust</i>							
1997a	40S	5MR	60S	45S	35S	15MS	30S
1997C	15S	5M	15S	20S	50S	20S	50S
1997W	30S	5M	30S	45S	50S	10MS	60S
1998a	20M	TR	40MS	20MS	20MS	TR	40MS
1998b	40S	5MR	20MS	40MS	40S	10MR	30S
1998W	55S	40S	60S	35MS-S	60S	10MR	70S
1999a	20M	10MR	40M	20MS	40MS	10MR	40S
1999b	50S	5MR	15MS	0R	65S	10MR	50S
1999W	35MS/S	5MR	40MS	60MS/S	75S	5MR	70S
2000W	5-10MS/S	Tr	5MS	5MS	15-20S	Tr R/MR	15S
2001W	40S	5R/MR	20MR/MS	30MS/S	40S	5R/MR	70VS
2002W	10MS	5R/MR	30S	5MS	10S	TR/R	30S
<i>(c) Common bunt</i>							
1997	55S	60S	n/a	73VS	78VS	62VS	79VS
2001	67VS	45S	80VS	83VS	60S	93VS	84VS
<i>(d) Powdery mildew m</i>							
1997	6.0	4.0	5.1	5.0	6.1	5.3	4.9

^zPercent infection and type of reaction: VS, very susceptible; S, susceptible; MS, moderately susceptible; MR, moderately resistant; TR, trace; R, resistant.

upright attitude; sheath and leaf blades glabrous; auricles anthocyanin coloration absent; tillers many; straw medium length, internode hollow, culm neck straight, anthocyanin coloration at maturity absent.

Spikes

Tapering, mid-dense to dense, inclined, awnless to apically awnleted; glumes mid-wide to wide, long, glabrous, white; glume shoulders oblique to rounded,

Table 5. CDC Ptarmigan compared with CDC Clair, CDC Falcon, CDC Harrier, CDC Kestrel, CDC Osprey, and CDC Raptor. Data from the Central Winter Wheat Co-operative Registration Trials (1997-2002)

Character	CDC Clair	CDC Falcon	CDC Harrier	CDC Kestrel	CDC Osprey	CDC Raptor	CDC Ptarmigan	LSD ($P = 0.05$)	No. tests
Heading Date (DOY) ^z	172	170	172	171	171	172	173	0.6	35
Maturity (DOY) ^z	213	211	214	214	212	214	214	0.9	35
Plant Height (cm)	87	74	93	93	89	82	91	1.7	48
Lodging (1-9) ^y	3.4	1.7	2.6	3.0	2.5	1.6	3.5	0.98	7
Protein (%)	12.0	12.5	11.4	11.2	12.1	12.2	10.3	0.25	32
Protein yield (kg ha ⁻¹)	501	513	478	467	482	519	445	27.0	31

^zDay of year.

^y1, all plants vertical; 9, all plants horizontal.

narrow to mid-wide; glume beak short to mid-long, acute.

Kernel

White, soft, mid-size to small, mid-long to short, mid-wide, elliptical to ovate; cheeks rounded; brush; small to medium; brush hairs mid-long to long; crease mid-wide, mid-deep; germ small to mid-size, round to oval.

Maintenance and Distribution of Pedigreed Seed

Breeder seed will be maintained by the Crop Development Centre, University of Saskatchewan, Saskatoon, Saskatchewan, Canada S7N 5A8. Western Canadian distribution and multiplication of pedigreed seed stocks are handled by Western Ag Innovations, 3-411 Downey Road, Saskatoon, Saskatchewan, Canada S7N 4L8.

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