

## Peregrine hard red winter wheat

D. B. Fowler

Department of Plant Sciences, University of Saskatchewan, 51 Campus Drive, Saskatoon, Saskatchewan, Canada S7N 5A8 (e-mail: Brian.Fowler@usask.ca). Received 16 March 2010, accepted 10 June 2010.

Fowler, D. B. 2010. **Peregrine hard red winter wheat**. Can. J. Plant Sci. **90**: 853–856. Peregrine is a medium tall, high-yielding, stem and leaf rust resistant winter wheat (*Triticum aestivum* L.) that is registered for production in western Canada. It is a hard red winter wheat cultivar that is eligible for grades of the Canada Western General Purpose (CWGP) wheat class. The CWGP class was created in 2007 to encourage the development of cultivars to fill the high energy demands of the biofuel and livestock feed markets in western Canada. In Manitoba and Saskatchewan, the grain yield of Peregrine was 117% of the Canada Western Red Winter Wheat Class grain quality check cultivar, CDC Osprey, and 106% of the high-yielding check, CDC Falcon. High grain yield potential and a high level of rust resistance mean that Peregrine provides a good fit for the CWGP class.

**Key words:** *Triticum aestivum* L., cultivar description, hard red, wheat (winter), Canada Western General Purpose

Fowler, D. B. 2010. **Le blé roux vitreux d'hiver Peregrine**. Can. J. Plant Sci. **90**: 853–856. Peregrine est une variété de blé d'hiver (*Triticum aestivum* L.) de taille moyenne et à haut rendement résistante à la rouille de la tige et des feuilles homologuée pour l'ouest du Canada. Ce cultivar roux vitreux est admissible à la classe du blé à des fins générales de l'Ouest canadien (BFGOC), créée en 2007 pour encourager le développement de cultivars qui satisferont à la forte demande d'énergie venant des marchés des biocarburants et des aliments du bétail dans l'Ouest canadien. Au Manitoba et en Saskatchewan, le rendement grainier de Peregrine correspondait à 117 pour cent du rendement du cultivar témoin pour la classe du blé d'hiver roux vitreux de l'Ouest canadien CDC Osprey et à 106 pour cent du rendement du cultivar témoin à haut rendement CDC Falcon. Un rendement grainier élevé et une forte résistance à la rouille font de Peregrine un candidat idéal pour la classe BFGOC.

**Mots clés:** *Triticum aestivum* L., description de cultivar, roux vitreux, blé (d'hiver), blé à des fins générales de l'Ouest canadien

Peregrine hard red winter wheat (*Triticum aestivum* L.) was developed at the Department of Plant Sciences, University of Saskatchewan, Saskatoon, SK. The Variety Registration Office, Plant Production Division, Canadian Food Inspection Agency issued registration no. 6486 for Peregrine on 2008 Jul. 24.

### Pedigree and Breeding Method

Peregrine was selected from the progeny of a cross McClintock/S86-808 (McClintock = GN567/Norstar) (S86-808 = Norstar\*2/Vona). Both McClintock and Norstar (Grant 1980) are registered Canada Western Red Winter wheat cultivars. Vona is registered in the United States of America (Welsh et al. 1978). The final cross was made in 1999. Doubled haploid lines were produced in the winter of 2000 and seed was increased during the fall and winter of 2000–2001 in a phytotron. These lines were then grown as rows in a special nursery inoculated with leaf (*Puccinia recondita* Rob. ex Desm.) and stem (*Puccinia graminis* Pers. f. sp. *tritici* Eriks. & E. Henn) rust at Saskatoon where winter survival, straw strength, height, maturity and disease reaction were evaluated. Peregrine was a row selection made in the fall of 2002 that was designated DH99-37-100.

The agronomic performance and disease reactions of DH99-37-100 were assessed in yield trials grown in Saskatchewan in 2002–2003. DH99-37-100 was entered into the Central Hard Red Winter Wheat Cooperative Registration Trials in 2003–2004, 2004–2005, 2005–2006 and 2006–2007.

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 Peregrine compared to the check cultivars.

### Performance

High grain yield potential is the primary strength of Peregrine (Table 1). In the Central Winter Wheat Cooperative Registration trials in Manitoba and Saskatchewan, the grain yield of Peregrine was 117% of CDC Osprey (Fowler 1997), the grain quality check, and 106% of CDC Falcon (Fowler 1999), the high-yielding check. This advantage was less apparent in Alberta, where the yield of Peregrine was similar to that of CDC Falcon and 107% of CDC Osprey. Peregrine is 6 cm taller than CDC Osprey with similar straw strength

**Table 1. Grain yield of Peregrine compared with CDC Falcon, CDC Osprey, and CDC Raptor. Data from the Central Winter Wheat Co-operative Registration trials (2004–2007)<sup>z</sup>**

Cultivar	Alberta	Saskatchewan	Saskatchewan Irrigation <sup>y</sup>	Southern Manitoba	Mean
CDC Falcon	7130	4730	6554	5103	5619
CDC Osprey	6588	4507	5688	4469	5125
CDC Raptor	6732	4558	6258	4733	5321
Peregrine	7061	5103	6875	5384	5855
LSD ( $P = 0.05$ )	321.1	297.5	613.6	417.6	185.9
No. of tests	8	12	4	10	34

<sup>z</sup>All means are weighted by the number of tests within a zone. Alberta locations included Lethbridge, Olds, and Lacombe. Saskatchewan locations included Saskatoon, Clair, Indian Head, Melfort, and Saskatoon (Irrigation). The Manitoba locations were Brandon, Winnipeg, and Carman.

<sup>y</sup>Rust nursery.

(Table 2). The average protein concentration of Peregrine was similar to CDC Raptor (Fowler 2002) and CDC Osprey and significantly ( $P > 0.05$ ) lower than CDC Falcon when 17 station years of replicated Central Winter Wheat Co-operative Registration trials were evaluated. In these trials, high grain yield potential resulted a grain protein yield for Peregrine that was similar to CDC Falcon and significantly ( $P < 0.05$ ) higher than CDC Raptor and CDC Osprey.

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. Limited information from the high stress winter of 2003–2004 indicated that Peregrine had winter hardiness that was better than CDC Raptor and CDC Falcon and similar to the cold tolerant check cultivar CDC Osprey (data not shown). CDC Osprey, CDC Raptor and CDC Falcon were also included in 2008–2009 and 2009–2010 regional trials planted on summerfallow fields with minimal snow trapping potential. The average winter survival (%) of Peregrine (79) was significantly lower than CDC Osprey (88) and higher than CDC Raptor (58) and CDC Falcon

(56) (LSD = 8.3,  $P = 0.05$ ) in seven of these trials where winter damage was recorded.

Although the ratings from Winnipeg were variable for stem rust, ranging from 5R to 5S-VS, the stem and leaf rust resistance of Peregrine are arguably similar to the most resistant check cultivars (Table 3). Limited data from 2006 suggest that Peregrine has stripe rust resistance that is superior to the check cultivars. These observations indicate that Peregrine carries the VPM resistance (Sr38, Lr37, Yr17) found in McClintock. Peregrine has a S/VS bunt rating, which is similar to the check cultivars in the Central Winter Wheat Cooperative Registration trials.

Kernel visual distinguishably (KVD) requirements were in place when Peregrine entered the Central Winter Wheat Co-operative Registration trials. Peregrine did not meet the KVD standards for registration in western Canada 2 out of the 4 yr of evaluation and as a result composite samples that were submitted to Grain Research Laboratory, Canadian Grain Commission, Winnipeg, MB, were only analyzed for grain quality in 2007 (data not shown). KVD requirements were dropped in 2008. With only 1 yr of grain quality data, Peregrine could not be considered for registration in the Canada Western Red Winter Wheat Class. However, 4 yr of agronomic and disease data allowed Peregrine to be considered for registration in the newly created Canada Western General Purpose (CWGP) wheat class. The CWGP class was introduced in 2007 to encourage the development of cultivars to fill the high energy demands of the biofuel and livestock feed markets in western Canada and a high grain yield potential meant that Peregrine provided a good fit for this class.

Detailed end-use quality testing was conducted by the Canadian International Grains Institute, Winnipeg, MB, on samples from each of the regional winter wheat trials grown at Clair, Indian Head and on dryland and irrigation at Saskatoon, SK, in 2007 and 2008. Samples of sufficient size for detailed quality analyses were obtained by bulking the grain from all three replicates of each of these trials, which provided a total of 8 station-years of data. Three registered

**Table 2. Agronomic performance of Peregrine compared with CDC Falcon, CDC Osprey and CDC Raptor. Data from the Central Winter Wheat Co-operative Registration trials (2004–2007)**

Character	CDC Falcon	CDC Osprey	CDC Raptor	Peregrine	LSD ( $P = 0.05$ )	No. tests
Heading Date (DOY) <sup>z</sup>	172	173	175	174	0.6	29
Maturity (DOY) <sup>z</sup>	210	212	215	213	1.0	24
Plant Height (cm)	79	97	88	103	1.5	33
Lodging (1–9) <sup>y</sup>	1.9	2.7	1.9	2.9	0.86	8
Protein (%)	11.8	11.3	11.4	11.2	0.24	17
Protein yield (kg ha <sup>-1</sup> )	599	532	558	615	31.2	17

<sup>z</sup>Day of year.

<sup>y</sup>1, all plants vertical; 9, all plants horizontal.

**Table 3.** Disease reactions of Peregrine compared to CDC Osprey, CDC Falcon and CDC Raptor. Data from artificial leaf and stem rust infections at the University of Saskatchewan, Saskatoon SK, and the Plant Science Department University of Manitoba, Winnipeg MB, using epidemic mixtures supplied by Agriculture and Agri-Food Canada in Winnipeg, MB. Stripe rust ratings were supplied by the Plant Science Department University of Manitoba, the Field Crop Development Centre, Alberta Agriculture, Lacombe, AB, and Agriculture and Agri-Food Canada, Lethbridge, AB. Powdery mildew ratings were supplied by the Plant Science Department, University of Manitoba, the Field Crop Development Centre, Alberta Agriculture, Lacombe, and Agriculture and Agri-Food Canada at Lethbridge. Leaf spot ratings were supplied by the Field Crop Development Centre, Alberta Agriculture, Lacombe. Physiological Leaf Spot ratings were supplied by University of Saskatchewan, Saskatoon. Tan spot ratings were supplied by Agriculture and Agri-Food Canada staff at Lethbridge. Common bunt data are from trials inoculated by Agriculture and Agri-Food Canada, Lethbridge

	CDC Osprey	CDC Falcon	CDC Raptor	Peregrine
<i>(a) Stem rust</i>				
2004W <sup>z</sup>	50S <sup>y</sup>	20MS	20 MR/MS	5S/VS
2004S <sup>z</sup>	35MS/S	R	R	R
2005W	60S	30MS	10MR	5R
2006W	80S/VS	15MS/S	5MR	5S
2006S	90S	R	R	R
2007W	30S	5R	1R	1R
2007 S	50S	R	R	R
<i>(b) Leaf rust</i>				
2004W	30MS	<5MR	1R	5MR
2005W	50S	5MR	15MR/MS	10MR
2006W	5MS	5MR	5MR	5R/MR
2007W	80S	30MR	15MR	5R/MR
2007S	80S	5R	20MR	15R/MR
<i>(c) Stripe rust</i>				
2006W (1–4)	1.8	2.8	2.5	1
2006La <sup>z</sup> (%)	90	45	43	11
2006Le <sup>z</sup> (1–9)	3	1	2	1
<i>(d) Powdery mildew</i>				
2004C <sup>z</sup> (1–5)	2.8	1.5	3.1	3.1
2005O <sup>z</sup> (1–9)	6.2	4.1	5.6	4.4
2005Le (1–9)	4.1	3.7	4.7	5.9
2006Le (1–9)	5.0	4.0	5.0	4.0
2007Le (1–9)	4.3	4.3	4.3	2.7
<i>(e) Leaf spot and physiological leaf spot</i>				
2004O (LS 1–5)	3.4	3.6	3.7	3.8
2004IH <sup>z</sup> (PLS 1–5)	1.3	3.8	2.2	1.3
<i>(f) Tan spot</i>				
2006Le (1–9)	1	5	3	1
<i>(g) Bunt</i>				
2004Le	84S	56MS	53MS	76S
2005Le	87VS	68VS	89VS	72VS
2006Le	70VS	56VS	67VS	58VS
2007Le	65VS	69VS	57VS	64VS

<sup>z</sup>S, Saskatoon; IH, Indian Head; W, Winnipeg; C, Carman; La, Lacombe; Le, Lethbridge; O, Olds.

<sup>y</sup>Percent infection and type of reaction: VS, very susceptible; S, susceptible; MS, moderately susceptible; MR, moderately resistant; R, resistant.

cultivars representing the Canada Western Red Winter Wheat Class (AC Bellatrix, McClintock and CDC Osprey) were included for comparison in these analyses. Where statistically significant ( $P < 0.05$ ) differences were detected, the end-used quality of Peregrine fell within the range of values observed for the cultivars representing the Canada Western Red Winter Wheat Class (Table 4).

## Other Characteristics

### Plant

Winter growth habit; coleoptile colour reddish; juvenile growth prostrate; leaves medium green; flag leaf medium

green, narrow to mid-wide, short to mid-long, intermediate to upright attitude; sheath and leaf blades glabrous; auricles light red, glabrous to slightly pubescent; tillers many; straw medium tall, internode hollow, culm neck straight, anthocyanin coloration at maturity absent.

### Spikes

Tapering to oblong, lax to mid-dense, inclined, long, awned; glumes mid-wide, mid-long to long, glabrous to slightly pubescent, white; glume shoulders oblique, narrow to mid-wide; glume beak mid-long, acuminate.

**Table 4. Wheat and flour analytical data for Peregrine compared with AC Bellatrix, McClintock and CDC Osprey. End-use quality testing conducted by the Canadian International Grains Institute, Winnipeg, MB, on samples from the 2007 and 2008 regional winter wheat trials grown at Clair, Indian Head, and on dryland and irrigation at Saskatoon, SK. American Association of Cereal Chemists methods were followed for determining the various end-use suitability traits**

Character	AC Bellatrix	McClintock	CDC Osprey	Peregrine	LSD ( $P = 0.05$ )
Wheat protein (%)	11.7	11.8	12.1	11.3	NS <sup>x</sup>
Flour protein (%)	10.9	10.9	11.4	10.4	NS
Protein loss (%)	0.8	0.9	0.7	0.9	0.11
Falling number (sec)	412	375	395	384	NS
Flour yield (%)	75.4	75.6	77.2	76.3	1.68
Flour ash (%)	0.46	0.41	0.41	0.43	0.029
Particle size index (%)	54.8	52.0	57.4	52.4	1.55
Flour colour L-value (Minolta)	86.2	86.3	86.6	86.3	NS
Starch damage, UCD	18.7	16.2	15.0	16.8	1.65
Remix loaf volume (cm <sup>3</sup> )	891	895	926	878	NS
Test bake absorption (%)	58.1	56.9	54.8	55.4	1.30
Test bake mixing time (min)	3.7	5.8	5.0	5.8	0.42
Farinogram absorption (%)	57.7	55.8	54.0	54.1	0.84
Farinogram DDT <sup>z</sup> (min)	4.4	5.3	5.3	4.1	NS
Farinogram MTT <sup>y</sup> (BU)	54	21	28	39	12.3
Farinogram stability (min)	5.1	12.2	12.1	7.9	2.43

<sup>z</sup>Dough development time.

<sup>y</sup>Mixing tolerance index.

<sup>x</sup>NS, non-significant differences.

### Kernel

Red, hard, small to mid-size, mid-long, narrow to mid-wide, ovate; cheeks rounded; brush midsize, mid-long to long; crease mid-wide, shallow to mid-deep; germ small to mid-size, round to oval.

### Maintenance and Distribution of Pedigreed Seed

Breeder seed will be maintained by the Department of Plant Sciences, University of Saskatchewan, Saskatoon, Saskatchewan, Canada S7N 5A8. Distribution and multiplication of pedigreed seed stocks are handled by SeCan Association, 501-300 March Rd., Kanata, Ontario, Canada K2E 2E2.

The assistance provided by the many students and technicians (especially R. Hankey, G. Schellhorn, T. Krug, and K. Smith) who have worked on this program is gratefully acknowledged.

Appreciation is also expressed to the co-operators who have contributed to the database of the Central Winter Wheat Co-operative Registration trials. This project was made possible by grants from the Saskatchewan Agriculture Development Fund, Western Grains Research Foundation, and Ducks Unlimited Canada.

**Fowler, D. B. 1997.** CDC Osprey winter wheat. *Can. J. Plant Sci.* **77**: 665–667.

**Fowler, D. B. 1999.** CDC Falcon winter wheat. *Can. J. Plant Sci.* **79**: 599–601.

**Fowler, D. B. 2002.** CDC Raptor winter wheat. *Can. J. Plant Sci.* **82**: 407–409.

**Grant, M. N. 1980.** Registration of Norstar wheat. *Crop Sci.* **20**: 552.

**Welsh, J. R., Ellis, G., Normann, R., Ball, W. S., Hinze, G. and Mann, H. 1978.** Registration of Vona Wheat (Reg. No. 599). *Crop Sci.* **18**: 695.