CULTIVAR DESCRIPTION

Lovitt hard red spring wheat

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DePauw, R. M., Knox, R. E., Clarke, J. M., McCaig, T. N., Clarke, F. R. and Fernandez, M. R. 2004. **Lovitt hard red spring wheat.** Can. J. Plant Sci. **84**: 811–814. Lovitt hard red spring wheat (*Triticum aestivum* L.) is adapted to the Canadian prairies. Lovitt is earlier maturing than AC Barrie with similar grain yield and smaller kernels. Lovitt has resistance to prevalent races of leaf and stem rust and loose smut. Lovitt has very good pre-harvest sprouting resistance similar to RL4137. Lovitt is eligible for grades of the Canada Western Red Spring wheat class.

Key words: *Triticum aestivum* L., cultivar description, resistance to leaf and stem rust, dormancy

DePauw, R. M., Knox, R. E., Clarke, J. M., McCaig, T. N., Clarke, F. R. et Fernandez, M. R. 2004. **Le blé roux vitreux de printemps Lovitt**. Can. J. Plant Sci. **84**: 811–814. Lovitt est une variété de blé roux vitreux de printemps (*Triticum aestivum* L.) acclimatée aux Prairies canadiennes. Lovitt parvient à maturité plus tôt que AC Barrie mais a un rendement grainier analogue et des grains plus petits. Lovitt résiste aux races prévalentes de rouille des feuilles et de la tige ainsi qu'au charbon nu. La variété démontre une très bonne résistance à la germination sur pied, semblable à celle de RL4137. Lovitt entre dans les catégories de classement établies pour le blé roux vitreux de printemps de l'Ouest canadien.

Mots clés: *Triticum aestivum* L., description de cultivar, résistance à la rouille des feuilles et de la tige, dormance

Lovitt hard red spring wheat (*Triticum aestivum* L.) was developed at the Semiarid Prairie Agricultural Research Centre, Agriculture and Agri-Food Canada (AAFC), Swift Current, SK. It received regional registration No. 5556 from the Variety Registration Office, Food Production and Inspection Branch, Canadian Food Inspection Agency 2002 Nov. 08.

Pedigree and Breeding Method

Lovitt derives from the cross 8405-JC3C*2/BW152 made in 1992 at the Semiarid Prairie Agricultural Research Centre, AAFC, Swift Current. The female parent, 8405-JC3C, is a high yield and high grain protein concentration sister line of AC Barrie (McCaig et al. 1996). BW152, registered as AC Cora, possesses the gene Lr13, which is now ineffective in conferring resistance to prevalent races, and the gene Lr21, which does confer resistance to prevalent races of leaf rust (*Puccinia recondita* Roberge ex Desmaz.) (Kolmer 1996; Townley-Smith and Czarnecki 1993). A modified pedigree breeding method was used to develop Lovitt. The BC_1F_2 seed was inoculated with common bunt [*Tilletia laevis* Kuhn in Rabenh., and *T. caries* (DC.) Tul.& C. Tul.] races L1, L16, T1, T6, T13 and T19 (Hoffmann and Metzger 1976) , and grown as individual plants in a leaf and stem rust (*P. graminis* Pers.:Pers. f.sp. *tritici* Eriks. & E. Henn.) epiphytotic nursery near Swift Current. The rust races used were representative of those found in the previous year (McCallum and Seto-Goh 2003). The BC_1F_3, and BC_1F_5 generations were grown as head rows in a winter nursery near Brawley, California, to multiply seed for early generation tests while the BC_1F_8 generation was grown near Leeston, New Zealand. In the BC_1F_4, BC_1F_6, BC_1F_7 and BC_1F_9 generations, 189, 98, 14, and 54 lines respectively, were screened for time to maturity, straw strength, plant height, grain yield and grain protein concentration using early generation screening procedures (DePauw et al. 1989). Grain yield potential was measured by growing replicated trials at two or three locations; grain protein concentration was assessed on a composite from each location, using near infrared reflectance spectroscopy (Williams 1979). In the same generations, reaction to leaf and stem rust was assessed in an epiphytotic nursery near Glenlea, Manitoba. A subsample of seed from the yield trial composites was used to measure grain quality and kernel characteristics. Selected BC_1F_9 lines were screened for reaction to loose smut [*Ustilago tritici* (Pers.) Rostr.] using a mixture of races T2, T9, T10, and T39, and common bunt using the same races as in the F_2 generation.

An experimental line, 9205-MA22**K, was evaluated in the Western Bread Wheat 'A3' test in 1997, the Western Bread Wheat 'B' test in 1998, and in the Parkland Wheat Cooperative test from 1999 to 2001 as PT205. The check cultivars in the Parkland Wheat Cooperative test were AC Barrie and AC Splendor for the three test years 1999 to 2001. Neepawa and Roblin were also used as check cultivars in 1999 and 2000 but were replaced by Katepwa and CDC Teal in 2001. The variables measured and the protocols followed in the Parkland Cooperative test have been described by Graf and Fox (2000). Preharvest sprouting response was measured on intact spikes using protocols

Table 1. Agronomic performance of Lovitt compared to the check cultivars, based on data from the Parkland[z] Cooperative tests from 1999–2001

	Yield (kg ha^{-1})				Maturity (d)			
	1999	2000	2001	Mean	1999	2000	2001	Mean
Neepawa	3859	3601			108.8	107.6		
Roblin	3789	3789			108.7	106.9		
Katepwa		4017					102.7	
CDC Teal			3936				101.9	
AC Barrie	3902	4045	3885	3940	110.8	109.7	103.2	107.6
AC Splendor	4095	3823	3682	3875	107.8	106.3	99.6	104.3
Lovitt	4199	3971	3914	4035	109.3	108.9	101.4	106.2
LSD[y]	220	215	207	180				1.4
No. tests	12	10	11	33	8	7	9	24

	Lodging (1–9)[x]				Height (cm)			
	1999	2000	2001	Mean	1999	2000	2001	Mean
Neepawa	2.6	3.5			100	103		
Roblin	1.5	2.1			94	98		
Katepwa			2.7				92	
CDC Teal			1.8				89	
AC Barrie	1.3	3.1	1.9	2.0	95	100	88	94
AC Splendor	2.0	2.8	2.2	2.3	95	102	91	96
Lovitt	1.8	2.7	2.2	2.2	96	100	90	95
LSD				0.7				2
No. tests	5	4	4	13	11	9	10	30

	Test Weight (kg hL^{-1})				Kernel weight (mg)			
	1999	2000	2001	Mean	1999	2000	2001	Mean
Neepawa	79.2	76.9			33.3	34.0		
Roblin	78.1	75.5			35.6	34.4		
Katepwa			80.0					34.6
CDC Teal			79.6					36.0
AC Barrie	79.9	78.4	81.0	79.8	37.6	36.3	38.8	37.6
AC Splendor	79.3	77.2	79.6	78.7	36.4	36.8	37.1	36.7
Lovitt	79.3	77.7	80.4	79.2	34.1	34.3	34.6	34.3
LSD					0.8			1.4
No. tests	12	10	11	33	12	10	11	33

[z]Locations in the Peace River Region included: Beaverlodge, Dawson Creek, Fort St. John, Fort Vermilion; and locations in the Parkland Region included: Breton, Clive, Edmonton, Kelvington, Saskatoon, Lacombe, Lake Lenore, Loon Lake, Melfort, Neapolis.
[y]Least significant difference. $P \leq 0.05$, based on the mean squares genotype by environment interaction.
[x]A rating scale of 1 to 9 with a rating of 1 indicating all plants in a plot were vertical and 9 indicating all plants in a plot were horizontal.

described by DePauw and McCaig (1991). Polyphenol oxidase was measured using catechol as a substrate according to the procedure described by McCaig et al. (1999). Each year, the data were analyzed using the S506 statistical program developed by Statistical Research Services, AAFC. SAS GLM was used to perform a combined analysis over years, using a mixed model with environments and replications as random and genotypes as fixed (SAS Institute, Inc. 1990).

During the Parkland Cooperative testing period, leaf and stem rust seedling infection types were assessed by pathologists at the Cereal Research Centre, AAFC, Winnipeg, MB. Stem rust races used for one or more years were: QTHST (C25), RKQSR (C63), RTHJT (C57), RHTSK (C20), TMRTK (C10), and TPMKR (C53) (Fetch 2003). Leaf rust races used for one or more years were: MBDS (12-3), MBDS (185-1), MBRJ (128-1), MGBJ (74-2), and TJBJ (77-2) (McCallum and Seto-Goh 2003). Field evaluations of both leaf and stem rust reactions, using the same races as for the seedling tests, were measured in an epiphytotic nursery near Glenlea, MB. Reaction to fusarium head blight (*Fusarium* spp.) was assessed in artificially inoculated field tests conducted near Winnipeg, MB. To determine the loose smut reaction type, a mixture of the prevalent races T2, T9, T10 and T39 was injected into florets at anthesis of plants grown in the field. A mixture of the common bunt races L1, L16, T1, T6, T13, and T19 was used to inoculate the seed which was planted in mid-April of each year, near Lethbridge. The race designations are those described by Fetch (2003) and Roelfs and Martens (1988) for stem rust, Hoffmann and Metzger (1976) for common bunt, and Nielsen (1987) for loose smut.

Performance

Based on 33 replicated tests in the Parkland Cooperative tests, mean yield of Lovitt was 2.4% more ($P \leq 0.10$) than AC Barrie and 4.1% more ($P \leq 0.05$) than AC Splendor (Table 1). Lovitt matured 1.4 d earlier than AC Barrie and 1.9 d later than AC Splendor (Table 1). Lovitt was intermediate in height to AC Barrie and AC Splendor. Lovitt had similar lodging scores to AC Barrie and AC Splendor. The test weight of Lovitt was

Table 2. Disease reaction of Lovitt and check cultivars, based on data from Parkland Wheat Cooperative tests 1999–2001

	Leaf rust[z]			Stem rust[z]		
	1999	2000	2001	1999	2000	2001
Neepawa	80S	60S		5R	TrR	
Roblin	20MSS	40MRMS		Tr	0R	
Katepwa			35MRMS			TrR
CDC Teal			15MR			2R
AC Barrie	80MRMS	50MRMS	50MRMS	5MR	0R	2R
AC Splendor	30MRMS	25MR	20MRMS	Tr	0R	TrR
Lovitt	20RMR	Tr	5MR	Tr	TrR	TrR

	Bunt[z]				Loose smut[z]			Fusarium head blight[zy]
	1998[x]	1999	2000	2001	1999	2000	2001	2001
Neepawa	24 I	18 I	35 I	0	0			
Laura	56 S							
AC Elsa	49 S							
Roblin	30 S	41 S	0	9				
Katepwa				6 MR			0 R	28 I
CDC Teal				5 MR			0 R[w]	54 S
AC Barrie	12 R	32 S	23 I	5 MR	0	3	0 R	16 MR
AC Splendor		29 MS	25 I	7 MR	0	11	–[v]	35 MS
Lovitt	35 I	35 S	27 MS	13 I	0	18	0 R[w]	36 MS

[z]Percent infection and type of reaction: Tr, trace; R, resistant; MR, moderately resistant; I, intermediate resistant; MS, moderately susceptible; S, susceptible.
[y]Fusarium Head Blight index = (%infected spikelets * % infected spikes)/100.
[x]Data from Western Bread Wheat 'B' test.
[w]Assessment made on less than 10 plants.
[v]No plants.

intermediate between that of AC Barrie and AC Splendor while the kernel weight was lower than both check cultivars.

Other Characteristics

SPIKES: Fusiform to oblong, mid-dense, mid-long, erect to slightly nodding, apically awnleted; glumes are mid-wide, mid-long, glabrous, white; glume shoulders are primarily square, some tending to oblique, some tending to rounded, and some tending to elevated, mid-wide to wide; glume beak is short and acute.

KERNEL: Color is red, medium to small size, mid-wide, mid-long, ovate to oval; cheeks rounded to slightly angular; brush mid-size, with mid-size hairs; embryo mid-size and round.

SHATTERING: Resistant.

DISEASE REACTION: Resistant to prevalent races of leaf and stem rust, and loose smut (Table 2). Lovitt expresses resistance to races that are virulent on Lr16 and which is at least partially due to the expression of the Lr21 gene. The KSUD14 DNA assay (Huang and Gill 2001) indicated the same pattern as the Lr21 control. It is moderately susceptible to prevalent races of common bunt and fusarium head blight.

END-USE SUITABILITY: Based on 3 yr of testing in the Parkland Wheat Cooperative test (Table 3), Lovitt was rated equal to the control cultivars for grain quality by the Quality Evaluation Team of the Prairie Recommending Registration Committee for Grain. Lovitt is eligible for grades of the Canada Western Red Spring wheat class.

PREHARVEST SPROUTING: Based on 2 yr of testing to measure length of dormancy period, Lovitt expressed preharvest sprouting response comparable to the very dormant genotype RL4137 (Table 4), and significantly more dormant than Neepawa.

Maintenance and Distribution of Pedigreed Seed

Lovitt consists of a composite of 140 Breeder Lines that originate from BC_1F_7-derived F_{11} random single plants which were grown out as Pre-Breeder Lines in 3-m-long rows in isolation near Swift Current in 2000, and again as 15-m rows near Indian Head in 2001. Breeder Seed will be maintained by the Seed Increase Unit of the Research Farm, Indian Head, Saskatchewan S0G 2K0. Application for Plant Breeders' Rights had been submitted. The variety will be added to the OECD list of Cultivars. Lovitt has been released for distribution and multiplication to Canterra Seeds Ltd., #14-62 Scurfield Blvd, Winnipeg, Manitoba R3Y 1M5.

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Table 3. Averages of end-use suitability[z] traits of Lovitt and check cultivars, Parkland Wheat Cooperative tests 1999–2001

	Wheat protein (%)	Flour protein (%)	Flour yield (%)	Flour color Agtron	Flour ash (%)	Amylograph viscosity B.U.	Hagberg falling no. sec
C Barrie	15.3	14.8	76.3	79.3	0.42	693	393
C Splendor	15.3	14.9	75.2	78.7	0.42	603	372
Lovitt	14.9	14.4	76.2	79.7	0.41	658	402

	Starch Damage megazm	Farinograph[y]				Canadian Short Process		
		Absorption (%)	DDT min	MTI B.U.	Stability min	LV[x] cc	Time min	Absorption (%)
C Barrie	6.6	66.7	6.25	31.7	9.0	1097	11.7	70.7
C Splendor	6.3	68.4	7.08	16.7	13.8	1118	12.1	71.7
Lovitt	6.5	66.8	5.75	28.3	9.2	1093	11.3	70.7

[z]American Association of Cereal Chemists methods were followed by the Grain Research Laboratory, Canadian Grain Commission for determining the various end-use suitability traits on a composite of 6 to 10 locations each year.
[y]DDT is the Farinograph dough development time; MTI is Farinograph mixing tolerance index.
[x]LV is loaf volume.

Table 4. Response to sprouting conditions of Lovitt and check cultivars grown in length of dormancy trials near Swift Current in 2001 and 2002

Genotype	Seed color	T1HS[z]	T2HS	T1KS	T2KS	T1AA	T2AA	TWT	PPO	FNO
AC Barrie	Red	0.3	2.2	4.7	13.2	0.04	0.28	78.5	0.35	451
Neepawa	Red	0.3	5.5	3.7	30.5	0.08	1.51	77.2	0.37	435
RL4137	Red	0.0	0.3	3.0	4.0	0.01	0.10	78.6	0.33	459
Lovitt	Red	0.0	0.5	5.0	2.7	0.02	0.08	78.0	0.36	503
LSD		2.3	4.2	19.9	24.6	0.56	1.71	1.6	0.09	65

[z]T1HS = 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.
TWT = kg/hL.
PPO = polyphenol oxidase relative absorbance measured at 405 nm.
FNO = Hagberg falling number(s).

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