CULTIVAR DESCRIPTION

AAC Bailey hard red spring wheat

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DePauw, R. M., Knox, R. E., Cuthbert, R. D., Singh, A. K. and McCaig, T. N. 2014. **AAC Bailey hard red spring wheat**. Can. J. Plant Sci. **94**: 175–181. AAC Bailey hard red spring wheat (*Triticum aestivum* L.) had grain yield within the range of the checks with maturity significantly earlier than the mean of the checks. The quantity of protein of AAC Bailey was significantly less than Lillian but gluten strength was stronger than Lillian as measured by farinograph. AAC Bailey is eligible for grades of Canada Western Red Spring. AAC Bailey expressed resistance to prevalent races of leaf rust and stem rust, moderate resistance to common bunt, and moderate susceptibility to loose smut. AAC Bailey frequently had lower fusarium head blight disease index and lower deoxynivalenol concentration than Lillian and Laura.

Key words: *Triticum aestivum* L., wheat, cultivar description, grain yield, disease resistance

DePauw, R. M., Knox, R. E., Cuthbert, R. D., Singh, A. K. et McCaig, T. N. 2014. **Le blé roux vitreux de printemps AAC Bailey**. Can. J. Plant Sci. **94**: 175–181. Le rendement grainier du blé (*Triticum aestivum* L.) roux vitreux de printemps AAC Bailey se situe dans la plage des cultivars témoins, mais la variété est significativement plus précoce que la moyenne enregistrée par ceux-ci. Le grain de AAC Bailey renferme sensiblement moins de protéines que Lillian, mais la force de son gluten, mesurée au farinographe, est supérieure. AAC Bailey est admissible aux classes de la catégorie « blé rouge de printemps de l'Ouest canadien ». Le cultivar résiste aux races courantes de la rouille de la feuille et de la rouille de la tige, résiste modérément à la carie et est modérément sensible au charbon nu. AAC Bailey a souvent obtenu un indice inférieur pour la brûlure de l'épi causée par *Fusarium* et renferme moins de désoxynivalénol que Lillian et Laura.

Mots clés: *Triticum aestivum* L., blé, description de cultivar, rendement grainier, résistance à la maladie

AAC Bailey, a hard red spring wheat (*Triticum aestivum* L.), was developed at the Semiarid Prairie Agricultural Research Centre (SPARC), Agriculture and Agri-Food Canada (AAFC), Swift Current, SK. It received registration No. 7218 from the Variety Registration Office, Plant Production Division, Canadian Food Inspection Agency on 2012 Jun. 07. AAC Bailey was accepted for filing of Plant Breeders' Rights, application No. 11-7268, by the Plant Breeders' Rights office, Canadian Food Inspection Agency on 2011 Apr. 29.

Pedigree and Breeding Method

AAC Bailey derives from the cross 9505-LP03A/Journey//Lillian made in 2002 at the Semiarid Prairie Agricultural Research Centre of Agriculture and Agri-Food Canada, Swift Current, SK. The female parent of the first cross, 9505-LP03A, derives from the cross Chiroca 'S'//3Ag14/4*Condor/3/BW621/4/BW591/5/BW 674/6/BW666. The parentage of Journey is CDC Teal// Grandin/PT819 (Graf et al. 2003). Lillian, a doubled haploid cultivar, was used as the top cross parent whose parentage is BW621*3/90B07-AU2B (DePauw et al. 2005). In 2003, about 10 000 F_2 seed were inoculated with common bunt [*Tilletia laevis* Kühn in Rabenh., and *T. tritici* (Bjerk.) G. Wint. in Rabenh.] races L16 and T19 (Hoffmann and Metzger 1976). The seed was planted in 90-m-long rows that were 23 cm apart with every second row planted with CDC Kestrel winter wheat (Fowler 1997), which is susceptible to leaf rust (*Puccinia triticina* Eriks.) and stem rust (*P. graminis* Pers.:Pers. f.sp. *tritici* Eriks. & E. Henn.). An irrigated leaf rust and stem rust epiphytotic nursery was established by planting genotypes susceptible to prevalent races of leaf and stem rust in every fifth row and needle inoculating a sample of plants in each row. Representative rust races found the previous year were applied (McCallum and Seto-Goh 2006). Stem rust races used were: QTHST (C25), RHTSK (C20), RKQSR (C63), RTHJT (C57), TMRTK (C10) and TPMKR (C53) (Roelfs and Martens 1988; Fetch 2005). From the disease nursery, 290 disease-free, strong-stemmed and early-maturing individuals were selected, threshed individually, and selected for kernel characteristics. The F_3 seed of 256 F_2 derived individuals was planted as 2-m long head-rows in a contra season nursery near Lincoln, New Zealand. From these, 140 lines were selected on the basis of most desirable time to maturity, plant height and straw strength, and were harvested as individual rows. In the F_4 generation, seed of the 140 lines was grown in four-row plots near Swift Current, SK, with two replications, and one replication at each of Stewart

Valley, SK, and Lethbridge, AB, to assess agronomic performance. Grain protein concentration was measured using near infrared reflectance spectroscopy (Williams 1979) on a whole-grain sample within each location. Volume weight, seed size and kernel attributes were assessed on the harvested grain samples. A subsample was submitted to the Central Quality Laboratory, Cereal Research Centre, AAFC, Winnipeg, MB, to determine end-use suitability for the Canada Western Red Spring market class. Five spikes were collected from plots of each F_4 line at Swift Current. Head-rows of the F_5 generation, 40 F_2-derived families with four to five lines per family, were grown near Irwell, NZ. Families were selected on the basis of grain quality and kernel attributes assayed on remnant seed from the F_4 yield trial. Experimental F_5 lines within acceptable families were selected on the same basis as in the F_3 generation. In the $F_{4:6}$ generation, 89 lines were evaluated in replicated trials near Swift Current, Stewart Valley and Lethbridge following a protocol similar to that of the F_4 generation. Five spikes were collected from plots of each F_6 line at Swift Current. In the F_7 generation, 26 families at four lines per family were grown out near Irwell, NZ, and selected on the same basis as the F_5 generation. In the $F_{6:8}$ generation, 53 lines were evaluated in replicated trials near Swift Current, Stewart Valley and Lethbridge following a protocol similar to that of the F_4 generation. In the F_4, F_6 and F_8 generations reaction to leaf and stem rust was used as a selection criterion by assessing response to the rusts in an epiphytotic nursery near Glenlea, MB. Selected F_8 lines were screened for reaction to a mixture of races T2, T9, T10 and T39 of loose smut [*Ustilago tritici* (Pers.) Rostr.] (Nielsen 1987), and races L16 and T19 of common bunt. Through this breeding process the experimental line B0203-KE02B met all selection criteria at each generation.

The experimental line B0203-KE02B was evaluated in the Western Bread Wheat A_1 test in 2007, and entered in the Western Bread Wheat Cooperative (WBWC) tests from 2008 to 2010 as BW901. Annually, the WBWC consisted of 25 experimental lines and five check cultivars grown in 5×6 lattice design with three replications at up to 13 locations. The check cultivars were Carberry (DePauw et al. 2011), Katepwa (Campbell and Czarnecki 1987), Laura (DePauw et al. 1988), Lillian (DePauw et al. 2005) and CDC Kernen (Hucl et al. 2012). The variables measured and protocols followed in the WBWC test were described in the operating procedures of the Prairie Recommending Committee for Wheat, Rye and Triticale (Anonymous 2013). The PROC MIXED procedure was used to analyze the data annually and to perform a combined analysis over years using a mixed model with environments and replications considered random and genotypes considered fixed (SAS Institute, Inc. 2003). Least significant differences were calculated using appropriate mean squares and degrees of freedom, and differences were declared significant at probability 5% level.

Response to several diseases was assessed in specialized disease nurseries from 2008 to 2010. Leaf and stem rust seedling infection types were assessed using stem rust races: QTHST (C25), RHTSK (C20), RKQSR (C63), RTHJT (C57), TMRTK (C10) and TPMKR (C53) (Roelfs and Martens 1988; Fetch 2005), and leaf rust races: MBDS (12-3), MBRJ (128-1), MGBJ (74-2), TDBG (06-1-1), TDBJ (70-1), and TJBJ (77-2) (McCallum and Seto-Goh 2006). Field evaluations of leaf and stem rust reactions, using leaf rust races representative of those found the previous year and the same stem rust races as for the seedling tests, were measured annually in epiphytotic nurseries near Glenlea, MB. Reaction to fusarium head blight was assessed in artificially inoculated field tests conducted annually near Glenlea and Carman, MB (Gilbert and Woods 2006). To determine the response to loose smut, a mixture of the prevalent races T2, T9, T10 and T39 was injected into florets at anthesis of plants grown in the field and the inoculated seed subsequently grown out in a greenhouse

Table 1. Grain yield (kg ha^{-1}) of AAC Bailey compared with the check cultivars in the Western Bread Wheat Cooperative test, 2008 to 2010

	Yield (kg ha^{-1})									
	Zone 1[z]			Zone 2			Zone 3			Mean[y]
Cultivar	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008–2010
Carberry	3263	3945	3362	4563	4183	3661	6562	6427	5889	4498
CDC Kernen	3285	3602	3747	4495	4417	4020	7044	7373	6485	4723
Katepwa	2885	3393	3614	4205	3927	3500	5840	6418	5367	4195
Laura	3270	3597	3478	4532	4256	3815	5990	6693	5923	4519
Lillian	3165	3572	3464	4072	4220	3358	5748	6750	5623	4250
AAC Bailey	3112	3873	3674	4145	4119	3482	6355	6401	5731	4321
$LSD^{x}_{0.05}$	363	393	384	286	283	282	978	680	501	245
No. of trials	2	2	1	9	9	8	2	2	3	38

[z]Locations: Zone 1: Stewart Valley, Swift Current; Zone 2: Beiseker, Goodale, Indian Head, Kernen, Lethbridge, Neapolis, Three Hills, Regina, Scott, Watrous; Zone 3: Edmonton, Lacombe, Melfort.
[y]Means are based on LS Means procedure of SAS.
[x]Least significant difference, $P \leq 0.05$, includes the appropriate genotype by environment interaction variation.

Table 2. Three-year averages for agronomic characteristics of AAC Bailey compared with the check cultivars in the Western Bread Wheat Cooperative test, 2008 to 2010

	Maturity (d)	Height (cm)	Lodging[z] (1–9)	Test weight (kg hL^{-1})	Kernel size (mg)	Grain protein (%)
Cultivar	2008–2010[y]	2008–2010	2008–2010	2008–2010	2008–2010	2008–2010
Carberry	109	84	1.3	80.5	37.7	14.3
CDC Kernen	107	100	1.9	79.7	38.0	14.4
Katepwa	105	99	2.1	78.7	34.6	14.1
Laura	108	98	2.8	78.9	34.5	14.2
Lillian	106	95	2.2	78.4	37.8	15.2
Mean of checks	107	95	2.1	79.2	36.5	14.5
AAC Bailey	105	95	1.8	78.8	37.8	14.5
$LSD^x_{0.05}$	1.5	2.9	0.7	0.7	2.1	0.4
No. of trials	36	39	12	39	39	39

[z]Straw strength rated on a scale of 1, indicating that all plants in plot are erect, to 9, indicating that all plants in a plot are lying horizontal.
[y]Means are based on LS Means procedure of SAS.
[x]Least significant difference, $P \leq 0.05$, includes the appropriate genotype by environment interaction variation.

(Menzies et al. 2003). To determine the response to common bunt, a mixture of prevalent races L1, L16, T1, T6, T13 and T19 was used to inoculate the seed planted in mid-April of each year near Lethbridge, AB (Anonymous 2013).

A sample of grain of the checks from each location was submitted to the Canadian Grain Commission to determine grain grade and protein concentration. End-use suitability was determined on a composite sample made up from sites with grain samples representative only of the top hard red spring wheat grades available. The quantity of grain from a location was adjusted to achieve a final composite protein concentration approximating that of the average for the crop. A consistent quantity of grain within a location for all experimental lines was used to make up the composite. All end-use

Table 3. Disease reactions of AAC Bailey and check cultivars based on the Western Bread Wheat Cooperative Trials 2008 to 2010

	Field leaf rust						Field stem rust					
	2008		2009		2010		2008		2009		2010	
Cultivar	Severity	Rating	Severity	Rating	Severity	Rating	Severity	Reaction	Severity	Reaction	Severity	Reaction
Carberry	0[z]	R	0	R	5	R	5[y]	R[x]	10	RMR	10	RMR
CDC Kernen	17	MR	10	R	8	R	5	R	15	RMR	10	RMR
Katepwa	75	S	30	MR	70	S	10	RMR	10	RMR	10	R
Laura	5	R	0	R	2	R	5	R	7	RMR	10	R
Lillian	5	R	3	R	2	R	2	R	10	RMR	10	R
AAC Bailey	0	R	0	R	0	R	5	R	5	RMR	5	R
$LSD_{0.05}$	10		6		10							
	Bunt						Loose smut					
	2008		2009		2010		2008		2009		2010	
	Infection	Reaction	Infection	Reaction	Infection	Reaction	Infection	Reaction	Infection	Reaction	Infection	Reaction
Carberry	4[w]	VR[x]	1	R	4	RMR	21[v]	MR[x]	17	MR	NA[u]	
CDC Kernen	36	I-MS	16	MR-I	25	MS	0	R	0	R	2	R
Katepwa	18	MR-I	23	I	5	RMR	0	R	3	R	8	R
Laura	58	VS	49	S	46	S	33	MR	31	MR	72	MS
Lillian	20	MR-I	4	R	8	RMR	50	I	30	MR	56	MS
AAC Bailey	18	MR-I	12	MR-I	7	RMR	56	MS	27	MR	60	MS
$LSD_{0.05}$	10		14		19							

[z]Leaf rust rating scale based on percent leaf area affected: 0–10 R, 11–30 MR, 31–39 I, 40–60 MS, >60 S.
[y]Percent of the stem infected with stem rust based on modified Cobb scale.
[x]Disease response category: R = resistant, RMR = resistant/moderately resistant, MR = moderately resistant, MRMS is equal to I = intermediate in reaction, MS = moderately susceptible, S = susceptible, and VS = very susceptible.
[w]Percentage of plants with common bunt symptoms.
[v]Percentage of plants with loose smut symptoms.
[u]Only one plant resulting in insufficient data.

Table 4. Fusarium head blight ratings and deoxynivalenol concentration of AAC Bailey and check cultivars based on the Western Bread Wheat Cooperative Trials 2008 to 2010

	Fusarium head blight 2008							
	Carman		Ottawa	Charlottetown	Glenlea		Levis, QC	
Cultivar	Index[z]	Disease response	Incidence[y] (%)	Index[z]	Index[z]	Disease response	Index[z]	Mean[w] disease index
Carberry	8	MR[x]	20	13	5	MR	50	19
CDC Kernen	39	MS	32	14	3	MR	67	31
Katepwa	18	I	40	14	4	MR	52	25
Laura	29	I	37	20	8	MR	87	36
Lillian	53	S	48	20	47	S	87	51
AAC Bailey	21	I	27	14	13	I	78	31
$LSD^{v}_{0.05}$	9		12	7	10		13	11

	Fusarium head blight 2009								
	Glenlea		Carman		Ottawa	Levis, QC		PE	
Entry	Index	Disease response	Index	Disease response	Incidence[y] (%)	Index	Disease response	Index	Mean disease index
Carberry	15	MR	13	I	22	56	MS	67	26
CDC Kernen	11	MR	25	MS	18	53	MS	56	27
Katepwa	16	MR	15	I	25	58	MS	56	28
Laura	26	I	15	I	27	73	S	67	35
Lillian	41	S	53	S	42	75	S	62	53
AAC Bailey	26	I	17	I	30	66	S	61	35
$LSD_{0.05}$	15		9		6	17		15	9

	Fusarium head blight 2010								
	Glenlea		Carman		Ottawa	Levis, QC		PE	
Entry	Index	Disease response	Index	Disease response	Incidence[y] (%)	Index	Disease response	Index (Aug. 12)	Mean disease index
Carberry	5	R	11	MR	36	24	MR	90	14
CDC Kernen	37	S	28	I	32	53	I	85	25
Katepwa	13	MR	25	I	42	56	I	88	21
Laura	52	S	19	MR	78	53	I	100	39
Lillian	65	S	57	S	60	72	S	85	47
AAC Bailey	15	I	22	I	33	62	MS	93	19
$LSD_{0.05}$	20		10			10		17	18

	Deoxynivalenol (ppm)			
	2008	2009	2009	2010
Entry	Glenlea	Glenlea	Ottawa	Glenlea
Carberry	4.4	18.3	27.1	7.5
CDC Kernen	3.0	9.3	14.8	9.3
Katepwa	3.6	16.1	17.0	6.4
Laura	6.0	22.9	19.0	24.4
Lillian	9.2	19.9	34.0	15.7
AAC Bailey	6.0	23.1	15.3	7.2

[z]Fusarium head blight disease index = (percentage of infected heads × percentage of diseased florets on infected heads)/100 on a 0–100 scale.
[y]Percentage of spikes with FHB symptoms.
[x]Disease response category: R = resistant, MR = moderately resistant, I = intermediate in reaction, MS = moderately susceptible, S = susceptible.
[w]Calculated using LS Means procedure of SAS.
[v]Least significant difference, $P \leq 0.05$, includes the appropriate genotype by environment interaction variation.

suitability analyses were performed by personnel at the Grain Research Laboratory, Canadian Grain Commission, Winnipeg, MB, following protocols of the AACC (American Association of Cereal Chemists 2000). In 2010, stem solidness was rated using a scheme described by DePauw and Read (1982).

Performance

Grain yield of AAC Bailey was within the range of the checks for grain yield, maturity, height, lodging, test weight, seed size, and protein concentration (Tables 1 and 2). AAC Bailey was significantly ($P \leq 0.05$) earlier than the mean of the checks. AAC Bailey was significantly taller than Carberry, and significantly less prone to lodging than Laura. AAC Bailey was significantly lower test weight than Carberry and CDC Kernen, while the kernels were significantly larger than those of Katepwa and Laura. AAC Bailey had significantly higher grain protein concentration than Katewpa.

Other Characteristics

Disease Reactions

AAC Bailey expressed resistance to prevalent races of leaf rust and stem rust, moderate resistance to common bunt, and moderate susceptibility to loose smut (Table 3). AAC Bailey frequently had lower fusarium head blight disease index and lower deoxynivalenol (DON) than Lillian and Laura (Table 4).

End-use Suitability

AAC Bailey had quality parameters within the range of the checks and notably higher flour yield and stronger gluten than Lillian even though the protein concentration was less than Lillian (Table 5). However, the protein concentration of the whole grain and flour were comparable to the other checks and the protein loss upon milling was desirably less than all checks. While the farinograph absorption was less than Lillian, it was within the mean of the checks. AAC Bailey is eligible for grades of Canada Western Red Spring.

Spike

Parallel sided, medium density, erect to inclined attitude at maturity, medium glaucosity, white chaff colour at maturity, awnless; glumes are glabrous with medium width, short length, square to slightly elevated shoulder of medium width, and short beak length.

Kernel

Hard red type, medium red colour, small to medium size kernel, oval kernel shape, round to angular cheek shape, short brush hairs, medium large to midsize germ,

Table 5. Averages of end-use suitability[z] traits of AAC Bailey and checks cultivars in the Western Bread Wheat Cooperative tests from 2008 to 2010

	Wheat and flour analytical									
Cultivar	Wheat protein (%)	Flour protein (%)	Protein loss (%)	Hagberg falling no. (s)	Amylo-graph viscosity (BU)	Flour yield (% 0.50 ash)	Flour ash (%)	Flour color (Agtron)	Starch damage (mega-zeme)	Particle size index
Carberry	13.9	13.0	0.8	358	435	76.2	0.44	80.7	8.2	51.3
CDC Kernen	13.8	13.1	0.7	410	543	77.3	0.43	86.0	8.4	54.3
Katepwa	13.7	13.0	0.7	378	480	75.3	0.46	80.3	8.6	53.3
Laura	13.6	12.7	0.9	378	478	75.8	0.43	87.7	7.4	54.7
Lillian	14.4	13.7	0.7	425	578	74.7	0.49	81.3	7.9	53.7
Mean of checks	13.9	13.1	0.8	390	503	75.8	0.45	83.1	8.1	53.4
AAC Bailey	13.7	13.2	0.5	405	597	76.0	0.48	79.7	7.7	54.7
SD[y]	0.05	0.05		15	5	0.34	0.005	0.9	0.08	0.9

	Farinograph				Canadian short process (150 ppm ascorbic acid)			
	Absorption (%)	DDT[x] (min.)	MTI[w]	Stability (min)	Loaf volume (cc)	Baking absorption (%)	Mixing energy[v] ($w\text{-}hkg^{-1}$)	CSP mixing time (min)
Carberry	67.9	7.9	21.7	12.3	1098	67.0	10.2	4.2
CDC Kernen	68.3	8.7	18.3	15.5	1098	67.7	10.1	3.9
Katepwa	68.6	5.3	20.0	10.3	1060	67.7	8.9	3.6
Laura	67.4	10.2	16.7	18.8	1118	67.3	10.0	4.0
Lillian	69.9	5.9	20.0	11.2	1080	69.0	7.9	3.5
Mean of checks	68.4	7.6	18.7	13.7	1091	67.9	9.4	3.8
AAC Bailey	66.7	7.8	15.0	21.2	1092	67.0	10.5	4.4
SD[y]	0.2	0.4	2.6	1.4	45	NA[u]	0.3	0.2

[z]American Association of Cereal Chemists methods were followed by the Grain Research Laboratory, Canadian Grain Commission (GRL, CGC) for determining the various end-use suitability traits on a composite of 6 to 10 locations each year.
[y]SD is the standard deviation based on repeated testing of Allis mill check samples, and standard bake flour sample with replicate tests carried out over an extended period of time each season, provided by GRL, CGC.
[x]DDT is the farinograph dough development time measured in minutes.
[w]MTI is farinograph mixing tolerance index expressed in Brabender units (BU).
[v]Mixing energy expressed as watts per hour per kilogram.
[u]NA, not available.

Table 6. Stem solidness rating of each of four internodes of AAC Bailey and checks on plants grown near Swift Current, 2010

	Internode 1		Internode 2		Internode 3		Internode 4	
Cultivar	Mean	Duncan grouping	Mean	Duncan grouping	Mean	Duncan grouping	Mean	Duncan grouping
AAC Bailey	3.0[z]	c	2.3	bcde	1.7	b	2.1	bcd
AC Abbey	3.3	bc	2.9	ab	2.3	ab	3.5	a
AC Eatonia	3.8	ab	3.5	a	3.0	a	3.0	ab
Carberry	2.1	d	1.5	e	1.4	b	1.4	cd
CDC Kernen	3.0	c	2.0	cde	1.3	b	1.4	cd
Glenlea	3.0	c	2.2	bcde	1.7	b	1.8	bcd
Katepwa	2.9	c	2.2	bcde	1.8	b	1.8	bcd
Lancer	4.1	a	3.6	a	3.1	a	3.1	ab
Laura	2.8	c	1.8	de	1.1	b	1.1	d
Lillian	3.5	abc	2.6	bc	2.1	ab	2.5	abcd

[z]Solidness rated on a 1 (stem cavity hollow and thin walled) to 5 (stem cavity completely filled with pith) scale. Analysis of solidness rating based on a subsample of 10 plants per replication from each of four replicates.

round shape of germ, and medium wide crease of medium depth.

Stem

AAC Bailey had a semi-solid stem and the expression of 'solidness' was less pronounced than Lillian (Table 6).

Maintenance and Distribution of Pedigreed Seed

The 68 Breeder Lines, which originated from random $F_{6:10}$ single plants of B0203-KE02B, were grown out as pre-Breeder-Lines in 3-m-long rows in isolation near Swift Current in 2009, and again as 15-m rows near Indian Head in 2010. Breeder Seed will be maintained by the Seed Increase Unit of the Research Farm, Indian Head, Saskatchewan, Canada S0G 2K0. Application for Plant Breeders' Rights has been filed. The variety will be added to the OECD list of Cultivars. AAC Bailey has been released for distribution and multiplication to CANTERRA SEEDS 201 - 1475 Chevrier Boulevard, Winnipeg, Manitoba, Canada R3T 1Y7. Phone +1 (204) 988-9752; Fax +1 (204) 487-7682. www.canterra.com.

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American Association of Cereal Chemists. 2000. Approved methods of the AACC. 10th ed. AACC, St. Paul, MN.

Anonymous. 2013. Operating procedures, Prairie Recommending Committee for Wheat, Rye and Triticale. [Online] Available: http://www.pgdc.ca/pdfs/wrt/2013-14%20PRCWRT%20Operating%20Procedures_May_2013.pdf.

Campbell, A. B. and Czarnecki, E. 1987. Katepwa hard red spring wheat. Can. J. Plant Sci. **67**: 229–230.

DePauw, R. M., Knox, R. E., McCaig, T. N., Clarke, F. and Clarke, J. M. 2011. Carberry hard red spring wheat. Can J. Plant Sci. **91**: 529–534.

DePauw, R. M. and Read, D. W. L. 1982. The effect of nitrogen and phosphorus on the expression of stem solidness in Canuck wheat at 4 locations in S.W. Saskatchewan. Can. J. Plant Sci. **62**: 593–598.

DePauw, R. M., Townley-Smith, T. F., Humphreys, G., Knox, R. E., Clarke, F. R. and Clarke, J. M. 2005. Lillian hard red spring wheat. Can. J. Plant Sci. **85**: 397–401.

DePauw, R. M., Townley-Smith, T. F., McCaig, T. N. and Clarke, J. M. 1988. Laura hard red spring wheat. Can. J. Plant Sci. **68**: 203–206.

Fetch, T. G. 2005. Races of *Puccinia graminis* on wheat, barley, and oat in Canada, in 2002 and 2003. Can. J. Plant Pathol. **27**: 572–580.

Fowler, D. B. 1997. CDC Kestrel winter wheat. Can. J. Plant Sci. **77**: 673–675.

Gilbert, J. and Woods, S. 2006. Strategies and considerations for multi-location FHB screening nurseries. Pages 93–102. *in* T. Ban, J. M. Lewis, and E. E. Phipps, eds. The global fusarium initiative for international collaboration: A strategic planning workshop held at CIMMYT, El Batàn, Mexico. 2006 Mar. 14–17. CIMMYT, Mexico, D.F.

Graf, R. J., Potts, D. A. and Hanson, K. M. 2003. Journey hard red spring wheat. Can. J. Plant Sci. **83**: 807–811.

Hoffmann, J. A. and Metzger, R. J. 1976. Current status of virulence genes and pathogenic races of the wheat bunt fungi in the northwestern USA. Phytopathology **66**: 657–660.

Hucl, P. 2012. CDC Kernen. Plant Varieties Journal. Number 84. [Online] Available: http://www.inspection.gc.ca/english/plaveg/pbrpov/cropreport/whe/app00007709e.shtml.

McCallum, B. D. and Seto-Goh, P. 2006. Physiologic specialization of *Puccinia triticina*, the causal agent of wheat leaf rust, in Canada in 2004. Can. J. Plant Pathol. **28**: 566–576.

Menzies, J. G., Knox, R. E., Nielsen, J. and Thomas, P. L. 2003. Virulence of Canadian isolates of *Ustilago tritici*:

1964–1998, and the use of the geometric rule in understanding host differential complexity. Can. J. Plant Pathol. **25**: 62–72.
Nielsen, J. 1987. Races of *Ustilago tritici* and techniques for their study. Can. J. Plant Pathol. **9**: 91–105.
Roelfs, A. P. and Martens, J. W. 1988. An international system of nomenclature for *Puccinia graminis* f. sp. *tritici*. Phytopathology **78**: 525–533.
SAS Institute, Inc. 2003. SAS software. Version 9. SAS Institute, Inc. Cary, NC.
Williams, P. C. 1979. Screening wheat for protein and hardness by near infrared reflectance spectroscopy. Cereal Chem. **56**: 169–172.