CULTIVAR DESCRIPTION

Radiant hard red winter wheat

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Thomas, J. B., Conner, R. L. and Graf, R. J. 2012. Radiant hard red winter wheat. Can. J. Plant Sci. 92: 169–175. Radiant hard red winter wheat (Triticum aestivum L.) is well adapted to the non-hazard region for stem rust (Puccinia graminis Pers.: Pers. f. sp. tritici Eriks. & E. Henn.) within the Canadian prairies. Based on evaluation relative to Norstar, CDC Osprey, AC Tempest and AC Bellatrix in the Western Winter Wheat Cooperative registration trials, Radiant was similar in grain yield to AC Bellatrix, the highest yielding check. Radiant displayed very good winter survival, relatively late maturity, moderate height, very strong straw, high test weight and large seeds. It is the first Canadian wheat cultivar with resistance to colonization by the wheat curl mite (Aceria tosichella Keifer), the sole vector of wheat streak mosaic. Radiant was also shown to have good resistance to the prevalent races of stripe rust. It is susceptible to stem rust, leaf rust and common bunt. Radiant is eligible for all grades of the Canada Western Red Winter (CWRW) wheat class, having demonstrated a desirable combination of grain protein content, milling properties, dough functionality and baking performance. It has gained widespread commercial acceptance, particularly in Alberta.

Key words: Triticum aestivum L., wheat (winter), cultivar description, cold tolerance, wheat curl mite, wheat streak mosaic, stripe rust

Radiant hard red winter wheat (Triticum aestivum L.) was developed by Agriculture and Agri-Food Canada (AAFC) at the Lethbridge Research Centre (LRC), in Lethbridge, AB. It is the first wheat cultivar in Canada with protection from wheat streak mosaic virus, conditioned through resistance to colonization by the wheat curl mite (WCM) (Aceria tosichella Keifer) vector.

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Radiant received registration No. 5839 from the Variety Registration Office, Plant Production Division, Canadian Food Inspection Agency on 2004 Jul. 12. Plant Breeders’ Rights certificate No. 2355 was granted on 2005 Dec. 29.

Radiant is well adapted to the non-hazard region for stem rust (Puccinia graminis Pers.: Pers. f. sp. tritici Eriks. & E. Henn.) within the Canadian prairies and meets the end-use quality attributes of the Canada Western Red Winter (CWRW) wheat class. Since its release, it has been eligible for price premiums under the Canadian Wheat Board’s CWRW “Select” identity.

Abbreviations: AAFC, Agriculture and Agri-Food Canada; LRC, Lethbridge Research Centre; CWRW, Canada Western Red Winter; WCM: wheat curl mite; WSM, wheat streak mosaic.
preserved contract program. The name “Radiant” is in reference to the glowing appearance of its bronze chaff at maturity.

Rationale for Wheat Curl Mite Resistant Cultivars
Wheat streak mosaic (WSM) is a damaging viral disease of wheat in the Great Plains region of North America that has caused sporadic, but extensive losses (Atkinson and Grant 1967; Harvey et al. 1994). Vectored by the WCM (Slykhuis 1955), WSM incidence is enhanced in areas where spring and winter wheat are cultivated extensively, providing the opportunity for WSM to cycle from over-summered wheat plants onto the winter wheat crop in the fall, or onto spring wheat crops from over-wintered wheat plants in the spring (Slykhuis et al. 1957; Christian and Willis 1993). WCM resistance was originally considered for disease control in winter wheat because it had the potential to prevent the spread of both WSM and wheat spot mosaic (Slykhuis 1956). More recently, the high plains virus (Seifers et al. 1997; Mahmood et al. 1998) and Triticum mosaic virus (Seifers et al. 2009) were also shown to be vectored by the WCM. The development of mite-resistant cultivars is therefore expected to reduce the occurrence of all of these diseases (Thomas et al. 2004) and could become increasingly important if winter wheat continues to gain popularity in western Canada. WCM resistance has been highly effective in reducing the prevalence of WSM in Kansas (Harvey et al. 1994), but there is compelling evidence that the WCM can evolve to overcome any resistance that is deployed (Harvey et al. 1995a, b, 1997, 1999). To preserve the effectiveness of the WCM resistance gene utilized in Radiant (Cmc1), whenever practical, winter wheat producers should continue to use responsible agronomic practices that eliminate the “green bridge” of plant material that serves as a potential disease reservoir for young seedlings of a new crop.

Pedigree and Breeding Method
Radiant hard red winter wheat was selected from the cross Norstar*6/PGR16635/ Norwin/UT125512 made at the AAFC, LRC in Lethbridge. The final cross was made in 1987. Norstar is a CWRW wheat cultivar developed at the LRC from the cross Winalta/Alabaskaya (Grant 1980). PGR16635 is a synthetic hexaploid wheat produced at the University of Saskatchewan Crop Development Centre (D. B. Fowler, personal communication, University of Saskatchewan, Saskatoon, SK) and obtained from Plant Gene Resources of Canada, with the parentage Triticum tauschii [(Coss.) Schmalh.] CI 4/Novomichurinka; it is the source of Cmc1, a single dominant gene for resistance to colonization by the WCM (Thomas and Conner 1986). Norwin is a hard red winter wheat cultivar developed by Montana State University and registered as a CWRW wheat in 1986. It was derived from the cross Froid/Winoka/MT6928/Trader (Taylor et al. 1986). UT125512 is an experimental line developed by Utah State University with the pedigree: Delmar/3/Delmar/P1173438/Columbia/4/ McCall/5/Hansel (D. Hole, personal communication, Utah State University, Logan, UT).

Following greenhouse increase of the F1 seed, the F2 to F4 generations were grown as field bulks. Head selections were taken from the F4 bulk and screened for freezing tolerance, WCM resistance, and kernel appearance. Surviving F4-derived F5 families were grown as F6 hills and F7 rows in Lethbridge. Head selections were taken from desirable F7 rows based on screening for plant type, straw strength, protein content, test weight, and kernel appearance. The criteria for selection and harvest of the F8 rows were similar to those in the previous generation. In 1995, an F7-derived F8 line designated APB4AK7J was evaluated in preliminary agronomic trials and subsequently confirmed as wheat curl mite resistant. Three years of favourable agronomic performance and promising end-use quality attributes in replicated trials across Alberta and western Saskatchewan prompted entry into the Western Winter Wheat Cooperative (WWWC) registration trials. Tested as W337, merit assessment took place from 1997/1998 (1998) to 1999/2000 (2000) under the auspices of the Prairie Registration Recommending Committee for Grain: Wheat, Rye and Triticale Subcommittee.

Evaluation of suitability for registration in the WWWC trials was relative to Norstar, CDC Osprey (Fowler 1997), AC Tempest (Thomas and Graf 2012), and AC Bellatrix (Thomas et al. 2012). Agronomic trials were grown in Alberta (Beaverlodge, Lacombe, Lethbridge “dry land”, Lethbridge “irrigated”, Olds, Vegreville Vulcan, Warner), Saskatchewan (Indian Head, Melfort, Saskatoon, Swift Current), and Manitoba (Carman) through the collaborative efforts of AAFC, Alberta Agriculture and Rural Development, the University of Saskatchewan, the University of Manitoba, and the Alberta Research Council. Disease and pest resistance was measured by AAFC, the University of Manitoba, and the agronomic trial collaborators when differential reactions for various pathogens were observed. End-use quality analysis was performed by the Canadian Grain Commission. MINITAB was used for the combined mixed model statistical analysis, in which the effects of environment were considered random and genotypes were fixed (MINITAB Inc. 2007).

During the 3 yr of registration testing, resistance to the major diseases of economic importance to winter wheat in both the western and eastern prairies was assessed. Adult plant reactions to stem rust (Puccinia graminis Pers.: Pers. f. sp. tritici Eriks. & E.enn.) and leaf rust (P. triticina Eriks.) were determined in inoculated field nurseries conducted by the University of Manitoba in Winnipeg, MB. The composite of stem rust races used for 1 or more years included: QTHST (C25), RHTSK (C20), RKQR (C63), RHTHT (C57), TMRTF (C95),
Performance

Grain yield and agronomic trait data for Radiant are reported from replicated tests conducted over 8 yr (1998 to 2005) in the WWWC registration trials, in which the first 3 yr of data were used to determine the merit for registration, with the latter 5 yr of data collected as part of the test check data. The reporting of the additional data following the recommendation for registration was facilitated by the stable complement of check cultivars in the registration trial, providing a longer term indication of agronomic performance.

Based on 65 site-years (1998 to 2005) of grain yield data, Radiant yielded 8% higher than Norstar and 4% higher than AC Tempest (P ≤ 0.05) (Table 1). It was 1% higher yielding than CDC Osprey, and based on 57 sites of data (1999 to 2005) was similar in yield to AC Bellatrix. On a regional basis, Radiant exhibited a yield advantage over all of the check cultivars in Zone 1 (southern Alberta), where it was 14% higher than Norstar (P ≤ 0.05), 4% higher than AC Bellatrix, 3% higher than CDC Osprey, and 2% higher than AC Tempest.

Radiant exhibited very good winter survival, being similar to Norstar and CDC Osprey, and significantly better than AC Bellatrix and AC Tempest (Table 2). On average, Radiant matured 3.5 d, 1.8 d and 1.5 d later than CDC Osprey, Norstar and AC Bellatrix, respectively. It was 0.7 d earlier maturing than AC Tempest. The grain filling period, defined as the time from heading to maturity, was also longer for Radiant than all of the checks except AC Tempest. Radiant was similar in height to all of the checks except Norstar, which was 17.5 cm taller. Straw strength, as indicated by the lodging score, was better than all of the checks except AC Tempest.

Radiant was susceptible to stem rust, leaf rust and common bunt (Table 3). The reaction to powdery mildew infection was similar to the best checks, but

Table 1. Grain yield (t ha⁻¹) of Radiant compared with the check cultivars, Western Winter Wheat Cooperative registration trials (1998–2005)

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Zone 1</th>
<th>Zone 2</th>
<th>Zone 3</th>
<th>Zone 4</th>
<th>1999–2005</th>
<th>1998–2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norstar</td>
<td>3.910</td>
<td>4.150</td>
<td>3.137</td>
<td>4.592</td>
<td>4.147</td>
<td>4.210</td>
</tr>
<tr>
<td>CDC Osprey</td>
<td>4.338</td>
<td>4.139</td>
<td>3.921</td>
<td>5.031</td>
<td>4.436</td>
<td>4.489</td>
</tr>
<tr>
<td>AC Bellatrix</td>
<td>4.298</td>
<td>4.432</td>
<td>3.584</td>
<td>5.061</td>
<td>4.520</td>
<td>4.551</td>
</tr>
<tr>
<td>Radiant</td>
<td>4.475</td>
<td>4.229</td>
<td>3.402</td>
<td>5.055</td>
<td>4.503</td>
<td>4.498</td>
</tr>
<tr>
<td>LSD (P ≤ 0.05)</td>
<td>0.282</td>
<td>0.234</td>
<td>0.780</td>
<td>0.406</td>
<td>0.168</td>
<td>0.166</td>
</tr>
<tr>
<td>No. of tests</td>
<td>20</td>
<td>20</td>
<td>2</td>
<td>15</td>
<td>57</td>
<td>65</td>
</tr>
</tbody>
</table>

*All means are weighted by the number of tests.

†All zone means are for the 1999–2005 period.

Zone 2: Parkland sites (Beaverlodge, Lacombe, Melfort, Olds, Vegreville).
Zone 3: Semi-arid prairie site (Swift Current).
Zone 4: Eastern prairie rust hazard sites (Carman, Indian Head, Saskatoon).

“AC Bellatrix was not included in the 1998 trials.

Least significant difference includes variation from the genotype by environment interaction.
tended to be similar to or worse than the checks for leaf spotting diseases. Good resistance to the WCM was shown through the absence of typical leaf rolling and trapping of subsequent leaves as compared to susceptible check cultivars. In 2006, a severe epidemic of stripe rust (*Puccinia striiformis*) Westend.) in Alberta and much of the Canadian prairies (McCallum et al. 2007) demonstrated that Radiant had good resistance to the prevalent races. Molecular analysis later identified the presence of the 1100 bp DNA fragment from the *Yr10* resistance gene (Frick et al. 1998). Further pedigree expansion of UT125512 revealed that PI178383 was a parent of Hansel (Dewey 1975) and is the likely contributor of *Yr10* (Metzger and Silbaugh 1970).

During the 3 yr of evaluation for registration, CDC Osprey and AC Tempest were used as the end-use quality checks. The data for seed characteristics were therefore only collected for these checks. The test weight of Radiant was significantly higher than CDC Osprey but significantly lower than AC Tempest (Table 4). Kernel mass was significantly higher than CDC Osprey and similar to AC Tempest. Radiant had a grain protein content and protein yield per hectare similar to CDC Osprey, but significantly lower than AC Tempest. Radiant was rated as equal to the check cultivars in end-use quality, exhibiting acceptable grain protein concentration, milling properties, dough functionality and baking performance (Table 5). It is eligible for registration because of its overall good agronomic and end-use performance.

### Table 2. Agronomic performance of Radiant compared with the check cultivars, Western Winter Wheat Cooperative registration trials (1999–2005)

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Winter Survival (%)</th>
<th>Headinga (d)</th>
<th>Maturitya (d)</th>
<th>Height (cm)</th>
<th>Lodginga (1–9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norstar</td>
<td>91.6</td>
<td>176.5</td>
<td>200.9</td>
<td>105.3</td>
<td>4.7</td>
</tr>
<tr>
<td>AC Tempest</td>
<td>79.9</td>
<td>174.2</td>
<td>220.4</td>
<td>86.6</td>
<td>1.6</td>
</tr>
<tr>
<td>CDC Osprey</td>
<td>87.9</td>
<td>170.3</td>
<td>219.6</td>
<td>87.1</td>
<td>2.9</td>
</tr>
<tr>
<td>AC Bellatrix</td>
<td>81.8</td>
<td>175.5</td>
<td>221.2</td>
<td>86.9</td>
<td>1.9</td>
</tr>
<tr>
<td>Radiant</td>
<td>87.4</td>
<td>174.1</td>
<td>222.7</td>
<td>87.8</td>
<td>2.0</td>
</tr>
<tr>
<td>LSD (P ≤ 0.05)b</td>
<td>4.5</td>
<td>0.5</td>
<td>0.8</td>
<td>1.6</td>
<td>0.5</td>
</tr>
<tr>
<td>No. of tests</td>
<td>33</td>
<td>42</td>
<td>43</td>
<td>50</td>
<td>29</td>
</tr>
</tbody>
</table>

*Days to heading and maturity expressed as day of year.

*Lodging scale: 1=all plants vertical, 9=all plants horizontal.

*Least significant difference includes variation from the genotype by environment interaction.

### Table 3. Disease reactions of Radiant compared with the check cultivars, Western Winter Wheat Cooperative registration trials (1998–2000; 2006 for stripe rust)

<table>
<thead>
<tr>
<th>Year</th>
<th>Norstarc</th>
<th>AC Tempest</th>
<th>CDC Osprey</th>
<th>AC Bellatrixd</th>
<th>Radiant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stem rustb</td>
<td>1998</td>
<td>70 S</td>
<td>30 S</td>
<td>40 MS-S</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>1999</td>
<td>50 VS</td>
<td>50 VS</td>
<td>30 S</td>
<td>60 VS</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>40 S</td>
<td>80 S-VS</td>
<td>60 S</td>
<td>60 S</td>
</tr>
<tr>
<td>Leaf rustb</td>
<td>1998</td>
<td>40 S</td>
<td>30 S</td>
<td>60 MS-S</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>1999</td>
<td>70–80 S</td>
<td>60 S</td>
<td>60–70 S</td>
<td>60 S</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>15–20 S</td>
<td>20–30 S</td>
<td>10 MS-S</td>
<td>10–15 MS-S</td>
</tr>
<tr>
<td>Common buntc</td>
<td>1998</td>
<td>64 VS</td>
<td>33 S</td>
<td>69 VS</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>1999</td>
<td>83 VS</td>
<td>54 S</td>
<td>78 VS</td>
<td>9 R</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>–</td>
<td>58 S</td>
<td>74 S</td>
<td>25 I</td>
</tr>
<tr>
<td>Powdery mildewb</td>
<td>1998</td>
<td>2.3</td>
<td>3.1</td>
<td>3.7</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>1999</td>
<td>3.4</td>
<td>2.8</td>
<td>4.0</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>2.5</td>
<td>2.8</td>
<td>3.1</td>
<td>2.2</td>
</tr>
<tr>
<td>Leaf spotswx</td>
<td>1998</td>
<td>3.1</td>
<td>3.1</td>
<td>3.8</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>1999</td>
<td>3.6</td>
<td>2.9</td>
<td>3.8</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>2.5</td>
<td>2.6</td>
<td>3.0</td>
<td>2.8</td>
</tr>
<tr>
<td>Wheat curl mite</td>
<td>1998</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>1999</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Stripe rustx</td>
<td>2006</td>
<td>–</td>
<td>2.6</td>
<td>3.3</td>
<td>7.1</td>
</tr>
</tbody>
</table>

*aNorstar was not included in the 2006 trials; AC Bellatrix was not included in the 1998 trials.

*bPercent infection and type of reaction: R = resistant, MR = moderately resistant, I = intermediate, MS = moderately susceptible, S = susceptible, VS = very susceptible.

*xRated using a 1–9 scale: 1 = disease free, 9 = very severe symptoms.

*wSpecific leaf spotting pathogens were not determined.
all grades of CWRW wheat and is one of the check cultivars in the WWWC registration trials. Certified seed of Radiant became commercially available to producers in fall 2004 and by 2006 it had become the predominant CWRW wheat cultivar in Alberta (Canadian Wheat Board 2006). In 2009, it was the predominant cultivar in western Canada, planted on 27.1% of the CWRW wheat acreage; in 2010, Radiant accounted for 61.8% of the CWRW wheat acreage in Alberta (Canadian Wheat Board 2010).

The continued development and use of lodging resistant, intermediate height cultivars is an important consideration in managing sustainable agricultural systems. Blackshaw (1994) showed that planting taller, more competitive winter wheat cultivars resulted in higher crop yields and less downy brome seed for weed establishment in subsequent crops. In a further study, it was shown that at a row spacing of 23 cm, seeding rates of 300 and 450 seeds m\(^{-2}\) versus a higher seeding rate of 600 seeds m\(^{-2}\) maximized yield for Radiant and several other winter wheat cultivars (Beres et al. 2010). The higher plant densities helped to preserve adequate and competitive spring stands for all cultivars in the study. Total weed biomass was reduced at the higher plant densities, particularly for Radiant, which is intermediate in height with an erect plant type and excellent straw strength. This was in contrast to shorter cultivars, which were less competitive with weeds and did not reduce weed biomass, a result of greater light penetration into the crop canopy (Blackshaw 1994; Beres et al. 2010).

**Other Characteristics**

**Seedling Characteristics**
Coleoptile anthocyanin colouration: absent (green).
Intensity of anthocyanin colouration: absent.
Juvenile growth habit: prostrate.
Pubescence of lower leaf sheath: glabrous.
Pubescence of lower leaf blades: glabrous.
Colour of lower leaf blade: medium green.
Tillering capacity (at low densities): medium-plus.

**Plant Characteristics at Booting**
Growth habit: erect to semi-erect.
Flag leaf colour: medium green.
Pubescence of flag leaf blade: glabrous.
Waxiness of lower side of flag leaf blade: slight.
Waxy bloom of flag leaf sheath: medium to strong.
Pubescence of flag leaf sheath: glabrous.
Flag leaf width: medium-narrow.
Flag leaf length: medium-long.
Flag leaf attitude: intermediate.
Anthocyanin colouration of flag leaf auricles: absent or very weak.
Pubescence of flag leaf auricle margins: moderate.

**Plant Characteristics after Heading**
Shape of culm neck: straight.
Waxiness of culm upper internode: weak to medium-weak.
Pubescence of culm upper internode: glabrous.
Pubescence of rachis margins: very strong.
Anthocyanin colouration of straw at maturity: absent.
Pith in cross-section of straw (at middle of internode below the neck): hollow.
Stem colour at maturity: light yellow.

**Spike Characteristics**
Shape: tapering.
Attitude at maturity: somewhat inclined.
Density: medium to medium-dense.
Length: medium long.
Waxy bloom: medium.
Colour at maturity: brown.
Awnedness: awned.
Length of awns at tip of spike: shorter than spike.
Awn colour: brown.
Awn attitude: very slightly spreading.
Supernumary spikelets: absent.

**Lower Glume Characteristics**
Width: medium-narrow.
Length: medium-long.
Pubescence: pubescent on glume margins, otherwise glabrous.
Shape of shoulder: sloping to slightly sloping.
Shoulder width: narrow.
Shape of beak: slightly curved.
Beak length: medium-long.
Lower glume – internal imprint: absent.
Colour at maturity: dark brown.

**Kernel Characteristics**
Class eligibility: CWRW Wheat.
Type: hard red.
Colour: medium red.

### Table 4. Seed characteristics of Radiant compared with the check cultivars, Western Winter Wheat Cooperative registration trials (1998–2005)

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Test weight (kg hL(^{-1}))</th>
<th>Kernel mass (mg)</th>
<th>Grain protein(^{a}) (%)</th>
<th>Protein yield (kg ha(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC Tempest</td>
<td>79.7</td>
<td>35.9</td>
<td>13.8</td>
<td>628</td>
</tr>
<tr>
<td>CDC Osprey</td>
<td>78.4</td>
<td>30.4</td>
<td>12.3</td>
<td>579</td>
</tr>
<tr>
<td>Radiant</td>
<td>79.3</td>
<td>35.5</td>
<td>12.3</td>
<td>586</td>
</tr>
<tr>
<td>LSD ((P &lt; 0.05))(^{x})</td>
<td>0.4</td>
<td>0.7</td>
<td>0.2</td>
<td>20</td>
</tr>
<tr>
<td>No. of tests</td>
<td>54</td>
<td>55</td>
<td>53</td>
<td>52</td>
</tr>
</tbody>
</table>

\(^{a}\)Grain protein content determined using whole grain NIR analysis.
\(^{x}\)Norstar and AC Bellatrix seed characteristics were not determined in all years and are therefore not reported.
\(^{x}\)Least significant difference includes variation from the genotype by environment interaction.
Maintenance and Distribution of Breeder Seed

Breeder Seed production was initiated by randomly selecting approximately 200 plants from a rogued F7-derived F13 increase plot grown in 1999. Seed from each plant was grown in a 3 m long row, with a small amount of seed retained to confirm resistance to WCM colonization. Following the harvest of WCM resistant, morphologically similar rows in 2000, grain protein content and sodium dodecyl sulphate sedimentation volume were determined for each plant progeny row. Rows that were greater than one standard deviation below the mean for both of these quality parameters were discarded. In fall 2000, 165 lines were planted under isolation as individual plots in two randomized replicates. After removal of lines that revealed off-type plants or contamination, 135 Breeder Seed lines were inspected and then composited in equal proportions to generate 750 kg of Breeder Seed. The AAFC Seed Increase Unit at Indian Head, SK will maintain the Breeder Seed of Radiant. All other classes of seed will be multiplied and distributed by Canterra Seeds Ltd., 201 Chevrier Blvd., Winnipeg, MB, Canada R3T 1Y7.

Sincere appreciation is expressed to the AAFC LRC staff members who assisted in the development of Radiant winter wheat, in particular: David Quinn, Martin Fast, James Prus, Tara Vucurevich, Allan Kuzyk and Byron Puchalski. The authors also acknowledge all of the scientific and technical support provided by AAFC staff, particularly at the research centres in Lethbridge, Swift Current and Winnipeg, and all contributors to the Western Winter Wheat Cooperative registration trials. Financial support from the producer check-off on wheat collected by the Canadian Wheat Board and administered by the Western Grains Research Foundation is gratefully recognized.


<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Wheat protein (%)</th>
<th>Flour protein (%)</th>
<th>Protein loss (%)</th>
<th>Hagberg falling no. (s)</th>
<th>Amylograph peak viscosity (B.U.)</th>
<th>Flour yield (%)</th>
<th>Flour ash (%)</th>
<th>Flour colour (Agtron)</th>
<th>Starch damage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC Tempest</td>
<td>13.5</td>
<td>12.8</td>
<td>0.6</td>
<td>395</td>
<td>663</td>
<td>73.6</td>
<td>0.37</td>
<td>73.7</td>
<td>5.4</td>
</tr>
<tr>
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Table 5. Mean end-use quality characteristics of Radiant and check cultivars, Western Winter Wheat Cooperative registration trials (1998–2000)

Farinograph

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</table>

SD: Standard deviation. American Association of Cereal Chemists methods were followed by the CGC, GRL for determining the various end-use quality characteristics on a composite of several locations per year. Values provided by the CGC, GRL.


MINITAB Inc. 2007. MINITAB statistical software. Release 15.1.30.0. MINITAB Inc., State College PA.


