Red River 1997 Roundup Ready™ high erucic acid, low glucosinolate summer rape


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McVetty, P. B. E., Fernando, W. G. D., Li, G., Tahir, M. et Zelmer, C. D. 2010. Red River 1997 Roundup Ready™ high erucic acid, low glucosinolate summer rape. Can. J. Plant Sci. 90: 711/713. Red River 1997 summer rape (Brassica napus L.) is the world’s third Roundup Ready™ high erucic acid, low glucosinolate cultivar. On average, Red River 1997 yielded 13% more seed and 22 g kg⁻¹ more seed oil, but 4 g kg⁻¹ less meal protein than Millennium 03 high erucic acid, low glucosinolate summer rape. Red River 1997 has an erucic acid content of 51.4% in isolated field trials of HEAR lines and is adapted to the southern B. napus growing regions of western Canada.

Key words: Rape, Roundup Ready™ high erucic acid, low glucosinolate, cultivar description

Red River 1997 Roundup Ready™ summer rape (Brassica napus L.), tested as RRHR6818 in the Western Canadian Co-operative Canola/Rapeseed HEAR Contract Registration Tests in 2007 and 2008, is a high erucic acid (51.4%), rapeseed (HEAR) cultivar with low glucosinolate meal (12.1 μmol total glucosinolates g⁻¹ seed @ 8.5% H2O). On average, Red River 1997 yielded 13% more seed and 22 g kg⁻¹ more seed oil but 4 g kg⁻¹ less meal protein than Millennium 03 high erucic acid, low glucosinolate summer rape, the Western Canadian Canola/Rapeseed Recommending Committee Inc. (WCC/RRC Inc.) designated HEAR check. Red River 1997 was developed at the Department of Plant Science, University of Manitoba, and it was issued a Certificate of Restricted Registration no. 6733 on 2010 Feb. 05, by the Variety Registration Office, Plant Products Division Canadian Food Inspection Agency Ottawa, Ontario. The terms of the Restricted Registration state that the Registrant of Red River 1997 (i.e., Bunge Canada) shall implement and maintain a quality control system as reviewed and approved by the Registrar. Red River 1997 is the third in the series of Roundup Ready HEAR cultivars, after Red River 1826 (McVetty et al. 2006) and Red River 1852 (McVetty et al. 2006). The numeric designation 1997 refers to the year 1997, the year of the third largest Red River flood in recorded history.

Pedigree and Breeding Methods

Red River 1997 (RRHR6818) was derived from a cross between the homozygous Roundup Ready gene containing canola quality summer rape (B. napus) cultivar “SP Bucky RR” and the high erucic acid rapeseed (B. napus) line HR 102, made in 2003. HR 102 was developed from the cross Cyclone/Mercury//LG 3333, made in 1998. Twelve F₁ plants from the HR 102/SP Bucky cross were grown in the greenhouse, sprayed with Roundup and self-pollinated to produce an F₂ population. Three hundred and thirty-six F₂ plants were grown in the greenhouse and sprayed with Roundup. The surviving 282 F₂ plants were self-pollinated to produce an F₃ population. Three hundred and thirty-six F₃ plants were grown in the greenhouse and sprayed with Roundup. The surviving 282 F₂ plants were self-pollinated to produce an F₃ family. The seed of F₃ families were analyzed for erucic acid content. Fifty-five F₃ families with high erucic acid content (>40%) were selected for advancement. Twenty-four plants each from 55 F₃ families were grown in the greenhouse and sprayed with Roundup. The surviving 282 F₂ plants were self-pollinated to produce an F₃ family. The seed of F₃ families were analyzed for erucic acid content. Fifty-five F₃ families with high erucic acid content (>40%) were selected for advancement. Twenty-four plants each from 55 F₃ families were grown in the greenhouse and sprayed with Roundup. Twenty-three pure-breeding Roundup Ready F₃ families were identified and eight plants in each of these F₃ families self-pollinated to the F₄. The F₄ seed families produced on each plant from the pure-breeding Roundup Ready F₃ families were analyzed for erucic acid content. Nine pure breeding
high erucic acid content (>40%) F3 families were identified. Seventy-two pure breeding Roundup Ready, high erucic acid content F4 families were grown in isolated fields of HEAR materials in 2005. Selection in the F4 families was based solely on seed quality, i.e., on the basis of high erucic acid content, high seed oil content and high meal protein content. Ten F5 families were grown in advanced yield trials in 2006. Two bulk F4-derived families were grown in the HEAR Contract Registration Tests in 2007 and 2008. Red River 1997 (RRHR6818) was derived from a single F4 family, bulk harvested in 2005.

Performance
Red River 1997 was evaluated in 2007 and 2008 in the mid- and long-season zones of the WCC/RRC Inc. HEAR Contract Registration Tests. It surpassed Millenium 03 in yield in each production zone, and had an average yield advantage of 13% (Table 1). Red River 1997 matured in 95 d, 3 d later than Millenium 03, and 1 d later than the mean of the WCC/RRC Inc. designated canola quality checks for maturity, 46A65 and Q2 (data not shown). It had a lower lodging score (2.1) compared with Millenium 03 (2.6). Red River 1997 had an average seed oil content of 498 g kg\(^{-1}\), 2.2 g kg\(^{-1}\) higher than Millenium 03 and an average meal protein content of 462 g kg\(^{-1}\), 4.6 g kg\(^{-1}\) lower than Millenium 03. The erucic acid content of Red River 1997 seed averaged 51.4% of the total fatty acids in the seed oil, 2.2% lower than the erucic acid content of Millenium 03. The average total glucosinolate content of the whole seed on a 8.5% moisture basis, over the two years of official trials was 12.1 \(\text{mmol g}^{-1}\) seed for Red River 1997, higher than that for Millenium 03 (10.6 \(\text{mmol g}^{-1}\) seed) but lower than the mean of canola checks (17.5 \(\text{mmol g}^{-1}\) seed) (data not shown). This permits the meal produced by Red River 1997 to be used in similar applications to canola meal.

Other Characteristics
Red River 1997 was evaluated in the disease tests conducted in 2007 and 2008 by the WCC/RRC Inc. Based on the results from these tests, Red River 1997 is classified as resistant to blackleg disease (caused by \textit{Leptosphaeria maculans}) and fusarium wilt (caused by \textit{Fusarium oxysporum}) (Table 1). It is the third Roundup Ready\textsuperscript{TM} blackleg and fusarium wilt resistant high erucic acid rapeseed cultivar to be registered in Canada.

Maintenance and Distribution of Pedigreed Seed
Breeder seed is maintained by Viterra, 210-407 Downey Road, Saskatoon, Saskatchewan, Canada S7N 4L8 under contract to Bunge Canada. Viterra will also multiply and distribute other classes of pedigreed seed.

### Table 1. Yield, maturity, lodging, seed oil content, meal protein content, erucic acid content and total glucosinolate content of summer rape (\textit{Brassica napus} L.) cultivars Red River 1997 (RRHR6818) and Millenium 03 in the Western Canadian Co-operative Canola/Rapeseed HEAR Contract Registration Tests 2007-2008

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Yield (kg ha(^{-1}))</th>
<th>Maturity (1-5)</th>
<th>Lodging((x))</th>
<th>Seed oil((g kg(^{-1})))</th>
<th>Meal protein((g kg(^{-1})))</th>
<th>Erucic acid((%))</th>
<th>Total glucosinolates((\text{mmol g}^{-1}) seed))</th>
<th>Blackleg disease severity((0-5))</th>
<th>Fusarium wilt class ((0-5))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red River 1997</td>
<td>2674</td>
<td>351</td>
<td>21</td>
<td>498</td>
<td>462</td>
<td>51.4</td>
<td>12.1</td>
<td>R</td>
<td>1.1</td>
</tr>
<tr>
<td>Millenium 03</td>
<td>2515</td>
<td>315</td>
<td>0.5</td>
<td>476</td>
<td>3.4</td>
<td>53.6</td>
<td>10.6</td>
<td>1.1</td>
<td>2</td>
</tr>
<tr>
<td>LSD (0.05)(^q)</td>
<td>125</td>
<td>138</td>
<td>0.5</td>
<td>466</td>
<td>3.9</td>
<td>53.6</td>
<td>10.6</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Tests (2007-2008)</td>
<td>125</td>
<td>138</td>
<td>0.5</td>
<td>466</td>
<td>3.9</td>
<td>53.6</td>
<td>10.6</td>
<td>0.6</td>
<td>0.6</td>
</tr>
</tbody>
</table>

* \(x\): Long-season zone (Brandon, MB, 2007 and 2008; Yorkton, SK, 2007 and 2008).
* \(y\): Mid-season zone (Lake Lenore, SK, 2007 and 2008; Rosthern, SK, 2008; Valparaiso, MB, 2008; Watrous, SK, 2008; Yorkton, SK, 2007 and 2008).
* \(z\): Mid-season zone (Portage la Prairie, MB, 2008).
* \(w\): Oil content (whole-seed zero-moisture basis), by near infrared measurements.
* \(v\): Protein content (N\/(C\(\text{N}\)6.25 in oil-free meal, zero-moisture basis), by near infrared measurements.
* \(u\): Erucic acid (% of total fatty acids in seed oil), by gas chromatography from seed grown in isolated fields of HEAR materials.
* \(t\): Total glucosinolates (whole seed, 8.5% moisture basis), by near infrared measurements.
* \(s\): Mean of four field tests grown in 2007-2008, Westar mean 3.7 in these trials.
* \(r\): Mean of two trials grown in 2007-2008.
* \(q\): LSD derived from cultivar-by-test interaction mean square.
under contract to Bunge Canada, Bag #1, Highway 35 south, Nipawin Saskatchewan, Canada S0E 1E0.

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