

Red River 1861 Roundup Ready™ high erucic acid, low glucosinolate summer rape

P. B. E. McVetty, R. W. Duncan, W. G. D. Fernando, G. Li, and C. D. Zelmer

Department of Plant Science, University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2.

Received 5 June 2012, accepted 26 July 2012.

McVetty, P. B. E., Duncan, R. W., Fernando, W. G. D., Li, G. and Zelmer, C. D. 2012. **Red River 1861 Roundup Ready™ high erucic acid, low glucosinolate summer rape.** Can. J. Plant Sci. **92**: 1407–1409. Red River 1861 summer rape (*Brassica napus* L.) is the world's fourth Roundup Ready™ high erucic acid, low glucosinolate cultivar. On average, Red River 1861 yielded 19% more seed, 7 g kg⁻¹ more seed oil and 7 g kg⁻¹ more meal protein than MillenniUM 03 high erucic acid, low glucosinolate summer rape. Red River 1861 has an erucic acid content of 52.6% 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

McVetty, P. B. E., Duncan, R. W., Fernando, W. G. D., Li, G. et Zelmer, C. D. 2012. **Le colza à forte teneur en acide érucique et à faible teneur en glucosinolates Roundup Ready^{MC} Red River 1861.** Can. J. Plant Sci. **92**: 1407–1409. Le colza (*Brassica napus* L.) Red River 1861 est le quatrième cultivar à forte teneur en acide érucique et à faible teneur en glucosinolates Roundup Ready^{MC} au monde. En moyenne, Red River 1861 donne 19 % plus de graines, 7 g plus d'huile par kg de graines et 7 g de plus de protéines par kg de tourteau que la variété à forte teneur en acide érucique et à faible teneur en glucosinolates MillenniUM 03. La teneur en acide érucique de Red River 1861 a atteint 52,6 % dans les essais en champs isolés des lignées à forte teneur en acide érucique et la variété est acclimatée au sud des régions de l'Ouest canadien où l'on cultive *B. napus*.

Mots clés: Colza, Roundup Ready^{MC}, forte teneur en acide érucique, faible teneur en glucosinolates, description de cultivar

Red River 1861 Roundup Ready™ summer rape (*Brassica napus* L.), tested as RRHR8706 in the Western Canadian Co-operative Canola/Rapeseed High Erucic Acid Rapeseed (HEAR) Contract Registration Tests in 2009 and 2010, is a high erucic acid content in seed (52.6%), rapeseed cultivar with low glucosinolate content in seed meal (9.3 μmol total glucosinolates g⁻¹ seed at 8.5% H₂O). On average, Red River 1861 yielded 19% more seed, 7 g kg⁻¹ more seed oil and 7 g kg⁻¹ more 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 1861 was developed at the Department of Plant Science, University of Manitoba, and it was issued a Certificate of Restricted Registration no. 7155 on 2012 Mar. 07, 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 1861 (i.e., Bunge Canada) shall implement and maintain a quality control system as reviewed and approved by the Registrar. Red River 1861 is the fourth in the series of Roundup Ready™ HEAR cultivars, after Red River 1826 (McVetty et al. 2006a), Red River 1852 (McVetty et al. 2006b) and Red River

1997 (McVetty et al. 2010). The numeric designation 1861 refers to the year 1861, the year of the fourth largest Red River flood in recorded history.

Pedigree and Breeding Methods

Red River 1861 (RRHR8706) was derived from a cross between the homozygous Roundup Ready™ gene containing canola quality summer rape (*B. napus*) cultivar “SP Bucky RR” and the Roundup Ready™ gene containing high erucic acid rapeseed (*B. napus*) line RRHR1102, completed in 2003. RRHR1102 was derived developed from the cross Castor × UM1-73 RR, completed in 1996. Twelve F₁ plants from the RRHR1102 × SP Bucky RR cross were grown in the greenhouse, sprayed with Roundup and self-pollinated to produce an F₂ population. Two hundred and eighty-four F₂ plants were grown in the greenhouse and sprayed with Roundup. The surviving 282 F₂ plants were self-pollinated to the F₃. The F₃ seed samples were analyzed for erucic acid content. Twenty F₃ families with high erucic acid content (>40%) were selected for advancement. Ten plants each from 20 F₃ families were grown in the greenhouse, sprayed with Roundup and self-pollinated to F₄ seed lots. The F₄ seed families produced on each plant from the pure breeding Roundup Ready F₃ families were analyzed for erucic acid content.

Seven pure breeding high erucic acid content (>40%) F₃ families were identified. Fifty-two pure breeding Roundup Ready, pure breeding high erucic acid content F₄ families were grown in isolated fields beginning in 2006. Selection in the F₄ 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. Eight F₅ families were grown in preliminary yield trials in 2007. Selection in the F₅ was based on seed yield, seed quality, blackleg (caused by *Leptosphaeria maculans*) resistance and fusarium (caused by *Fusarium oxysporum*) resistance. Seven F₆ selections from the preliminary yield trials were grown in advanced yield trials in 2008. Selection in the F₆ was based on seed yield, seed quality and blackleg resistance. Three advanced yield trial entries from this cross were advanced to HEAR Contract Registration Tests grown in 2009 and 2010. Red River 1861 (RRHR8706) was derived from a single F₄ family bulk harvested in 2006.

Performance

Red River 1861 was evaluated in 2009 and 2010 in the mid and long season zones of the WCC/RRC Inc. HEAR Contract Registration Tests. It surpassed MillenniUM 03 in yield in both years and had an average yield advantage of 19% (Table 1). Red River 1861 matured in 101 d, identical to MillenniUM 03 and identical to the mean of the WCC/RRC Inc. designated canola quality checks for maturity, 46A65 and Q2 (data not shown). It had a much lower lodging score (2.4) compared with MillenniUM 03 (3.3). Red River 1861 had an average seed oil content of 500 g kg⁻¹, 7 g kg⁻¹ higher than MillenniUM 03 and an average meal protein content of 458 g kg⁻¹, 7 g kg⁻¹ higher than MillenniUM 03. The erucic acid content of Red River 1861 seed averaged 52.6% of the total fatty acids in the seed oil, 0.3% lower than the erucic acid content of MillenniUM 03 seed produced in 12 isolated field trials of HEAR lines. The average total glucosinolate content of Red River 1861 whole seed on a 8.5% moisture basis, over the 2 yr of official trials was 9.3 μmol g⁻¹ seed, lower than that for MillenniUM 03 (13.0 μmol g⁻¹ seed) and much lower than the mean of canola checks (16.2 μmol g⁻¹ seed) (data not shown). This permits the meal produced by Red River 1861 to be used in similar applications to canola meal.

Other Characteristics

Red River 1861 was evaluated in the disease tests conducted in 2009 and 2010 by the WCC/RRC Inc. Based on the results from these tests, Red River 1861 is classified as resistant to blackleg disease and fusarium wilt (Table 1). It is the fourth Roundup Ready™ blackleg and fusarium wilt resistant high erucic acid rapeseed cultivar to be registered in Canada. Each successive Roundup Ready™ HEAR cultivar in the Red River 1852, Red River 1826, Red River 1997 and Red River 1861 series had incremental improvements for seed yield of approximately 8%, with Red River 1861 yielding 26%

Table 1. Yield, flower, maturity, height, lodging, seed oil content, meal protein content, erucic acid content and total glucosinolate content of summer rape (*Brassica napus* L.) cultivars Red River 1861 (RRHR8706) and MillenniUM 03 in the Western Canadian Co-operative Canola/Rapeseed HEAR Contract Registration Tests 2009–2010

Cultivar	Yield (kg ha ⁻¹)							Blackleg disease severity (0–5) ^s	Fusarium wilt class ^r				
	Long season zone ^z	Mid season zone ^y	Mean	Flower (d)	Maturity (d)	Height (cm)	Lodging (1–5) ^x			Seed oil (g kg ⁻¹) ^w	Meal protein (g kg ⁻¹) ^y	Erucic acid (%) ^u	Total glucosinolates (μmol g ⁻¹ seed) ^t
Red River 1861 (RRHR8706)	2572	3945	3488	44	101	102	2.4	500	458	52.6	9.3	0.7	R
MillenniUM 03	2260	3245	2916	43	96	101	3.3	493	451	52.9	13.0	0.7	R
LSD (0.05) ^q	66	162	137	0.5	0.5	8.5	0.2	3.2	4.6	1.8	0.6	–	–
Tests (2009+2010)	4	8	12	6	12	7	10	12	12	12	12	3	2

^zTests grown at Brandon and Carman, MB (2009–2010) and Portage la Prairie, MB (2009).

^yTests grown at Lake Lenore, SK, Rosthern, SK, and Watrous, SK (2009–2010), Valparaiso, SK, and Yorkton, SK (2009).

^x1 = erect, 5 = prostrate.

^wOil content (whole-seed zero-moisture basis), by near infrared measurements.

^yProtein content (N × 6.25 in oil-free meal, zero-moisture basis), by near infrared measurements.

^uErucic acid (% of total fatty acids in seed oil), by gas chromatography, from seed grown in isolated fields of HEAR materials.

^tTotal glucosinolates (whole seed, 8.5% moisture basis), by near infrared measurements.

^sMean of three field tests grown in 2009–2010, Westar mean 3.1 in these trials.

^rMean of two trials grown in 2009–2010.

^qLSD derived from cultivar-by-test interaction mean square.

more than Red River 1852. These yield increases were accompanied by an oil content improvement of 0.7%, a protein content improvement of 2.2%, and erucic acid content improvement of 3% and a $3 \mu\text{mol g}^{-1}$ seed reduction in glucosinolate content for the Red River 1861 versus Red River 1852 comparison (data not shown).

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 under contract to Bunge Canada, Bag #1, Highway 35 South, Nipawin Saskatchewan, Canada S0E 1E0.

The authors acknowledge the technical support provided by Dave Audette, Lynn Coleman, Sandra Fuller, Judith Nugent-Rigby, Paula Parks, Robert Smith, Baoling Wang, Yaping Wang and Debrah Witko during the development of this cultivar.

McVetty, P. B. E., Fernando, W. G. D., Scarth, R. and Li, G. 2006a. Red River 1826 Roundup Ready™ high erucic acid, low glucosinolate summer rape. *Can. J. Plant Sci.* **86**: 1179–1180.

McVetty, P. B. E., Fernando, W. G. D., Scarth, R. and Li, G. 2006b. Red River 1852 Roundup Ready™ high erucic acid, low glucosinolate summer rape. *Can. J. Plant Sci.* **86**: 1181–1182.

McVetty, P. B. E., Fernando, D., Li, G., Tahir, M. and Zelmer, C. D. 2010. Red River 1997 Roundup Ready™ high erucic acid, low glucosinolate summer rape. *Can. J. Plant Sci.* **90**: 711–713.