

HYHEAR 2 Roundup Ready[®] high erucic acid, low glucosinolate hybrid summer rape

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Abstract: HYHEAR 2 summer rape (*Brassica napus* L.) is the world's second hybrid Roundup Ready[®] high erucic acid, low glucosinolate cultivar. On average, HYHEAR 2 yielded 12% more seed, 4 g kg⁻¹ more seed oil, but 8 g kg⁻¹ less meal protein than Red River 1861 Roundup Ready[®] high erucic acid, low glucosinolate summer rape. HYHEAR 2 has an erucic acid content of 51.6% in isolated field trials of HEAR lines and is adapted to the southern *B. napus* growing regions of western Canada.

Key words: rape, hybrid Roundup Ready[®] high erucic acid, low glucosinolate, cultivar description.

Résumé : La variété HYHEAR 2 de colza (*Brassica napus* L.) est le deuxième cultivar hybride Roundup Ready[®] à forte concentration d'acide érucique et à faible concentration de glucosinolates au monde. HYHEAR 2 produit en moyenne 12 % plus de graines, 4 g d'huile de plus par kg de graines, mais 8 g de tourteau protéique de moins par kg que la variété Red River 1861 Roundup Ready[®] à forte concentration d'acide érucique et à faible concentration de glucosinolates. Lors de l'essai des lignées HEAR en parcelles isolées, HYHEAR 2 s'est caractérisé par une concentration de 51,6 % d'acide érucique. Cette variété est adaptée aux zones de culture du colza de l'Ouest canadien. [Traduit par la Rédaction]

Mots-clés : colza, hybride Roundup Ready[®] à forte concentration en acide érucique et à faible concentration en glucosinolates, description de cultivar.

Introduction

Tested as H118017 in the Western Canadian Co-operative Canola/Rapeseed High Erucic Acid Rapeseed (HEAR) Contract Registration Tests in 2012 and 2013, HYHEAR 2 is a Roundup Ready[®] summer rape (*Brassica napus* L.) hybrid cultivar having a high content of erucic acid in the seed oil (51.6%), and low content of glucosinolates in the seed meal (11.3 μmol total glucosinolates g⁻¹ seed at 8.5% H₂O). On average, HYHEAR 2 yielded 12% more seed, 4 g kg⁻¹ more seed oil, but 8 g kg⁻¹ less meal protein than the open-pollinated, Roundup Ready[®], high erucic acid, low glucosinolate summer rape cultivar Red River 1861, the HEAR check designated by the Western Canadian Canola/Rapeseed Recommending Committee Inc. (WCC/RRC Inc.). HYHEAR 2 was collaboratively developed by DL Seeds/

Norddeutsche Pflanzenzucht (NPZ) Lembke and the Department of Plant Science, University of Manitoba, and it was issued a Certificate of Restricted Registration No. 7767 on 29 June 2015 by the Variety Registration Office, Plant Products Division of the Canadian Food Inspection Agency, Ottawa, Ontario. The terms of the restricted registration state that the registrant of HYHEAR 2 (i.e., Bunge Canada) shall implement and maintain a quality control system as reviewed and approved by the registrar. HYHEAR 2 is the world's second hybrid Roundup Ready[®] HEAR cultivar following HYHEAR 1 (McVetty et al. 2014).

Pedigree and Breeding Methods

The HYHEAR 2 Roundup Ready[®] HEAR hybrid cultivar is developed based upon the DL Seeds/NPZ Lembke

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Table 1. Seed yield, days to flowering, days to maturity, height, lodging, seed oil content, meal protein content, erucic acid content, total glucosinolate content and disease reactions of summer rape (*Brassica napus* L.) cultivars HYHEAR 2 (H118017), Red River 1861, 45H29 and 5440 in the Western Canadian Co-operative Canola/Rapeseed HEAR Contract Registration Tests in 2012–2013.

Cultivar	Seed yield (kg ha ⁻¹)			Days to flowering (d)	Days to maturity (d)	Height (cm)	Lodging ^c (1–5)	Seed oil ^d (g kg ⁻¹)	Meal protein ^e (g kg ⁻¹)	Erucic acid ^f (%)	Total glucosinolates ^g (μmol g ⁻¹ seed)	Blackleg disease severity ^h (0–5)	Fusarium wilt class ⁱ
	Long ^a season zone	Mid ^b season zone	Mean										
HYHEAR 2 (H118017)	2637	2206	2402	38	93	104	2.1	480	504	51.6	11.3	0.9	R
Red River 1861	2454	1890	2146	38	92	105	2.8	476	512	51.1	10.0	0.7	R
45H29	3249	2720	2960	37	91	111	2.4	468	477	2.8	16.3	1.0	R
5440	3351	2805	3053	38	93	119	1.8	457	466	3.1	13.5	0.9	R
LSD (0.05) ^j	176	152	115	0.6	0.8	14.6	0.6	3.9	4.8	0.9	0.7	—	—
Tests (2012 + 2013)	5	6	11	2	9	3	7	11	11	11	11	3	2

^aTests grown at Carman MB (2012), Glenboro MB (2012–2013), Rosebank MB (2013) and Winkler MB (2013).

^bTests grown at Lake Lenore SK (2012–2013), Rosthern SK (2012–2013), Vegreville SK (2012) and Watrous SK (2013).

^c1 = erect, 5 = prostrate.

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

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

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

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

^hMean of three field tests grown in 2012–2013, Westar mean 3.3 in these trials.

ⁱTests grown at Star City SK (2012) and Yorkton SK (2013) in field conditions with natural inoculum.

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

proprietary genetic male sterile Lembke (MSL) non-herbicide tolerant HEAR female line “MSL59900C NHT” and the University of Manitoba Roundup Ready® HEAR male line RRHR9825. MSL59900C NHT was produced by crossing the HEAR sterile line MSL599A with the HEAR maintainer (fertile) line MSL600. MSL599A was a BC₁F₄ selection from the cross PF 3356 C × Ho 3269-01 while MSL600B was a BC₁F₄ selection from the cross PF 3356 B × PF 2846-02. MSL59900C NHT was grown in the field in 2007 and 2008 and selected for flowering time to verify flowering synchrony with RRHR9825 and seed quality. RRHR9825 with the pedigree [RRHR802 (Castor × UM1-73 RR canola line)//RRHR802/PR6336] is a Roundup Ready® HEAR line. The initial cross was made in 2004 between two lines, RRHR802 and PR6336, both carrying the gene for tolerance to glyphosate herbicide (transformation event RT73). RRHR802 is a high erucic acid, low glucosinolate (*B. napus*) line while PR6336 is a canola quality summer *B. napus* cultivar. The F₁ of RRHR802 × PR6336 was backcrossed to RRHR802 in 2005. Twenty-two BC₁F₁ plants were grown in 2005. The BC₁F₂ and BC₁F₃ progeny of this cross were selected through pedigree selection for the gene conferring tolerance to glyphosate herbicide and high erucic acid content. Eight BC₁F₄ families were grown in nursery rows ($n = 163$) in 2007 and selection was based on high erucic acid content, high seed oil content, high meal protein content and agronomic characteristics. In 2008, twelve BC₁F₅ selections were again grown in nursery rows and selected for the same agronomic and seed quality characteristics as the previous generation. Nine BC₁F₆ selections were advanced to yield trials in 2009 and selection of RRHR9825 was based on seed yield, seed quality and blackleg resistance. RRHR9825 was originally derived from a single BC₁F₄ selected nursery row harvested in 2007. The presence of the gene for glyphosate tolerance was monitored in every generation by spraying, and the purity of the transformation event RT73 was tested and confirmed in the Breeder/Certified Seed. Hybrid seed for H118017 was produced in isolation under tents in Chile 2009–2010. The hybridity of this seed lot was over 98%. H118017 was evaluated in advanced yield trials in 2011 for agronomic performance, seed quality and blackleg [*Leptosphaeria maculans* (Desm.) Ces. & de Not. (anamorph *Phoma lingam* (Tode ex Fr.) Desm.) resistance and fusarium wilt [caused by *Fusarium oxysporum* f. sp. *conglutinans* (Wollenweb.) W.C. Snyder & H.N. Hans.] resistance. H118017 was advanced to the 2012 and 2013 HEAR Contract Registration Tests based on its superior agronomic performance, seed quality, blackleg and fusarium wilt resistance.

Performance

HYHEAR 2 was evaluated in 2012 and 2013 in the mid- and long-season zones of the WCC/RRC Inc. HEAR Contract Registration Tests. It surpassed Red River 1861 in yield in both zones and had an average yield advantage of 12% (Table 1). HYHEAR 2 matured in 93 d, one

day later than Red River 1861 and one day later than the mean of the WCC/RRC Inc. designated canola quality checks for maturity, 45H29 and 5440 (Table 1). HYHEAR 2 had a lower lodging score (2.1) compared with Red River 1861 (2.8) but identical to the mean lodging score of the WCC/RRC Inc. designated canola quality checks. HYHEAR 2 had an average seed oil content of 480 g kg⁻¹, 4 g kg⁻¹ higher than Red River 1861, and an average meal protein content of 504 g kg⁻¹, 8 g kg⁻¹ lower than Red River 1861. The erucic acid content of HYHEAR 2 seed averaged 51.6% of the total fatty acids in the seed oil, 0.5% higher than the erucic acid content of Red River 1861 seed produced in 11 isolated field trials. The average total glucosinolate content of HYHEAR 2 whole seed on a 8.5% moisture basis, over the two years of official trials was 11.3 μmol g⁻¹ seed, slightly higher than that for Red River 1861 (10.0 μmol g⁻¹ seed) but lower than the mean glucosinolate content of the WCC/RRC Inc. designated canola quality checks. This permits the meal produced by HYHEAR 2 to be used in similar applications to canola meal.

Other Characteristics

HYHEAR 2 was evaluated in disease resistance evaluations conducted in 2012 and 2013 by the WCC/RRC Inc. Based on the results from these tests, HYHEAR 2 was supported for registration and registered as resistant to blackleg disease and resistant to fusarium wilt (Table 1).

Maintenance and Distribution of Pedigreed Seed

Breeder seed of MSL59900C NHT and RRHR9825 is maintained by DL Seeds, PO Box 2499, Morden Manitoba, R6M 1C2. HYHEAR 2 hybrid Certified Seed is produced by DL Seeds. HYHEAR 2 Certified Seed has at least 80% fertile F₁ hybrid seed and a maximum of 20% sterile plants that may include various percentages of the following: sterile F₁ plants, MSL59900C NHT plants, or sterile non-target F₁ plants. Certified Seed of HYHEAR 2 also has a minimum of 85% of the plants resistant to glyphosate herbicide. Certified Seed of HYHEAR 2 is retailed by Crop Production Services (CPS), 210-407 Downey Road, Saskatoon SK, S7N 4L8 under contract to Bunge Canada, Bag No. 1, Highway 35 South, Nipawin SK S0E 1E0.

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