



**CMBTC™**  
CANADIAN MALTING BARLEY TECHNICAL CENTRE

**NEWDALE**

Two-rowed, a cross of CDC Stratus/TR236, was fully registered in 2001, and was developed by Dr. W. Legge, Agriculture and Agri-Food Canada, Brandon Research Centre.

### AGRONOMIC TRAITS

- Excellent yield
- Good lodging resistance and harvestability
- Medium-late in maturity (one day later than AC Metcalfe)
- Good disease resistance

### MALTING QUALITY TRAITS

- Improved resistance to peeling
- Increased friability
- Moderate extract level
- Good enzyme and soluble protein levels
- Low wort Beta-glucan
- Fast modification

### BREWING QUALITY TRAITS

- Satisfactory overall brewhouse performance
- Fast conversion time
- Similar lautering when compared to AC Metcalfe
- Good yield and material efficiencies

### OVERALL COMMENTS

Newdale's moderate levels of enzyme make this variety very suitable when used with adjuncts. Its low Beta-glucan content also makes Newdale attractive to brewers who experience problems with slow runoffs and poor beer filtration.

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### COMPARATIVE MALT QUALITY PARAMETERS

 <b>CMBTC™</b> <small>CANADIAN MALTING BARLEY TECHNICAL CENTRE</small>	NEWDALE	AC METCALFE
FINE EXTRACT, %	~80.5	~81.5
COLOR, EBC	3.5-4.5	3.0-4.5
TOTAL PROTEIN, %	~12.5	~12.5
SOLUBLE PROTEIN, %	4.6-5.2	4.7-5.3
KOLBACH INDEX	40-45	42-48
DIASTATIC POWER, °L	105-135	110-150
WORT BETA - GLUCAN, PPM	65-100	70-120



## Newdale barley

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Legge, W. G., Haber, S., Harder, D. E., Menzies, J. G., Noll, J. S., Tekauz, A., Thomas, P. L., Turkington, T. K. and Bizimungu, B. 2008. **Newdale barley**. *Can. J. Plant Sci.* **88**: 717–723. Newdale is a two-row spring malting barley (*Hordeum vulgare* L.) cultivar widely adapted to western Canada that has performed particularly well in Manitoba and Saskatchewan. Developed from a cross made in 1991, Newdale was evaluated in the Western Cooperative Two-row Barley Registration Test (1998–1999) and the Collaborative Malting Barley Trials (1999–2000) conducted by the malting and brewing industry before being registered in 2001. Newdale is a significantly higher yielding cultivar with good agronomic traits, moderate disease resistance and good malting quality.

**Key words:** Malting barley, *Hordeum vulgare* L., cultivar description, yield, disease resistance, malting quality

Legge, W. G., Haber, S., Harder, D. E., Menzies, J. G., Noll, J. S., Tekauz, A., Thomas, P. L., Turkington, T. K. et Bizimungu, B. 2008. **L'orge Newdale**. *Can. J. Plant Sci.* **88**: 717–723. Newdale est un cultivar d'orge brassicole à deux rangs (*Hordeum vulgare* L.) largement adapté aux conditions de culture de l'Ouest canadien. Newdale a donné des résultats particulièrement intéressants au Manitoba et en Saskatchewan. Issu d'un croisement réalisé en 1991, Newdale a été évalué dans le cadre des essais d'homologation coopératifs sur l'orge à deux rangs effectués dans l'Ouest en 1998 et 1999 et des essais coopératifs sur l'orge brassicole entrepris en 1999 et 2000 par l'industrie brassicole, avant d'être homologué en 2001. Newdale donne un rendement sensiblement plus élevé et présente de bons caractères agronomiques. La variété résiste modérément à la maladie et a une bonne qualité brassicole.

**Mots clés:** Orge brassicole, *Hordeum vulgare* L., description de cultivar, rendement, résistance à la maladie, qualité brassicole

Newdale is a two-row spring malting barley (*Hordeum vulgare* L.) cultivar developed at the Agriculture and Agri-Food Canada (AAFC) Brandon Research Centre, Brandon, MB. It received registration No. 5384 from the Variety Registration Office, Plant Products Division, Canadian Food Inspection Agency (CFIA) on 2001 Dec. 05. Plant Breeders' Rights for Newdale (certificate No. 1692) were granted by the Plant Breeders' Rights Office, CFIA on 2003 Dec. 15.

### Pedigree and Breeding Methods

Newdale was developed from the cross CDC Stratus//TR236/WM862-6 made in 1991 at the AAFC Brandon Research Centre, Brandon, MB. CDC Stratus was a two-row malting barley cultivar with good agronomic performance and acceptable malting quality. TR236 (breeding line number WM873-46) was selected for resistance to net blotch (*Pyrenophora teres* Drechs.) and loose smut [*Ustilago nuda* (Jens.) Rostr.] from the cross Wpg8419-24-2-1//Oxbow/Manley, where Wpg 8419-24-2-1 was a breeding line developed by the

AAFC Cereal Research Centre (CRC), Winnipeg, MB, with the pedigree SM80489/C19214 where SM80489 was a breeding line from the University of Saskatchewan, Saskatoon, SK. WM862-6 was selected for resistance to spot blotch [*Cochliobolus sativus* (Ito & Kurib.) Drechs. ex Dast.] from the cross Ellice/S7729//ND7556, where S7729 is from the University of Saskatchewan, and ND7556 from North Dakota State University, Fargo, ND. Early generations were handled by a modified bulk method. The F<sub>1</sub> generation was grown as a bulk in the greenhouse and the F<sub>2</sub> generation as a bulk plot in the field at Brandon in 1992. The F<sub>3</sub> generation was grown as a bulk increase in a 1992–1993 winter nursery at Brawley, CA, where spikes were selected from single plants on the basis of appearance, kernel plumpness and maturity. Spikes were threshed in bulk, and approximately 2000 seeds were space-planted as an F<sub>4</sub> population at Brandon in 1993. A number of F<sub>4</sub> plants were

**Abbreviations:** DON, deoxynivalenol; FHB, fusarium head blight

selected on the basis of agronomic appearance and foliar disease resistance. Each plant was harvested individually with harvested seeds planted as a single F<sub>5</sub> progeny row in the field at Brandon in 1994. Progeny rows, one of which was BM9123–34, were selected on the basis of height, maturity, lodging resistance, general appearance, resistance to net blotch and spot blotch, and preliminary malting quality analyses (i.e., alpha amylase activity, diastatic power and fine grind extract). Selected F<sub>6</sub> lines were grown in preliminary replicated yield tests at Brandon in 1995. Selection was based on the same criteria plus yield, heading date, kernel plumpness, test weight, kernel weight, advanced malting quality analyses (i.e., above quality traits plus grain protein concentration, coarse grind extract, difference between fine and coarse extracts, amino nitrogen concentration, soluble protein concentration and wort viscosity), and evaluation for reactions to stem rust (*Puccinia graminis* Pers.), net blotch, spot blotch, scald [*Rhynchosporium secalis* (Oud.) J.J. Davis], loose smut, covered smut [*U. hordei* (Pers.) Lagerh.] and false loose smut (*U. nigra* Tapke). BM9123–34 was grown in an advanced yield test at six locations across western Canada in 1996 (Brandon, Lowes Farm south of Brandon, and Oak River, MB; Saskatoon and Scott, SK; and Lacombe, AB), and at five locations in 1997 (Brandon, Lowes Farm south of Brandon, and Green Farm east of Brandon, MB; Saskatoon, SK; and Lacombe, AB) where it was evaluated for the same traits as in 1995 plus kernel brightness, hull peeling and resistance to common root rot [*C. sativus* (Ito & Kurib.) Drechs. ex Dast.]. BM9123–34 was advanced in 1998 to the Western Cooperative Two-row Barley Registration

**Table 1. Grain yield (kg ha<sup>-1</sup>) for Newdale and check cultivars, Western Cooperative Two-row Barley Registration Test, 1998–1999**

Cultivar	Soil zone			Overall
	Black (East) <sup>z</sup>	Brown <sup>y</sup>	Black and Grey (West) <sup>x</sup>	
Harrington	4465	4958	4985	4837
Manley	5616	5818	5609	5718
CDC Dolly	5639	5786	5503	5683
Newdale	6027	6146	5659	6004
LSD <sub>0.05</sub>	389	252	371	183
No. of tests	9	18	8	35

<sup>z</sup>Black Soil Zone (East): Brandon and Glenlea, MB; Indian Head, Lake Lenore and Melfort (1998 only), SK.

<sup>y</sup>Brown Soil Zone: Breton, Irricana and Lethbridge, AB; Elrose, Kindersley (1999 only), Regina, Saskatoon, Scott, Swift Current and Watrous (1998 only), SK.

<sup>x</sup>Black and Grey Soil Zone (West): Beaverlodge, Calmar, Fort Vermilion (1998 only), Lacombe (1998 only) and Stettler, AB.

<sup>w</sup>Least significant difference among cultivar means at the 5% probability level, where each test was treated as one replication.

Test, where it was evaluated for 2 yr as TR258. TR258 was also evaluated in the 1999 and 2000 Collaborative Malting Barley Trials conducted at the pilot-scale level by the malting and brewing industry as part of the registration recommending process under the auspices of the Barley and Oat Subcommittee, Prairie Registration Recommending Committee for Grain.

### Performance

Newdale is widely adapted to western Canada, particularly Manitoba and Saskatchewan. It out-yielded the

**Table 2. Agronomic trait data for Newdale and check cultivars, Western Cooperative Two-row Barley Registration Test, 1998–1999**

Cultivar	Days to heading	Days to maturity	Height (cm)	Lodging (1–9) <sup>z</sup>	Test weight (kg hL <sup>-1</sup> )	1000-kernel weight (g)	Plump (%) <sup>y</sup>
Harrington	59.0	91.1	82.6	3.4	63.3	41.3	85.8
Manley	62.2	95.2	84.2	2.8	64.7	44.6	87.2
CDC Dolly	56.8	92.3	77.0	3.2	66.5	47.1	91.5
Newdale	59.5	92.2	79.6	2.7	64.5	43.8	88.2
LSD <sub>0.05</sub>	0.7	0.7	1.3	0.8	0.6	1.1	3.2
No. of tests	27 <sup>w</sup>	25 <sup>v</sup>	33 <sup>u</sup>	16 <sup>t</sup>	26 <sup>s</sup>	26 <sup>s</sup>	11 <sup>t</sup>

<sup>z</sup>1 = no lodging; 9 = completely lodged.

<sup>y</sup>Kernel plumpness (%) as determined over a 6/64 inch (238 mm) slotted screen.

<sup>w</sup>Least significant difference among cultivar means at the 5% probability level, where each test was treated as one replication.

<sup>u</sup>Locations: Brandon and Glenlea, MB; Indian Head, Lake Lenore, Melfort (1998), Regina, Saskatoon and Watrous (1998), SK; Beaverlodge, Calmar, Fort Vermilion, Irricana, Lacombe (1998), Lethbridge and Stettler, AB.

<sup>v</sup>Locations: Brandon and Glenlea, MB; Indian Head, Lake Lenore, Melfort (1998), Regina, Scott (1998), Swift Current, (1998) and Watrous (1998), SK; Calmar, Fort Vermilion, Irricana, Lacombe (1998), Lethbridge and Stettler, AB.

<sup>t</sup>Locations: Brandon and Glenlea, MB; Indian Head, Kindersley (1999), Lake Lenore, Melfort (1998), Regina, Saskatoon, Scott, Swift Current (1998) and Watrous (1998), SK; Beaverlodge, Breton, Calmar, Fort Vermilion, Irricana, Lacombe (1998), Lethbridge and Stettler, AB.

<sup>s</sup>Locations: Brandon and Glenlea (1998), MB; Elrose (1999), Indian Head (1998), Lake Lenore (1998), Melfort (1998), Regina (1998), Saskatoon (1999) and Watrous (1998), SK; Beaverlodge (1998), Breton (1998), Calmar (1998), Fort Vermilion (1998), Lethbridge (1998) and Stettler (1999), AB.

<sup>r</sup>Locations: Brandon and Glenlea (1998), MB; Elrose (1999), Indian Head (1998), Lake Lenore (1998), Melfort (1998), Regina (1998), Saskatoon and Scott (1999), SK; Beaverlodge, Breton, Calmar, Fort Vermilion, Irricana, Lacombe (1998), Lethbridge and Stettler, AB.

<sup>q</sup>Locations: Brandon (1999), MB; Elrose (1999), Lake Lenore (1999) and Saskatoon, SK; Beaverlodge, Calmar, Irricana (1999) and Lacombe (1998), AB.

malting check cultivars Harrington and Manley by 24 and 5%, respectively, across all soil zones over 2 yr of evaluation in the Western Cooperative Two-row Barley Registration Test (Table 1). It also out-yielded the feed check cultivar CDC Dolly by 6%. In these trials, Newdale was 1 d later maturing than Harrington and 3 d earlier than Manley (Table 2). It was 3–5 cm shorter than Harrington and Manley, and was more resistant to lodging than Harrington. Newdale had higher test and kernel weight than Harrington, and approached Manley in these traits. It had similar to slightly higher kernel plumpness than Harrington and Manley. During its 2 yr in Western Cooperative Two-row Barley Registration Test, Newdale had higher friability and lower wort viscosity and beta glucan concentration than Harrington and Manley (Table 3). At the only site evaluated, Newdale had less barley hull peeling than Harrington. While Newdale was similar to Harrington and Manley in fine grind malt extract, it had a higher course grind

malt extract and a smaller fine/coarse difference. However, Newdale had lower alpha amylase activity and diastatic power and higher grain protein concentration than Harrington. Newdale was intermediate to Harrington and Manley for soluble protein concentration and the ratio of total to soluble protein. During the 2 yr of pilot-scale testing by industry (Collaborative Malting Barley Trials), Harrington was the only common check cultivar in both years (Table 4). Comparing Newdale to Harrington, similar trends were observed as in the Western Cooperative Two-row Barley Registration Test, except that alpha amylase and diastatic power were the same on average while soluble protein concentration was lower for Newdale. As for grain protein concentration, malt protein concentration was slightly higher for Newdale. In 2000, AC Metcalfe (Legge et al. 2003) and CDC Kendall were added as newer two-row malting check cultivars to the pilot-scale malting tests. Both had higher alpha amylase activity and diastatic

Table 3. Malting quality trait data<sup>z</sup> for Newdale and check cultivars, Western Cooperative Two-row Barley Registration Test, 1998–1999<sup>y</sup>

Cultivar	Kernel plumpness (%)	1000-kernel weight (g)	Grain protein (g hg <sup>-1</sup> ) <sup>xw</sup>	Germination energy		Friability (%) <sup>xo</sup>
				4 mL (%)	8 mL (%)	
Harrington	86.1	41.6	11.3	99.4	90.9	77.0
Manley	83.8	43.5	11.9	97.4	85.6	74.2
Newdale	88.8	42.9	11.8	98.9	88.7	85.8
LSD <sub>0.05</sub>	7.2	2.3	1.0	1.2	7.7	8.9
No. of tests	7	7	7	7	7	6
Cultivar	Fine grind extract (g hg <sup>-1</sup> ) <sup>xv</sup>	70°C coarse grind extract (g hg <sup>-1</sup> ) <sup>xvn</sup>	Fine-coarse difference (g hg <sup>-1</sup> ) <sup>xvn</sup>	Soluble protein (g hg <sup>-1</sup> ) <sup>xv</sup>	Ratio of soluble to total protein (%) <sup>x</sup>	
Harrington	80.2	74.6	6.1	4.66	42.2	
Manley	80.1	76.1	4.9	4.77	39.5	
Newdale	80.2	77.8	2.9	4.72	40.1	
LSD <sub>0.05</sub>	1.0	2.1	1.4	0.12	2.9	
No. of tests	7	3	3	7	7	
Cultivar	Diastatic power (°L) <sup>wu</sup>	Alpha amylase (DU) <sup>wt</sup>	Beta glucan (mgL <sup>-1</sup> ) <sup>s</sup>	Wort viscosity (cps) <sup>wr</sup>	Barley hull peeling (%) <sup>xp</sup>	
Harrington	109	56.6	328	1.49	16.1	
Manley	153	65.0	236	1.48	11.3	
Newdale	105	52.9	131	1.43	14.1	
LSD <sub>0.05</sub>	17	5.2	75	0.03	4.4	
No. of tests	7	7	7	7	1	

<sup>z</sup>Malting quality characteristics determined at the Grain Research Laboratory, Canadian Grain Commission, Winnipeg, MB, as described by Mather et al. (1997).

<sup>y</sup>Locations: 1998 — Lacombe, AB; Lake Lenore and Watrous, SK; 1999-Lethbridge, AB; Lake Lenore, Saskatoon and Swift Current, SK.

<sup>x</sup>Expressed as % by the malting and brewing industries.

<sup>w</sup>On a grain dry matter basis.

<sup>v</sup>On a malt dry matter basis.

<sup>u</sup>Degrees Lintner.

<sup>t</sup>Dextrinizing unit measure of alpha amylase activity.

<sup>s</sup>On a malt extract basis, expressed as ppm by the malting and brewing industries.

<sup>r</sup>Centipoise, international viscosity units used by the malting and brewing industries.

<sup>q</sup>Least significant difference among cultivar means at the 5% probability level, where each test was treated as one replication.

<sup>p</sup>Percentage of barley with hull peeling as measured on all three replications at Neapolis, AB, in 1998 (LSD<sub>0.05</sub> for one test only).

<sup>o</sup>Friability not determined for Saskatoon, SK, 1999; mean of six tests.

<sup>n</sup>Determined in 1998 only; mean of three sites.

**Table 4. Malting quality trait data<sup>z</sup> for Newdale and check cultivars, Collaborative Malting Barley Trials conducted at pilot-scale level by industry, 1999–2000<sup>y</sup>**

Cultivar	1000-kernel weight (g)	Grain protein (g hg <sup>-1</sup> ) <sup>xw</sup>	Germination energy		Friability (%) <sup>x</sup>	Malt protein (g hg <sup>-1</sup> ) <sup>xv</sup>
			4 mL (%)	8 mL (%)		
Overall means (1999–2000)						
Harrington	41.3	12.1	99.0	94.2	76.3	11.7
Newdale	43.3	12.4	97.6	89.6	78.6	12.3
LSD <sub>0.05</sub>	1.1	0.3	2.7	10.3	3.8	0.4
No. of tests	9	9	9	9	7	9
Means for 2000 only						
Harrington	38.6	12.4	98.2	94.4	85.0	12.0
AC Metcalfe	39.2	12.7	96.4	93.0	81.7	12.5
CDCKendall	39.3	12.3	96.8	90.2	86.7	12.1
Newdale	40.4	12.5	96.0	96.0	84.1	12.2
LSD <sub>0.05</sub>	1.0	0.3	4.6	6.1	4.2	0.4
No. of tests	5	5	5	5	4	5
Cultivar	Fine grind extract (g hg <sup>-1</sup> ) <sup>xv</sup>	70°C coarse grind extract (g hg <sup>-1</sup> ) <sup>xv</sup>	Fine-coarse difference (g hg <sup>-1</sup> ) <sup>xv</sup>	Soluble protein (g hg <sup>-1</sup> ) <sup>xv</sup>	Ratio of soluble to total protein (%) <sup>x</sup>	
Overall means (1999–2000)						
Harrington	79.9	78.2	1.9	4.96	43.0	
Newdale	79.8	78.9	1.1	4.77	39.5	
LSD <sub>0.05</sub>	0.2	0.5	0.3	0.23	1.5	
No. of tests	9	7	7	9	9	
Means for 2000 only						
Harrington	79.6	78.6	1.3	5.18	44.0	
AC Metcalfe	79.8	79.0	1.2	5.25	42.5	
CDC Kendall	79.5	78.9	0.8	5.00	41.6	
Newdale	79.6	79.1	0.8	4.89	40.8	
LSD <sub>0.05</sub>	0.8	1.1	0.4	0.29	2.7	
No. of tests	5	4	4	5	5	
Cultivar	Diastatic power (°L) <sup>wu</sup>	Alpha amylase (DU) <sup>wt</sup>	Beta glucan (mg L <sup>-1</sup> ) <sup>s</sup>	Wort viscosity (cps) <sup>wr</sup>	Peeled & Broken	
					Barley (%) <sup>xp</sup>	Malt (%) <sup>xp</sup>
Overall means (1999–2000)						
Harrington	131	66.9	228	1.46	2.79	9.07
Newdale	131	67.1	150	1.41	1.56	3.05
LSD <sub>0.05</sub>	8	3.6	73	0.03	2.05	9.03
No. of tests	9	9	7	8	5	4
Means for 2000 only						
Harrington	134	71.2	138	1.39	2.79	9.07
AC Metcalfe	145	77.2	109	1.41	1.82	4.80
CDC Kendall	156	73.3	64	1.40	1.44	4.90
Newdale	127	71.4	87	1.37	1.56	3.05
LSD <sub>0.05</sub>	10	4.3	67	0.02	1.17	4.47
No. of tests	5	5	3	4	5	4

<sup>z</sup>Malting quality characteristics determined by industry using procedures similar to the Grain Research Laboratory (GRL), Canadian Grain Commission, Winnipeg, MB (Mather et al. 1997).

<sup>y</sup>Locations (company lab): 1999 – Melfort, SK (GRL), Neapolis, AB (Anheuser-Busch Inc.), Tempest, AB (Canada Malting Co. Ltd.), Tempest, AB (GRL); 2000 – Irricana, AB (Anheuser-Busch Inc.), Irricana, AB (Dominion Malting Ltd.), Lethbridge, AB (Canada Malting Co. Ltd.), Lethbridge, AB (GRL), Rosthern, SK (Prairie Malt Ltd.).

<sup>x</sup>Expressed as % by the malting and brewing industries.

<sup>w</sup>On a grain dry matter basis.

<sup>v</sup>On a malt dry matter basis.

<sup>u</sup>Degrees Lintner.

<sup>t</sup>Dextrinizing unit measure of alpha amylase activity.

<sup>s</sup>On a malt extract basis, expressed as ppm by the malting and brewing industries.

<sup>r</sup>Centipoise, international viscosity units used by the malting and brewing industries.

<sup>q</sup>Least significant difference among cultivar means at the 5% probability level, where each test was treated as one replication.

<sup>p</sup>Percentage of peeled and broken barley and malt, respectively, as measured by industry.

power than Newdale, but Newdale had lower wort viscosity, soluble protein, ratio of soluble to total protein and malt peeling. Newdale had lower beta glucan than AC Metcalfe, but not CDC Kendall. Few differences were observed in malt extract. Overall, the malting quality profile of Newdale is more similar to that of Harrington than to the newer cultivars favoured in markets requiring higher enzyme levels. However, some malting and brewing markets desire lower enzyme

levels. Newdale was added to the 2007–08 Canadian Malting Barley Technical Centre recommended malting barley varieties list.

**Other Characteristics**

*Plant*

Semi-erect juvenile growth; whitish coleoptile with medium elongation; green leaves with slight waxy

**Table 5. Disease reactions for Newdale and check cultivars, Western Cooperative Two-row Barley Registration Test, 1998–1999**

Cultivar	<i>Ustilago</i> smuts			Net blotch					Spot blotch.		
	(% infected) <sup>z</sup>			Inoculated <sup>y</sup>		SASK <sup>x</sup>	BRAN <sup>w</sup>	BRAN <sup>w</sup>	Inoc. <sup>v</sup>	<i>Septoria</i>	
	<i>nuda</i>	<i>hordei</i>	<i>nigra</i>	102	858	857	(0–9)	(1–9)	(1–9)	1903	692 <sup>u</sup>
1998											
Harrington	–	5	18	9	9?	7	8	2.5	5.0	–	S
Manley	0	0	5	4/10	9?	3	5	2.5	4.0	–	S
CDC Dolly	30	0	3	9	7?	8	5	3.0	4.0	–	S
Newdale	33	5	5	2	4?	3	4	2.0	3.0	–	S
1999											
Harrington	63	10	25	9	9	8	8	4.0	9.0	9	S
Manley	92	13	10	10	9	3	5	3.5	7.5	9	S
CDC Dolly	80	10	5	9	9	7	7	3.0	7.0	9	S
Newdale	92	16	20	1	9	3	4	2.0	6.0	6	S
Common											
Cultivar	Root Rot		Stem Rust <sup>s</sup>		Inoculated <sup>f</sup>		Field <sup>g</sup>			BYD <sup>p</sup>	
	(% infected) <sup>t</sup>		GLEN	BRAN	1493	EDMT	LA-1	LA-2	LA-3	(1–9)	
1998											
Harrington	23		10.3	50.5	S	1	1	6	8	–	
Manley	9		5.3	70.7	S	1	2	6	7	–	
CDC Dolly	16		15.4	45.6	MR	1	1	1	1	–	
Newdale	12		3.2	60.6	MS	2	2	5	8	–	
1999											
Harrington	8		5.3	55.6	S	3	3	4	7	–	
Manley	17		10.4	85.8	S	4	3	5	8	–	
CDC Dolly	13		20.5	75.7	MS	1	2	4	5	–	
Newdale	19		10.3	80.7	MS	5	3	5	7	8	

<sup>z</sup>Smut tests conducted at the Agriculture and Agri-Food Canada (AAFC) Cereal Research Centre (CRC), Winnipeg, MB, where 10% or less infected plants is considered resistant.

<sup>y</sup>Seedlings inoculated with *Pyrenophora teres* net-form isolates 102 and 858, and spot-form isolate 857 from the CRC, Winnipeg, MB; 1 = very resistant, 10 = very susceptible; x/y = segregating, ? = equivocal rating, based on one plant only or plants were smaller in size than normal due to slower emergence or growth.

<sup>x</sup>Rated for reaction to spot-form net blotch (*P. teres*) at the Crop Development Centre (CDC) University of Saskatchewan irrigated nursery, Saskatoon, SK, on a 0–9 scale (0 = no disease, 9 = susceptible).

<sup>w</sup>Rated for net-form net blotch (*P. teres*) and spot blotch (*C. sativus*) reactions in the irrigated leaf disease nursery at AAFC, Brandon, MB, on a 1–9 scale (1 = resistant, 9 = susceptible).

<sup>v</sup>Seedlings inoculated with *Cochliobolus sativus* isolate 1903 from the CRC, Winnipeg, MB; 1 = very resistant, 9 = very susceptible.

<sup>u</sup>Seedlings inoculated with *Septoria passerinii* isolate 692 from the CRC, Winnipeg, MB; S = susceptible.

<sup>t</sup>Percentage of plants infected in the common root rot (*C. sativus*) nursery at AAFC, Lacombe, AB.

<sup>s</sup>Stem rust (*Puccinia graminis*) nursery at Glenlea (GLEN), MB, inoculated with several *P. graminis* races excluding QCCJ to detect the Rpg1 stem rust resistance gene; stem rust (*P. graminis*) nursery at Brandon (BRAN), MB, inoculated with race QCCJ only; rating x.y where x = % severity (0–100) and y = infection type with .1 = R, .2 = RMR, .3 = MR, .4 = MRMS, .5 = MRMS-S, .6 = MS, .7 = MS-S and .8 = S (R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible reaction types).

<sup>f</sup>Seedlings inoculated with *Rhynchosporium secalis* isolate 1493 from the CRC, Winnipeg, MB; S = susceptible, MS = moderately susceptible, MR = moderately resistant.

<sup>g</sup>Field ratings for scald (*R.secalis*) reactions on a 0–9 scale where 0 = no disease, 9 = susceptible; EDMT = University of Alberta scald nursery, Edmonton, AB; AAFC, Lacombe, AB, scald nursery rated three times where LA-1 = Jul. 5–6, LA-2 = Jul. 19–20, and LA-3 = Aug. 3–4.

<sup>p</sup>Rated for reaction to barley yellow dwarf (BYD) virus in the BYD nursery at Glenlea, MB, on a 1–9 scale (1 = resistant, 9 = susceptible); data not available for check cultivars in 1999.

bloom, green lower leaf sheath, glabrous sheath and blade; intermediate to upright flag leaf, medium to long length, medium to wide width, white to slightly purplish auricles, glabrous sheath, blade and auricles, and pronounced waxy sheath; medium green stem with medium waxy bloom, medium thickness, none to slight stem exertion (many spikes are not fully exerted above the flag leaf), 5 or occasionally 6 nodes, straight to slightly curved neck, and predominantly closed to V-shaped collar with an occasional open collar.

### Spike

Two-row type, slightly tapering to parallel shape, medium density, long in length, semi-erect attitude, spike often not fully emerged above flag leaf, with medium glaucosity; rough lemma awns longer than the spike with green tips, with few to many barbs on lateral veins; glumes mid-long in length with medium length hairs confined to a band, rough awns with green to slightly purplish tips equal to slightly longer than the glumes; first segment of rachis medium length with weak curvature, rachis edges strongly pubescent, weak to medium humping of rachis mid segment; sterile spikelet with very weakly divergent attitude, very long lemma, with rounded tip.

### Kernel

Covered, medium length and width, colourless aleurone, short rachilla with long hairs, no abnormal rachillas, green lateral lemma nerves, clasping lodicules, no hairs on ventral furrow, and horseshoe depression basal marking.

### Quality

Good malting quality (Tables 3 and 4).

### Disease reaction

Moderate resistance to stem rust (carries the *Rpg1* gene), but susceptible to race Pgt-QCCJ; moderate resistance to covered smut, false loose smut, spot-form of net blotch and common root rot; intermediate resistance to net-form of net blotch and spot blotch; susceptible to loose smut, scald, speckled leaf blotch (*Septoria passerinii* Sacc.) and barley yellow dwarf (Table 5). When Newdale was evaluated in the Western Cooperative Two-row Barley Registration Test, fusarium head blight (FHB) caused by *Fusarium graminearum* Schwabe was emerging as a major concern in western Canada, but no data were collected on reaction to this pathogen. While Newdale was undergoing market development and commercialization, data on FHB reactions and deoxynivalenol (DON) concentration in the grain were collected from 2000 to 2006 in the AAFC Brandon FHB nursery as described by Legge et al. (2004).

**Table 6. Mean fusarium head blight (FHB) reaction and deoxynivalenol (DON) concentration for Newdale and check cultivars, FHB nursery at Brandon, MB, 2000–2006**

Cultivar	FHB rating (0–5) <sup>z</sup>	DON (mg kg <sup>-1</sup> ) <sup>y</sup>
Harrington	2.8	7.9
Manley	3.0 <sup>w</sup>	14.3 <sup>w</sup>
CDC Dolly	2.6	12.2
AC Metcalfe	2.3	14.2
CDC Kendall	2.9	13.2
Newdale	2.8	14.7
LSD <sub>0.05</sub> <sup>x</sup>	0.5	3.4
No. of years	7	7

<sup>z</sup>Mean fusarium head blight (*Fusarium graminearum*) reaction rated visually on a 0–5 scale (0 = no symptoms, 5 = highly susceptible) in the irrigated FHB nursery at Agriculture and Agri-Food Canada (AAFC), Brandon, MB, 2000–2006; mean for each year calculated from three replications.

<sup>y</sup>Mean deoxynivalenol (DON) concentration normally expressed in ppm by industry (equivalent to mg kg<sup>-1</sup>) as determined by the Enzyme-Linked Immunosorbent Assay (ELISA) technique at the Eastern Cereal and Oilseed Research Centre (ECORC), Ottawa, ON, using a composite sample of 3 replications each year.

<sup>x</sup>Least significant difference among cultivar means at the 5% probability level, where each year was treated as one replication.

<sup>w</sup>Data missing for Manley in 2003; mean of 6 yr only.

Newdale had intermediate to moderate FHB reaction approaching that of AC Metcalfe (Table 6).

### Maintenance of Pedigreed Seed Stocks

Breeder seed will be maintained by the AAFC Seed Increase Unit, Experimental Farm, Box 760, Indian Head, SK, Canada S0G 2K0. Initial Breeder Seed was produced in 1999 by the Seed Increase Unit at Indian Head from a bulk of 133 F<sub>11</sub> lines derived from F<sub>9</sub> single plant selections originally made at the AAFC Brandon Research Centre from the same increase used to provide seed for evaluation of Newdale in the Western Cooperative Two-row Barley Registration Test. Distribution and multiplication of other classes of Pedigreed seed stocks will be handled by FarmPure Seeds Inc., 418B McDonald Street, Regina, SK, Canada S4N 6E1.

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