



REQUEST FOR SUPPORT TO REGISTER HY2161

Crop Kind: Spring Wheat

Type: Canada Prairie Spring Red

Proposer: Gurcharn Singh Brar, University of Alberta, Edmonton, Alberta

Developers: Dean Spaner, Gurcharn Singh Brar, Muhammad Iqbal, University of Alberta, Edmonton, Alberta

Experimental Designations: HY2161, Entry 51 HYWB 2021, UAW15475*F8MBK15

Origin and Breeding History: HY2161 originates from the cross HY2022/CDC Terrain, made in 2015 at the University of Alberta, Edmonton, Canada. The F₁ seeds were planted in 2×1 m rows during the 2015-16 season in Lincoln, New Zealand, and the two rows were bulk harvested. Filial generations were advanced using a modified bulk breeding method.

In 2016, 40 grams of bulked F₂ seed was planted in two 30-meter rows in Edmonton, where plants were selected based on rust resistance, plant height, and maturity. The selected F₃ seeds (25 grams) were grown in two 25-meter rows in Lincoln, New Zealand, during the 2016-17 season. Plants were selected based on the same criteria as F₂, and heads from selected plants were bulk-threshed.

In 2017, 40 grams of F₄ seeds were planted in two 30-meter rows in Edmonton. Single plants were selected for plant height, maturity, and rust resistance, and single heads from the selected plants were bulk-threshed. The F₅ generation (25 grams) was planted in two 25-meter rows in Lincoln, New Zealand, during the 2017-18 field season. From this, 144 single plants were selected based on the same agronomic traits, and single heads from these plants were individually threshed.

In 2018, the F₆ generation was grown in hill plots in inoculated leaf rust nursery in Edmonton. Twenty-five hills were selected based on plant height, maturity, and rust resistance, and single heads from these hills were planted as F₇ in two-meter rows in Lincoln, New Zealand, during the 2018-19 season for seed increase.

In 2019, the F₈ generation, consisting of 25 rows, was tested in an unreplicated Preliminary Yield Trial (PYT) in 3m × 1.14m plots in Edmonton. Additional disease screening was conducted in Edmonton (leaf rust, bunt, and leaf spot nurseries), Brandon, MB (Fusarium head blight nursery), and Creston, BC (stripe rust nursery). Based on agronomic performance, disease resistance, and end-use quality, the line UAW15475*F8MBK15 was selected for further evaluation.

In 2020, this line underwent replicated multi-location Advanced Yield Trials (AYTs) across western Canada. It was evaluated as entry number 51 in the HYWB test in 2021 and later as HY2161 in the High Yield Wheat Registration Trials from 2022 to 2024.

HY2161 neither has any novel trait nor it is a genetically modified organism.

Area of Adaptation: The wheat-growing regions of western Canada.

Strengths:

- Grain yield higher than all the checks. 15% higher yielding than AAC Brandon, 22% higher yielding than Carberry, and 14% higher yielding than AAC Penhold.
- Stands 5 cm shorter than AAC Brandon and only 2.8 cm taller than AAC Penhold.
- Strong straw. Lodging tolerance same as AAC Penhold (the best check) and better than all other checks.
- Higher kernel weight than AAC Brandon and Carberry.
- Consistent excellent resistance (R rating) to leaf rust, stripe rust, and common bunt. MR rating to stem rust.
- Endorsed for quality in the second year. Meets CPSR wheat class quality standards, with improved amylograph peak viscosity and clean flour yield.

Neutral Traits:

- Intermediate level of resistance to FHB.
- Grain protein concentration slightly lower (0.8%) than AAC Penhold.

Weaknesses:

- Maturity 1 day later than Carberry.
- Test weight slightly lower (78.6 kg/hl) than AAC Penhold (79.6 kg/hl).

Description: HY2161 is a short, awned, hollow-stemmed wheat line with high yield potential and strong lodging tolerance. In the 2022-24 High Yield Wheat Registration Trials, it demonstrated 15.3% and 13.7% higher yields than AAC Brandon and AAC Penhold, respectively (Table 1). HY2161 matures 1.9 and 1.7 days later than these cultivars and stands 6.2 cm shorter than Carberry, 5.1 cm shorter than AAC Brandon, and 2.8 cm taller than AAC Penhold, with improved lodging resistance compared to AAC Brandon (Table 1). In terms of grain characteristics, HY2161 has a lower test weight and NIR grain protein content than AAC Brandon and AAC Penhold (Table 1). However, its grain weight is higher than AAC Brandon and Carberry but lower than AAC Penhold (Table 1).

Over three years of testing, HY2161 has shown strong disease resistance, with a resistant (R) rating for leaf rust, stripe rust, and common bunt (Table 2). Its response to stem rust varied from intermediate (I) in 2022 to moderately resistant (MR) in 2023 and resistant (R) in 2024 (Table 2). Regarding the Fusarium Head Blight (FHB) visual rating index (VRI), HY2161 was moderately resistant (MR) in 2023 and 2024, but rated intermediate (I) in 2022 in Carman, MB (Table 3). In Morden, MB, it was moderately susceptible (MS) in 2022 and 2023 and intermediate (I) in 2024. The reaction to deoxynivalenol (DON) content followed a similar trend, with an MR rating in 2024 and I or moderately susceptible (MS) ratings in previous years (Table 3). HY2161 had slightly higher Fusarium-damaged kernels (FDK) than AAC Brandon and Carberry in Carman, MB (Table 3). It was assigned an overall rating of I for FHB resistance.

End-use quality evaluations indicate that HY2161 meets or exceeds CPSR wheat class standards. It exhibited improved or excellent amylograph peak viscosity and improved clean flour yield during the three years of testing (Table 4).



Overall, HY2161 is a high-performing wheat line with improved agronomic characteristics, strong disease resistance, and good end-use quality potential, providing western Canadian wheat farmers with a viable option to enhance wheat production.

Seed Stocks: The breeder seed of HY2161 originated from 150 heads selected from seed increase plots in Edmonton in 2022. These heads were grown in 1-meter pre-breeder rows in 2023, where 120 uniform rows were individually harvested. In 2024, seeds from these 120 rows were planted in 14-meter breeder rows in Edmonton, with non-uniform rows and off-types removed. Marker analysis confirmed the absence of the *Sm1* gene in 95 uniform rows that will be bulked to produce approximately 200 kg of breeder seed.

Table 1. Agronomic data for HY2161 and check cultivars in the High Yield Wheat Registration Trials, 2022-2024.

Entry	Grain Yield						Maturity				Plant Height				Lodging			
	(kg/ha)					% Brandon	(days)				(cm)				(1-9)			
	Zone 1	Zone 2	Zone 3	Zone 4	Mean	Mean	2022	2023	2024	Mean	2022	2023	2024	Mean	2022	2023	2024	Mean
Carberry	4824	4170	5166	5134	4847	93.0	99.7	98.3	98.1	98.8	80.0	80.8	83.2	81.4	2.4	1.7	2.7	2.5
AAC Brandon	5251	4563	5470	5743	5213	100.0	99.3	96.9	97.8	98.0	79.0	79.2	82.3	80.3	3.4	4.6	3.4	3.6
AAC Penhold	5426	4454	5509	5602	5296	101.6	98.9	97.8	97.2	98.2	72.0	72.2	73.2	72.4	2.4	1.7	2.3	2.2
HY2161	6293	4843	6512	6304	6011	115.3	100.9	98.7	99.7	99.9	75.0	74.2	76.4	75.2	2.2	1.5	2.6	2.2
HY2161 vs Brandon	1042	280	1042	561	798	15.3	1.6	1.8	1.9	1.9	-4.0	-5.0	-5.9	-5.1	-1.2	-3.1	-0.8	-1.4
CV (%)	4.9	5.8	5.6	7.4	7.7		1	1.2	1.2	1.4	3.3	3.2	3.43	4.8	18.5	39.5	27.2	26.9
LSD (0.05)	267	285	254	610	116		0.5	0.6	0.6	0.4	1.2	1.3	1.3	1.0	0.4	1.0	0.6	0.4
Stations	9	8	14	3	34		12	10	11	33	12	10	12	34	4	2	4	10
Entry	Test Weight (kg/hL)				Grain Weight (g/1000)				NIR Protein (%)									
	2022	2023	2024	Mean	2022	2023	2024	Mean	2022	2023	2024	Mean						
	2022	2023	2024	Mean	2022	2023	2024	Mean	2022	2023	2024	Mean						
Carberry	81.4	80.2	79.0	80.2	37.5	37.1	32.2	35.6	14.6	14.3	14.9	14.6						
AAC Brandon	81.3	79.8	78.8	80.0	38.0	37.3	32.3	35.9	14.0	14.5	14.7	14.4						
AAC Penhold	81.1	79.5	78.1	79.6	41.6	42.4	35.7	39.9	13.4	13.6	13.8	13.6						
HY2161	79.8	78.4	77.7	78.6	38.5	39.5	35.4	37.8	12.5	12.8	13.2	12.8						
HY2161 vs Brandon	-1.5	-1.4	-1.1	-1.4	0.5	2.2	3.1	1.9	-1.5	-1.8	-1.4	-1.6						
Stations	12	10	12	34	12	10	12	34	12	10	12	34						

Zone 1: Brandon, Indian Head, Fort Whyte; Zone 2: Kernen, Scott, Swift Current; Zone 3: Beaverlodge, St. Albert, Lacombe, Melfort, Morrin; Zone 4: Lethbridge (Irri)

Table 2. The reaction of HY2161 and check cultivars to different diseases in the High Yield Wheat Registration Trials, 2022-2024.

Year	Entry	Stem Rust (Morden)		Leaf Rust (Morden)		Stripe Rust (Lethbridge)		Common Bunt (Lethbridge)	
		Severity	IR	Severity	Rxn	Severity	Rxn	Severity	Rating
2023	Glenn	1	R	20	MR	35	I	7	MR
2024	Glenn	1	R	23	MR	-	I	18	MR
2022	Carberry	1	R	3	R	5	R	8	R
2023	Carberry	1	R	2	R	0	R	3.5	R
2024	Carberry	1	R	0	R	3	R	12	R
2022	AAC Brandon	1	R	17	MR	25	MR	38	MS
2023	AAC Brandon	1	R	5.7	R	55	S	11	I
2024	AAC Brandon	1	R	10	R	-	S	34	MS
2022	AAC Penhold	1	R	0	R	25	MR	0	R
2023	AAC Penhold	1	R	5	R	20	MR	6	MR
2024	AAC Penhold	1	R	8	R	-	MS	1	R
2023	Faller	1	R	33.3	I	75	S	25	MS
2024	Faller	1	R	62	S	80	S	23	I
2022	HY2161	5	I	1.7	R	5.5	R	2	R
2023	HY2161	2.3	MR	0	R	5	R	0	R
2024	HY2161	1	R	0	R	10	R	3	R
Overall			MR		R		R		R

R: Resistant; MR: Moderately resistant; I: Intermediate; MS: Moderately susceptible; S: Susceptible

Table 3. The reaction of HY2161 and check cultivars to Fusarium head blight (FHB) in the High Yield Wheat Registration Trials, 2022-2024.

Year	Entry	Morden						Carman						Ottawa		
		Mean INC ¹	Mean SEV ²	Mean VRI ³	VRI Rating ⁴	DON ⁵ ppm	DON Rating	Mean INC	Mean SEV	Mean VRI	VRI Rating	FDK ⁶ %	DON ppm	DON Rating	Mean VRI	DON ppm
2021*	Glenn	3.0	7.0	0.2	R(MR)	.	.	50.0	15.0	8.0	MR	.	.	.	.	.
2023	Glenn	71.7	30.0	21.1	I	17.0	I	11.7	15.0	1.8	MR	2.4	1.4	I	21.3	42.3
2024	Glenn	46.7	20.0	9.3	MR	8.2	I	41.7	33.3	14.0	I	25.9	4.4	MR	5.0	.
2021*	Faller	5.7	7.0	0.4	R(MR)	.	.	63.0	17.5	10.6	MR	.	.	.	.	.
2023	Faller	75.0	25.0	18.8	I	10.6	MR	10.0	20.0	2.5	MR	2.4	1.1	I	5.3	22.7
2024	Faller	61.7	30.8	19.1	I	5.3	MR	30.0	25.0	7.6	MR	19.1	3.1	MR	11.3	.
2021*	Carberry	2.0	10.5	0.2	R(MR)	.	.	65.0	22.5	14.6	MR	.	.	.	.	.
2022	Carberry	60.0	21.7	13.3	I	9.0	I	58.3	46.7	28.3	MR	5.5	6.8	MR	14.7	21.8
2023	Carberry	80.0	31.7	26.0	I	16.1	MR	8.3	10.0	0.8	MR	0.9	0.4	MR	4.1	21.7
2024	Carberry	80.0	26.7	21.4	I	12.9	I	33.3	21.7	7.3	MR	15.9	3.9	MR	10.3	.
2021*	AAC Brandon	2.4	7.0	0.2	R(MR)	.	.	45.0	18.0	8.0	MR	.	.	.	.	.
2022	AAC Brandon	38.3	23.3	8.8	MR	4.2	MR	60.0	46.7	28.2	MR	5.6	10.7	I	34.0	29.1
2023	AAC Brandon	81.7	33.3	27.5	I	12.3	MR	16.7	18.3	3.2	MR	2.6	1.5	I	12.9	15.4
2024	AAC Brandon	71.7	25.0	17.8	I	10.2	I	53.3	30.0	15.7	I	23.7	6.1	I	10.0	.
2021*	AAC Penhold	6.0	14.0	1.1	MR	.	.	83.0	35.0	29.0	MR/I	.	.	.	.	.
2022	AAC Penhold	61.7	43.3	28.3	MS	12.2	MS	55.0	60.0	33.0	I	6.3	10.3	MR	36.0	33.7
2023	AAC Penhold	76.7	33.3	25.3	I	26.5	I	10.0	25.0	2.6	MR	4.5	1.9	I	14.9	12.1
2024	AAC Penhold	76.7	36.7	28.7	MS	10.1	I	30.0	36.7	10.8	MR	25.3	3.4	MR	16.7	.
2021*	21HYWB51	30.0	7.0	2.1	MR	.	.	85.0	30.0	25.5	MR/I	.	.	.	.	.
2022	HY2161	75.0	43.3	32.5	MS	14.9	MS	56.7	70.0	39.7	I	10.6	15.6	I	50.7	42.7
2023	HY2161	90.0	36.7	33.0	MS	35.4	MS	11.7	21.7	2.6	MR	3.0	1.8	I	25.2	37.7
2024	HY2161	80.0	35.0	27.7	I	9.6	I	31.7	21.7	6.8	MR	33.1	4.0	MR	15.7	.

* Data from 2021 High Yield Wheat B Trial where HY2161 was tested as entry 51

¹ INC = Incidence; ² SEV = Severity

³ VRI = Visual Rating Index = ((R1inc*R1sev)+(R2inc*R2sev)+(R3inc*R3sev))/3

⁴ Rating = (R=resistant, MR=moderately resistant, I=intermediate, MS=moderately susceptible, S=susceptible)

⁵ DON = Deoxynivalenol

⁶ FDK = Fusarium Damaged Kernels



Table 4: Quality data for HY2161 and checks from the High Yield Wheat Registration Trials, 2022-2024.

Entry	Year	Vote			Wheat and Flour Characteristics					Milling Performance				Dough Properties						Baking Quality (LNT)					
		Endorse	Flag	Abstain	Grade (and degrading factors)	Wheat Pro	Flour Pro	Pro Loss	FN	Amyl Peak	Clean Wht Flr Yld	Fir Yld PB 0.50 Ash	Flour Ash	Starch Dmg	Farino Abs	Farino DDT	Farino Stab	EXT Area	EXT Rmax	EXT Length	Abs	Pk Time	WHR /KG	LV	LTR
Glenn	2023				1 CWRS	14.3	13.5	0.9	286	411	75.5	80.0	0.38	8.2	64.2	7.6	14.4	158	830	16.4	73	4.9	13.8	826	0.64
Glenn	2024				1 CWRS	14.5	13.8	0.7	333	584	76.6	78.5	0.41	7.9	64.9	9.5	12.1	158	760	17.5	74	4.6	11.5	828	0.57
Faller	2023				1 CNHR	13.0	12.2	0.9	356	559	77.7	80.0	0.38	8.6	64.1	5.3	8.3	106	480	17.9	73	3.6	9.6	763	0.58
Faller	2024				1 CNHR	13.4	12.5	1.0	399	714	77.3	80.0	0.38	8.2	63.7	5.7	9.7	133	582	18.4	73	3.8	12.5	803	0.57
Carberry	2022				1 CWRS	14.9	13.9	1.1	382	403	75.6	77.5	0.43	7.5	64.0	5.50	7.0	113	441	20.6	71	3.1	8.8	745	0.46
Carberry	2023				1 CWRS	14.2	13.5	0.8	315	481	76.1	79.0	0.40	7.4	63.0	6.4	10.2	138	566	19.8	72	3.9	11.2	749	0.58
Carberry	2024				1 CWRS	14.9	13.8	1.1	373	466	76.2	80.0	0.38	7.1	63.1	7.2	10.0	143	569	19.9	72	3.7	9.8	815	0.55
AAC Brandon	2022				1 CWRS	14.3	13.3	1.0	404	608	76.6	80.0	0.38	8.1	66.3	6.25	8.5	88	394	17.9	70	2.8	7.5	720	0.43
AAC Brandon	2023				1 CWRS	14.6	13.8	0.8	336	361	76.5	78.5	0.41	7.9	66.0	6.4	9.4	110	424	20.7	75	3.3	9.0	733	0.51
AAC Brandon	2024				1 CWRS	14.4	13.4	1.0	352	563	77.3	79.0	0.40	7.7	65.6	6.6	10.7	102	421	19.3	75	3.4	9.9	744	0.46
AAC Penhold	2022				1 CPSR	13.3	12.4	0.8	492	728	76.5	78.0	0.42	7.4	62.8	6.25	9.5	107	542	16.1	71	3.4	9.4	730	0.51
AAC Penhold	2023				1 CPSR	13.5	12.8	0.8	412	637	77.1	78.0	0.42	6.9	62.6	7.1	12.1	138	694	16.3	72	4.4	12.8	727	0.60
AAC Penhold	2024				1 CPSR	13.7	12.7	0.9	416	732	77.8	77.5	0.43	6.7	61.6	6.6	14.0	137	716	16.3	71	4.4	11.4	795	0.56
HY2161	2022			Motion to accept data	1 CPSR	12.8	12.0	0.9	427	877	77.5	78.0	0.42	7.8	60.9	7.25	13.0	129	766	14.0	.	.	.	.	.
HY2161	2023			Block-Endorse-16	1 CPSR	12.6	11.9	0.8	323	499	76.4	78.5	0.41	7.6	61.2	6.0	15.1	155	782	16.7	70	4.8	12.9	732	0.60
HY2161	2024				2 CPSR - SPTD 0.7	13.0	12.1	0.8	352	795	77.5	79.0	0.40	7.5	61.1	5.8	14.7	134	814	14.3	70	4.7	13.5	781	0.58

74% extraction flour was used for all flour, dough and baking tests