



Request for Support for Registration For BT980 (*Celebration*)

Crop: Barley (*Hordeum vulgare*)

Type: Six Row Spring Malt

Proposed Name: Celebration (see U.S. PVPA Certificate 200800311)

Proposers: Gary Hanning and Blake Cooper
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3515 E. Co. Rd. 52
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Test Number: BT980 aka 6B01-2218 or Celebration

Pedigree: 6B94-7378 // 6B89-2027 / M84

Area of Adaptation: Mid-western United States and Western Canada.

Strengths:

- **Malting profile** consistent with Anheuser-Busch-InBev brewing requirements. It has high levels of enzymes, α -amylase and diastatic power similar to the varieties Legacy and Tradition. Overall malting profile is equivalent to or superior to both Legacy and Tradition, with well balanced modification and consistently high levels of malt extract.
- **Competitive yields:** Celebration yielded 0.3% more than Legacy in the two year average of all (38) locations in the 2007 and 2008 Western Canadian Six-row Coop. In Canada, Celebration appears best adapted to the Eastern Black and Brown soil zones where it has a two year yield average of 101.1% and 106.4% of Legacy respectively.
- **Plumper Kernels:** Celebration averaged 3.2% more plump kernels than Legacy in the two year average of the 2007 and 2008 Western Canadian Coop Evaluations.
- **Shorter plant height:** Celebration averaged ~2 cm shorter than Legacy in the two year average of the 2007 and 2008 Western Canadian Coop Evaluations.
- **Reduced lodging:** Celebration averaged less lodging (2.9 vs.4.0) than Legacy in the two year average of the 2007 and 2008 Western Canadian Coop Evaluations.
- **Intermediate heading:** Celebration averaged 0.6 days earlier heading and 1.6 days earlier to maturity than Legacy in the 2007 and 2008 Western Canadian Coop.
- **Smuts:** Celebration is Resistant to all three races of loose smut and Moderately Resistant to covered smut.

Weaknesses:

- **Stem Rust:** Intermediate to Susceptible to Stem Rust in the field and MR-MS to race MCC at the seedling stage;
- **Net Blotch,** susceptible, similar to the check Legacy.
- **Scald;** susceptible, similar to the check Legacy.
- **Septoria;** susceptible, similar to the check Legacy.
- **Common Root Rot;** moderately susceptible, similar to Legacy.

Neutral:

- **Spot Blotch;** MR-MS, equal to the check Legacy.
- **Fusarium head blight;** In only 3 Location x years in the Canadian Coop data Celebration has visual scores equal to Legacy, but slightly higher DON scores.
Also see supplemental data tables 11 and 13 for a metadata analysis of DON scores.

Description: BT980 (*Celebration*) is a white aleurone, short rachilla haired six-rowed spring malting barley that is currently being evaluated in plant scale testing at Anheuser-Busch Inbev. The complete breeding history and extended pedigree of Celebration are shown in the section on additional information from the US PVPA application below. Based on the extended pedigree it is expected that Celebration has inherited ~ 37.5% of its genes in common by descent from the variety Excel. Celebration is primarily adapted to the upper Midwest U.S. and western Canada.

Table 1. Mean Grain Yield (Kg / Ha) for BT980 (Celebration) vs. BT 950 (Legacy)
Western Six-Row Cooperative Tests Two-year Summary (2007 - 2008).

Cultivar	E. Black Soil Zone	Brown Soils	W. Black Soils	Grey Soils	Grand Mean
	Kg/Ha (%)	Kg/Ha (%)	Kg/Ha (%)	Kg/Ha (%)	Kg/Ha (%)
Legacy (BT950)	5876 (100.0)	4870 (100.0)	7656 (100.0)	4757 (100.0)	5844 (100.0)
CELEBRATION	5943 (101.1)	5183 (106.4)	7423 (96.9)	4498 (94.6)	5863 (100.3)
Station Years	17	9	7	5	38

Reference. *PGDC Barley and Oat Sub-Committee website... Western Co-operative Six-Row Barley Registration Report 2007 and 2008.*

Table 2. Mean Grain Yield (Kg / Ha) for BT980 (Celebration) vs. BT 950 (Legacy)
Western Six-Row Cooperative Tests (2007).

Cultivar	E. Black Soil Zone	Brown Soils	W. Black Soils	Grey Soils	Grand Mean
	Kg/Ha (%)	Kg/Ha (%)	Kg/Ha (%)	Kg/Ha (%)	Kg/Ha (%)
Legacy (BT950)	5100 (100.0)	4339 (100.0)	7357 (100.0)	4547 (100.0)	5339 (100.0)
CELEBRATION	5275 (103.4)	4758 (109.7)	7398 (100.6)	4453 (97.9)	5512 (103.2)
Station Years	8	5	3	2	18

Reference. *PGDC Barley and Oat Sub-Committee website... Western Co-operative Six-Row Barley Registration Report 2008*

Table 3. Mean Grain Yield (Kg / Ha) for BT980 (Celebration) vs. BT 950 (Legacy)
Western Six-Row Cooperative Tests (2008).

Cultivar	E. Black Soil Zone	Brown Soils	W. Black Soils	Grey Soils	Grand Mean
	Kg/Ha (%)	Kg/Ha (%)	Kg/Ha (%)	Kg/Ha (%)	Kg/Ha (%)
Legacy (BT950)	6566 (100.0)	5403 (100.0)	7881 (100.0)	4897 (100.0)	6346 (100.0)
CELEBRATION	6536 (99.6)	5609 (103.8)	7441 (94.4)	4528 (92.5)	6231 (98.2)
Station Years	9	4	4	3	20

Reference. *PGDC Barley and Oat Sub-Committee website... Western Co-operative Six-Row Barley Registration Report 2008.*

Table 4. Mean Agronomic Performance for BT980 (Celebration) vs. BT 950 (Legacy)

Western Six-Row Cooperative Tests Two-year Averages (2007 - 2008).

Cultivar	Days to Head	Days to Mature	Height (cm)	Lodging Score	Test Wt. (Kg / HL)	TKW (g /1000)	% Plump
Legacy (BT950)	55.7	90.1	86.3	4.0	61.4	38.4	87.8
CELEBRATION	55.0	88.5	84.4	2.9	62.2	38.4	91.0
Station Years	32	31	36	10	28	27	20

Reference. *PGDC Barley and Oat Sub-Committee website... Western Co-operative Six-Row Barley Registration Report 2007 and 2008.*

Table 5. Mean Agronomic Performance for BT980 (Celebration) vs. BT 950 (Legacy)

Western Six-Row Cooperative Tests (2007).

Cultivar	Days to Head	Days to Mature	Height (cm)	Lodging Score	Test Wt. (Kg / HL)	TKW (g /1000)	% Plump
Legacy (BT950)	55.2	88.1	88.0	4.9	60.2	36.0	82.3
CELEBRATION	54.2	86.5	86.2	3.6	60.8	36.5	87.5
Station Years	15	14	19	6	15	14	12

Reference. *PGDC Barley and Oat Sub-Committee website... Western Co-operative Six-Row Barley Registration Report 2007.*

Table 6. Mean Agronomic Performance for BT980 (Celebration) vs. BT 950 (Legacy)

Western Six-Row Cooperative Tests (2008).

Cultivar	Days to Head	Days to Mature	Height (cm)	Lodging Score	Test Wt. (Kg / HL)	TKW (g /1000)	% Plump
Legacy (BT950)	56.1	91.8	84.4	2.7	63.4	40.5	96.0
CELEBRATION	55.8	90.2	82.5	1.9	64.4	40.1	96.2
Station Years	18	17	18	4	13	13	9

Reference. *PGDC Barley and Oat Sub-Committee website... Western Co-operative Six-Row Barley Registration Report 2008.*

Table 6. Mean Malting Quality Performance for BT980 (Celebration) vs. BT 950 (Legacy).

Western Two-Row Cooperative Tests. Two Year average (2007 - 2008) Mean of 6 Stations.

Cultivar	Plump %	Protein %	Fine Extract %	Sol. Protein %	S/T %	Diastatic Power	α -amylase	β -Glucan	Visc. (cps)	FAN mg/L	Friab. %
Legacy (BT950)	91.9	12.2	78.8	5.54	45.7	156	69.6	299	1.52	183	81.5
CELEBRATION	94.8	13.0	79.2	5.36	41.3	163	62.3	153	1.45	190	85.9
Station Years	6	6	6	6	6	6	6	6	6	3	6

Reference. PGDC Barley and Oat Sub-Committee website... Western Co-operative Six- Row Barley Registration Report 2007 and 2008.

Table 7. Mean Malting Quality Performance for BT980 (Celebration) vs. BT 950 (Legacy).

Western Six-Row Cooperative Tests (2007) Mean of 3 Stations.

Cultivar	Plump %	Protein %	Fine Extract %	Sol. Protein %	S/T %	Diastatic Power	α -amylase	β -Glucan	Visc. (cps)	FAN mg/L	Friab. %
Legacy (BT950)	85.1	12.1	78.3	5.93	49.2	154	71.4	75	1.41	-	96.4
CELEBRATION	91.4	12.9	78.7	5.39	41.7	155	61.4	73	1.41	-	98.0
Station Years	3	3	3	3	3	3	3	3	3	3	3

Reference. PGDC Barley and Oat Sub-Committee website... Western Co-operative Six-Row Barley Registration Report 2007.

Table 8. Mean Malting Quality Performance for BT980 (Celebration) vs. BT 950 (Legacy).

Western Two-Row Cooperative Tests (2008) Mean of 3 Stations.

Cultivar	Plump %	Protein %	Fine Extract %	Sol. Protein %	S/T %	Diastatic Power	α -amylase	β -Glucan	Visc. (cps)	FAN mg/L	Friab. %
Legacy (BT950)	98.6	12.2	79.2	5.15	42.1	158	67.7	522	1.63	183	66.5
CELEBRATION	98.2	13.0	79.7	5.33	40.9	171	63.2	233	1.49	190	73.8
Station Years	3	3	3	3	3	3	3	3	3	3	3

Reference. PGDC Barley and Oat Sub-Committee website... Western Co-operative Six- Row Barley Registration Report 2008.

Table 9. Mean Malting Quality Performance for BT980 (Celebration) vs. BT 950 (Legacy).

Western Two-Row COLAB Tests (2007 - 2008) Mean of 7 Stations.

Cultivar	Plump %	Barley Protein %	Fine Extract %	Sol. Protein %	Malt Protein %	S/T %	Diastatic Power	α -amylase	β -Glucan	Visc. (cps)	Friab. %
Legacy (BT950)	94.1	11.5	79.5	5.25	11.4	46.9	163	62.3	307	1.68	76.7
CELEBRATION	95.2	11.9	79.8	5.19	11.8	44.5	170	59.5	252	1.62	75.7
Station Years	7	7	7	7	7	7	7	7	7	7	7

Reference. Email from M. Brophy of 10 Feb, 2009

Table 10a. Disease Reaction Summaries for BT980 (Celebration) vs. BT 950 (Legacy).

Western Two-Row Cooperative Tests (2008). Report 2007 - 2008.

Line	Year	Stem Rust				Net Blotch					Spot Blotch				
		Field		MCC		S.net	Net form				1903	Brandon	Melfort	Saskatoon	Merit
		Sev	Rxn	Seed ling	Merit	wrs 857	wrs 102	wrs 858	Bran.	Merit	Seed ling				
BT 950	07	5	I			3	9	10	4		4	1.5	3.0		
	08	40	MS	12-	0	3	S	9		0/-	4	3.0	5.0	2.5	+
						MR	S	S			MRM S	MR	MR MS	MR	
BT 980	07	10	I			3	9	9	3		4	2.0	3.5		
	08	60	S	12-	0	3	8	9		0/-	4	3.0	6.0	3.0	+
						MRMS	MR	S	S		MRM S	MR	MR MS	MR	
Priority				1		1		1							1

Reference. PGDC Barley and Oat Sub-Committee website... Western Co-operative Six-Row Barley Registration Report 2008.

Table 10b. Disease Reaction Summaries (continued) for BT980 (Celebration) vs. BT 950 (Legacy).

Western Two-Row Cooperative Tests (2008). Report 2007 - 2008.

Line	Year	Scald				Septoria		Fusarium				CRR		Smuts					
		Edmont.	Lacombe	wrs 1493	Merit	692 / 1998	Merit	Sever. Brand on	DON ppm		Merit	%	Laco.	Merit	Ustilago				
									Bran	Port.					nuda	hordei	nigra	cover	Merit
BT 950	07	1.5	9.0	S				3.7	3.9			92		29	4	0			
	08	-	7.5	S	-	S	-	4.5	37.7	9.7	-	64	-	65	9	1	S	-/0	
		MR	MS	S		S				MS		MS		MS	R	R	S		
BT 980	07	4.0	8.5	MS				3.7	4.6			96		0	0	0			
	08	-	7.5	MS	-	S	-	4.5	48.2	6.2	-	64	-	9	4	1	M R	+ / +	
		MR MS	MS	MS		S				MS		MS		R	R	R	M R		
Priority				1		4					1		1	2		1			

Reference. PGDC Barley and Oat Sub-Committee website... Western Co-operative Six-Row Barley Registration Report 2008.

Table 11. Supplemental Agronomic and Pathology data for BT 980 (Celebration) vs BT 950 (Legacy).

All head-to-head paired data contained in BARMS database as of 01 Feb 2009

Canadian data includes all 2007 Coop data; but only limited 2008 Coop data. 1=short, early and best; 9= tall, late and worst

VARIETY		Agronomic Traits								Pathology Traits						
		HEADING DATE	MATURITY (1-9)	HEIGHT CM	LOGGING (1-9)	STRAW BREAK AGE	VISUAL PLOT WORTH	YIELD Bu/ac	YIELD Kg/ha	Foliar Disease (1-9)	SCALD (1-9)	Net-form Net Blotch (1-9)	SPOT BLOTCH (1-9)	Septoria (1-9)	FHB RXN (1-9)	DON ppm
CAN	BT 950	179.7	2.8	89.6	3.2	5.8	4.9	101.0	5428	4.0	5.0	3.5	2.8		4.5	6.0
CAN	BT 980	179.1	2.2	86.2	2.8	4.0	4.5	101.5	5456	4.1	5.2	3.4	3.0		4.6	4.2
CAN	No. Observations	70	2	79	23	2	17	90	90	15	24	14	14		10	5
CAN	Prob. Paired t-test	0.0000	0.5000	0.0000	0.2418	0.0903	0.2058	0.6138	0.6138	0.2873	0.4804	0.5463	0.7045		0.9139	0.1364
USA	BT 950	174.6	5.6	89.0	3.0	3.2	4.7	94.4	5075	3.9	6.6	3.9	2.6	5.3	3.5	4.6
USA	BT 980	174.0	4.6	85.5	3.0	3.1	4.0	98.0	5270	3.7	5.6	2.6	2.9	4.3	4.4	3.9
USA	No. Observations	87	40	85	43	8	43	116	116	21	9	17	7	5	15	29
USA	Prob. Paired t-test	0.0001	0.0000	0.0000	0.9637	0.7702	0.0000	0.0001	0.0001	0.2395	0.2981	0.0333	0.4764	0.1254	0.0326	0.1851

Table 12. Supplemental Malting Quality data for BT 980 (Celebration) vs BT 950 (Legacy).

All head-to-head paired data contained in BARMS database as of 01 Feb 2009

Canadian data includes 2007 Coop data; but only limited 2008 Coop data.

VARIETY		Grain Traits				Protein Traits					Extract and Modification Traits					Enzymes and Misc. Traits				
		PLUMP %	MIDS %	THINS %	BLIGHT (NIR)	GRAIN PROTEIN %	MALT PROTEIN %	WORT PROTEIN %	S/T	FAN ppm	PRED. EXTRACT (NIR)	FINE GRIND EXTRACT	COARSE GRIND EXTRACT	F-C DIFF	BETA GLUCAN	AA	DP	VISC cP	TURB	RDF
CAN	BT 950	85.5	8.7	7.0	1.4	12.4	12.0	5.6	46.6	243	77.9	79.4	79.4	0.9	263	69.0	174	1.53	3.2	
CAN	BT 980	89.2	6.6	6.0	1.1	12.9	12.2	5.5	44.4	234	77.3	79.7	80.0	0.9	128	68.2	183	1.46	3.5	
CAN	No. Observations	57	9	25	13	20	12	16	16	12	13	17	3	3	16	17	17	9	10	
CAN	Prob. Paired t-test	0.0019	0.2759	0.3178	0.0192	0.0005	0.3304	0.3317	0.0905	0.2706	0.0079	0.1822	0.3203	0.9061	0.0022	0.8072	0.0699	0.0702	0.4845	
USA	BT 950	84.1	10.4	4.4	1.0	12.7	12.7	6.1	48.8	251	77.8	79.5	78.6	1.0	190	79.7	191	1.43	5.1	70.4
USA	BT 980	88.1	8.1	3.0	0.4	13.3	13.0	6.0	46.5	240	77.1	79.8	78.7	0.9	85	74.8	197	1.42	5.3	70.4
USA	No. Observations	60	49	56	57	70	47	51	51	43	54	51	13	18	47	51	51	18	51	6
USA	Prob. Paired t-test	0.0000	0.0000	0.0007	0.0000	0.0000	0.0517	0.1757	0.0029	0.0021	0.0000	0.0153	0.3865	0.2567	0.0000	0.0000	0.0644	0.0276	0.6083	0.8182

Table 13. Supplemental Metadata Analysis of Several Six-Row Malting Varieties Relative to the common Check variety Robust.

Courtesy Dr. Kevin Smith University of Minnesota. Barley Improvement Conference, San Diego, CA, January 2009.

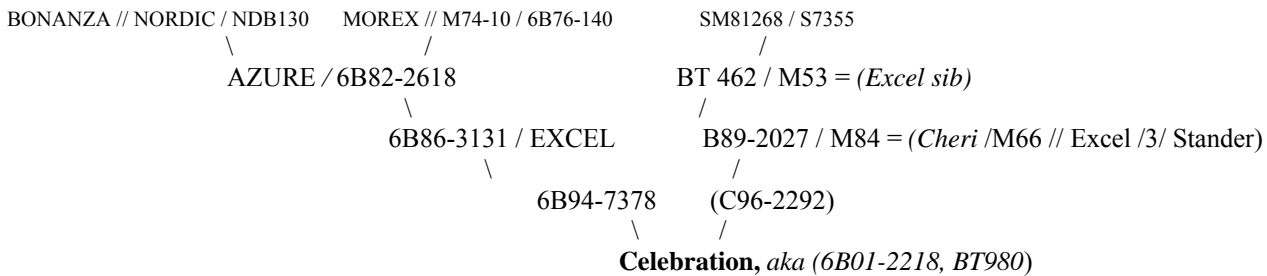
Variety	Yield (bu/A)	% Grain Protein	DON (ppm)	% Malt Extract
Robust	80.0	13.0	2.0	79.0
Lacey	88.2	12.7	2.2	79.4
Tradition	88.9	12.7	2.5	79.4
Stellar-ND	86.1	12.4	2.4	79.6
Rasmusson	91.5	12.2	2.5	80.2
Celebration	90.1	13.0	1.4	79.7
M122	88.6	12.5	1.2	79.4
ND20448	82.3	12.5	1.4	79.1

EXHIBIT A

ORIGIN AND BREEDING HISTORY OF CELEBRATION (6B01-2218)

PEDIGREE: B7378 // B2027 / M84 Date of Cross: 1998

BREEDING HISTORY: The line 6B01-2218 was derived from the three-way cross (C98-2052) made in fall of 1998 in Ft. Collins, CO between 6B94-7378 as female and the F1 hybrid (C96-2292) used as male. The female parent (6B94-7378) is a BARI breeding line with a pedigree of 6B86-3131 / Excel. The male parent (C96-2292) is from a cross between the released line B2027 and M84 from the University of Minnesota. *Based on the extended pedigree of 6B01-2218, which is shown below, it is expected that 6B01-2218 has inherited ~ 37.5% of its genes by descent from the variety Excel.*



The F₁ generation of Celebration was increased in the greenhouse in the fall/winter of 1998/99 and subsequently planted as an F₂ population in Moorhead, MN in 1999. The F₃ generation was grown as a single seed descent (SSD cycle of ~ 98 seed) in the greenhouse in the fall of 1999 and returned to Langdon, ND in 2000 as ninety-five (95) individual F₄ rows. Row #4660 was 1 of 7 such rows selected from this cross on the basis of visual appearance and whole grain NIR scores for protein, predicted extract, blight, etc. and increased as an F₅ plot (AZ 0343) in a counter-season nursery in Yuma, AZ during the fall/winter of 2000/01. The designation 6B01-2218 was assigned to this experimental line and subsequently tested in replicated yield trials, mostly in North Dakota from 2001–2005. 6B01-2218 was entered in regional trials (MVT and WRSBN) in 2003- 2005. In 2004, ~ 250 heads were selected from a pure seed plot at the F_{5:10} stage (03FC-PS source) and ~ 185 were planted in Ft. Collins as head-rows in 2005, with 64 being selected and harvested on visual uniformity. Sixty of these were grown as F_{11:12} progeny plots at Ft. Collins in 2006. Eighteen plots were selected on visual uniformity and planted separately as strips in Ft Collins in the summer of 2007. Thirteen of the 18 strips were selected, uniform and true to type. The uniform plots were bulked together, at harvest, to create breeders seed with a 1.0+ acre increase in Arizona during the fall/winter of 2007/2008. The experimental line name was formally changed to the varietal release name of **Celebration** in 2008. Celebration has been uniform and stable from F₉ through F₁₂. Less than .05% of the plants were rogued from fields in 2008. Approximately 95% of the rogued plants were 2 to 4 centimeters taller than Celebration. Less than .05% total variant plants may be encountered in subsequent generations. This will provide adequate seed for 20+ acres of Foundation in 2008 and drive subsequent plant scale evaluations as early as the 2009 and 2010 crop years. Certified seed should be produced in 2010.

EXHIBIT B

STATEMENT OF DISTINCTNESS

- **Celebration** is most similar to the spring barley variety “Legacy”; however it can be distinguished by the following morphological characteristics:
 - **Celebration** has a bowl shaped collar that forms a V-shape in the front.
Legacy has a saucer shaped collar.
 - **Celebration** base of the first segment is a margin flange with no hairs on the margin.
Legacy base of the first segment is a margin flange with hairs on the margin.
 - **Celebration** has short rachilla hairs
Legacy has long rachilla hairs.
 - **Celebration** has a mid-lax head.
Legacy has a lax head.
 - **Celebration** glumes are sparsely covered with short hairs.
Legacy has long glume hairs confined to a band.
 - **Celebration** rachis shape is plain with short hairs on the margin.
Legacy rachis shape is plain with long hairs on the margin.

EXHIBIT D

BOTANICAL DESCRIPTION OF CELEBRATION (Celebration)

Celebration is a six-rowed, mid-season spring barley bred and developed by Busch Agricultural Resources, Incorporated, Ft. Collins, Colorado. It has excellent malting quality.

Juvenile growth habit is erect. Plant color at boot is green with an upright flag leaf. Head shape is parallel and mid-lax in density with a slightly nodding head type. Neck is straight with a cupped collar that forms a V-shape in the front. First rachis segment is slightly bent back and is long and narrow.

Base of the first segment is a margin flange with no hairs on the margin. Rachis shape is plain with short hairs covering the margin edge. Glume length is one half the length of the kernel and glume hair is short and sparsely covering the outer surface of the glume. The glume awns are rough and more than the length of the glume. Lemma awns are semi-smooth, longer than the spike and persistent. Lemma teeth are frequent and sharkskin appears in the interveinal areas. Lemma hair is absent and the base is a depression showing a tendency to crease. Seed is covered, mid-long to long, finely wrinkled with a slight wax present. The aleurone is colorless. Palea tips are mid-sized. Rachilla length is one-fourth the length of the kernel with short hairs that get shorter at the tip. Ventral crease is open with crease hairs.

Celebration is a Midwestern six-rowed variety well adapted to Minnesota, North Dakota, Idaho and Montana. *(Based on the available Canadian Coop data Celebration also appears to be well adapted to the Eastern Black and Brown soil zones).*