"BG 006"

Six-rowed, Spring Barley

Exhibit A. Origin and Breeding History

BG 006 was developed by WestBred, a unit of Monsanto, Bozeman, Montana from a cross made in 1996 between Nebula/Stanuwax. Nebula is a six-rowed, semidwarf spring barley that was developed by WestBred for high yield, high test weight for the southwest Desert area of Arizona and the Central Valley of California. Stanuwax (also called Stanwax) is a six-rowed hulless, waxy endosperm spring barley developed by Phoenix Seed and released to the public in 1996 for production in North Dakota/Minnesota.

The F_1 seed was planted in growth chambers in Fargo, ND in November, 1996 with the F_2 seed harvested in January 1997. The F_2 seed was planted in growth chambers in Fargo, ND in February, 1997 where spikes with waxy starch endosperm, both hulless and covered seed were selected from the F_2 plants and used to plant single F_3 rows near Bozeman in May, 1997. Single spikes were selected from the F_3 rows in September, 1997 and planted as single F_4 rows near Brawley, CA in November, 1997. Single plants were selected for waxy starch from the F_4 rows in April, 1998 and planted as single F_5 plots near Bozeman, MT in May, 1998. Single spikes were selected from the F_5 plots in September, 1998 and planted as single F_6 rows near Yuma, AZ in November, 1998. Agronomically desired rows were selected for covered seed and waxy starch, harvested and given permanent numbers in April, 1999. One such row was given the experimental designation "YU599-006".

The F_7 bulk was planted near Bozeman, MT in May 1999 and harvested in bulk. The F8 bulk was increased near Yuma, AZ in November of 1999. YU599-006 was tested in replicated trials from 2000 to 2005 in Idaho, Washington and Montana. Heads were selected for purification from an increase plot grown near Bozeman, MT in 2004 and planted as head-row plots near Bozeman, MT in 2005. Uniform appearing plots were harvested individually in September, 2005 and planted separately as strips near Bozeman, MT in 2006. Uniform strips were harvested and bulked in 2007 as a breeders seed increase and YU599-006 was named BG 006. A Foundation seed increase was grown in 2008. The first unencumbered sale of BG 006 was in the spring of 2009. WestBred will maintain Breeder seed of BG 006 by planting head rows when necessary.

A hulless variant may occur at a frequency of up to 4 per 10,000 seed/plants and a non-waxy endosperm variant may occur at a frequency of up to 8 per 10,000 seed/plants. Otherwise, no other variants are known to occur and BG 006 is a stable and uniform variety in appearance and performance.

BG 006 has been evaluated for yield, quality, standability, and general agronomics in WestBred and University trials (Tables 1- 2). BG 006 has been found to be well adapted to the Northwest Region of the US.

Table 1. Comparison of BG 006 covered waxy barley with the commercial check Baronesse in WestBred irrigated ID and MT research plots from 2000 to 2008.

Cultivar	Head Type	Heading	Height	Lodging	Test Weight	Yield
		-dap-*	-cm-	-%-	-lb/bu-	-bu/a-
Average						
BG 006	6	59.0	71.4	23.4	49.8	135.9
Baronesse	2	58.0	85.2	47.7	52.9	136.2
No. Locations		2	17	13	14	19
Minimum						
BG 006	6	57.0	58.4	0.0	43.3	67.2
Baronesse	2	58.0	66.0	10.0	49.8	102.9
Maximum						
BG 006	6	61.0	91.4	55.0	53.2	186.2
Baronesse	2	58.0	109.2	90.0	56.6	189.5
Standard Deviation						
BG 006	6	2.8	9.8	25.3	2.4	30.5
Baronesse	2	0.0	11.3	25.3	1.9	20.8

*Abbreviations: dap= days after planting.

Table 2. Comparison of BG 006 covered waxy barley with the commercial check Nebula in WestBred and University research plots in ID and MT from 2000 to 2008.

Cultivar	Head Type	Heading	Height	Lodging	Test Weight	Yield
		-dap-*	-cm-	-%-	-lb/bu-	-bu/a-
Average						
BG 006	6	72.0	71.1	23.6	50.2	135.9
Nebula	6	70.6	74.9	43.7	50.0	136.3
No. Locations		5	12	6	11	18
Minimum						
BG 006	6	58.0	61.0	0.0	47.7	89.1
Nebula	6	58.0	58.4	0.0	47.5	80.8
Maximum						
BG 006	6	87.0	83.8	68.0	52.6	186.2
Nebula	6	84.0	89.9	78.0	53.5	191.0
Standard Deviation						
BG 006	6	12.2	7.9	28.9	1.8	24.8
Nebula	6	11.5	10.2	27.3	1.9	31.2

*Abbreviations: dap= days after planting.

Exhibit B. Statement of Distinctness

BG 006 is most similar to the variety Nebula but differs in three characteristics.

1) BG 006 has waxy starch (low amylose, stains light reddish brown with a solution of Iodine-Potassium-Iodide) in the endosperm and Nebula has normal starch (20-30% amylose, stains blue with a solution of Iodine-Potassium-Iodide) in the endosperm.
2) BG 006 has a smooth awn surface and Nebula has a rough awn surface.
3) BG 006 has short rachilla hairs and Nebula has long rachilla hairs.

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY
PLANT VARIETY PROTECTION OFFICE
BELTSVILLE, MD 20705

OBJECTIVE DESCRIPTION OF VARIETY
Barley *(Hordeum vulgare L.)*

NAME OF APPLICANT (S)	TEMPORARY OR EXPERIMENTAL DESIGNATION	VARIETY NAME
Monsanto Technology, LLC	YU599-006	BG 006

ADDRESS *(Street and No. or RD No., City, State, Zip Code, and Country)*

800 N. Lindbergh Blvd.
St. Louis MO 63167

FOR OFFICIAL USE ONLY

PVPO NUMBER

PLEASE READ ALL INSTRUCTIONS CAREFULLY:

Place the appropriate number that describes the varietal character of this variety in the boxes below. Place a zero in the first box (i.e., 0 9 9 or 0 9) when the number is either 99 or less or 9 or less.

1. GROWTH HABIT:

[1] 1 = Spring 2 = Facultative Winter 3 = Winter Early Growth: [2] 1 = Prostrate 2 = Semi-Prostrate 3 = Erect

2. MATURITY: (50% Flowering)

[2] 1 = Early (California Mariout) 2 = Mid-Season (Betzes) 3 = Late (Frontier)

[ ][ ][ ] No. Days Earlier Than _____ *

Same as Check Nebula *

[0][0][6] No. of Days Later Than WB 501 *

3. PLANT: (From Soil Level to Top of Head)

[1] 1 = Semi-Dwarf 2 = Short (California Mariout) 3 = Medium Tall (Betzes) 4 = Tall (Conquest)

[3] cm Shorter Than Nebula *

Same as Check _____ *

[4] cm Taller Than WB 501 *

4. STEM:

[1] Exsertion (Flag to Spike at Maturity): 1 = (0 – 3 cm) 2 = (3 – 10 cm) 3 = (10 – 15 cm)

[1] Anthocyanin: 1 = Absent 2 = Present

[0][5] No. of Nodes (Originating from Node Above Ground)

[1] Collar Shape: 1 = Closed 2 = V-Shaped 3 = Open 4 = Modified Closed or Open

[1] Shape of Neck: 1 = Straight 2 = Snaky 3 = Other (Specify) _____

* A commercial variety grown in the same trial.

5. LEAF:

1	Basal Leaf Sheath (Seedling): 1 = Glabrous 2 = Pubescent
2	Position of Flag Leaf (At Boot Stage): 1 = Drooping 2 = Upright
2	Waxiness: 1 = Absent (Glossy) 2 = Slightly Waxy 3 = Waxy
20	mm Width (First Leaf Below Flag Leaf)
23	cm Length (First Leaf Below Flag Leaf)
1	Anthocyanin in Leaf Sheath: 1 = Absent 2 = Present

6. HEAD:

2	Type: 1 = Two-Rowed 2 = Six-Rowed
2	Density: 1 = Lax 2 = Erect (Not Dense) 3 = Erect (Dense) 4 = Other (Specity) _____
2	Shape: 1 = Tapering 2 Strap 3 = Clavate 4 = Other (Specify) _____
1	Waxiness 1 = Absent (Glossy) 2 = Slightly Waxy 3 = Waxy
2	Lateral Kernels Overlap: 1 = None 2 = At Tip 3 = 1/4 – 1/2 of Head
2	Rachis (Hair on Edge): 1 = Lacking 2 = Few 3 = Covered

7. GLUME:

3	Length: 1 = 1/3 of Lemma 2 = 1/2 of Lemma 3 = More than 1/2 of Lemma
2	Hairs: 1 = None 2 = Short 3 = Long
2	Hair Covering: 1 = None 2 = Restricted to Middle 3 = Confined to Band 4 = Completely Covered
3	Awns: 1 = Less than Equal to Length of Glumes 2 = Equal to Length of Glumes 3 = More than Equal to Length of Glumes
2	Awn Surface: 1 = Smooth 2 = Semi-Smooth 3 = Rough

8. LEMMA:

5	Awn: 1 = Awnless 2 = Awnlets on Central Rows, Awnless on Lateral Rows 3 = Short on Central Rows, Awnlets on Lateral Rows 4 = Short (Less than Equal to Length of Spike) 5 = Long (Longer than Spike) 6 = Hooded
2	Awn Surface: 1 = Awnless 2 = Smooth 3 = Semi-Smooth 4 = Rough
1	Teeth: 1 = Absent 2 = Few 3 = Numerous
1	Hair: 1 = Absent 2 = Present
1	Shape of Base: 1 = Depression 2 = Slight Crease 3 = Transverse Crease
1	Raachilla Hairs: 1 = Short 2 = Long

9. STIGMA:

2	Hairs: 1 = Few 2 = Many

10. SEED:

[2] Type: 1 = Naked 2 = Covered

[1] Hairs on Ventral Furrow: 1 = Absent 2 = Present

[5] Length: 1 = Short (8.0 mm)
2 = Short to Mid-Long (7.5 – 9.0 mm)
3 = Mid-Long (8.5 – 9.5 mm)
4 = Mid-Long to Long (9.0 – 10.5 mm)
5 = Long (10.0 mm)

[4] Wrinkling of Hull: 1 = Naked 2 = Slightly Wrinkled 3 = Semi-Wrinkled 4 = Wrinkled

[1] Aleurone Color: 1 = Colorless (White or Yellow) 2 = Blue

[0 1] Percent Abortive [5 1] GMS. per 1000 Seeds

11. DISEASE: (0 = Not Tested, 1 = Susceptible, 2 = Resistant, 3 = Intermediate, 4 - Tolerant)

[0]	Septoria	[2]	Net Blotch	[3]	Spot Blotch	[0]	Powdery Mildew
[0]	Loose Smut	[0]	Bacterial Blight	[0]	Covered Smut	[0]	False Loose Smut
[0]	Stem Rust	[0]	Leaf Rust	[0]	Scab	[0]	Scald
[0]	Aster Yellows Virus	[0]	BSMV	[0]	BYDV	[ ]	Other (Specify) _____

12. INSECT: (0 = Not Tested, 1 = Susceptible, 2 = Resistant, 3 = Intermediate, 4 - Tolerant)

[0]	Green Bug	[0]	English Grain Aphid	[0]	Chinch Bug	[0]	Armyworm
[0]	Grasshoppers	[0]	Cerial Leaf Beetle	[ ]	Other (Specify) _____		

Hessian Fly Races: [0] GP [0] A [0] B [0] C [ ] Other Specify)_____
[0] D [0] E [0] F [0] G

13. CHEMICAL: (0 = Not Tested, 1 = Susceptible, 2 = Resistant, 3 = Intermediate, 4 = Tolerant)

[0] DDT [ ] Other (Specify) _____

14. INDICATE WHICH VAREITY MOST CLOSELY RESEMBLES THAT SUBMITTED:

CHARACTER	NAME OF VARIETY	CHARACTER	NAME OF VARIETY
Plant Tillering	Nebula	Seed Size	Nebula
Leaf Size	Nebula	Coleoptile Elongation	Nebula
Leaf Color	Nebula	Seedling Pigmentation	Nebula
Leaf Carriage	Nebula		

REFERENCES:

The following publications may be used as a reference aid for the standardization of character descriptions and terms used in this form:

1. Wiebe, G.A., and D.A. Reid, 1961, Classifications of Barley Varieties Grown in the United States and Canada in 1958, Technical Bulletin No. 1224, U.S. Department of Agriculture.
2. Reid, D.A., and G.A. Wiebe, 1968, Barley: Origin, Botany, Culture, Winter Hardiness, Genetics, Utilization, Pests, Agriculture Handbook No. 338, U.S. Department of Agriculture, pp. 61-84.
3. Malting Barley Improvement Association, Milwaukee, Wisconsin, 1971, Barley Variety Dictionary.

COLOR: Nickerson's or any recognized color fan may be used to determine color of the described variety.