ID-B-96
Soft White Winter Wheat
Proposed name: 'Brundage 96'

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'Brundage 96' soft white winter wheat (*Triticum aestivum* L.) is proposed for release by the Idaho Agricultural Experiment Station in 2001. Brundage 96 is a white chaffed, awnletted, semi-dwarf soft white common winter wheat with good to excellent yield potential in both dryland and irrigated areas of the Pacific Northwest. It is green-blue in color with an erect to semi-erect flag leaf. The kernels of Brundage 96 are intermediate in size, white, and soft. Brundage 96 has excellent end-use quality characteristics.

Pedigree and History

Brundage 96 is a head row reselection from a pre-breeder field of 'Brundage' (Zemetra et al. 1998) in 1996 based on a slightly different leaf color and a difference in response to stripe rust. It was designated ID-B-96 and tested in the Advanced Yield Nursery for three years (1997-98, 1998-99 and 1999-2000), the Western Regional White Winter Wheat Nursery for two years (1998-99 and 1999-2000) and in extension trials in Idaho, Oregon and Washington in 1999-2000. The pedigree of Brundage 96 is 'Stephens'/'Geneva' (Kronstad et al. 1978; Sorrells and Jensen 1987). Brundage 96 was grown out in head rows for two years and selected for trueness to type. After the two cycles of selection, seed was harvested and used for breeder seed in 1999-2000.

Area of Adaptation

Brundage 96 is a soft white common winter wheat with excellent straw strength that is adapted to intermediate to high rainfall dryland areas of the Pacific Northwest. It also performs well in irrigated regions.

Agronomic Characteristics

Brundage 96 is a semi-dwarf wheat that is similar in height to Brundage and slightly shorter than Stephens (Tables 2, 5,6,7,8,10). Brundage 96 is dark blue-green in color with erect to semi-erect flag leaves. Heading date for Brundage 96 is similar to Stephens and is later than Brundage (Tables 1, 5, 8). Brundage 96 has good to excellent straw strength showing little or no lodging under both dryland and irrigated conditions. It has a moderate level of winter hardiness, similar to that observed in Brundage. Glumes of Brundage 96 are awnletted and seed is intermediate in size, white and soft.

Agronomic Performance

Brundage 96 is high yielding under both dryland and irrigated conditions, similar to Brundage. In dryland trials Brundage 96 equaled or exceeded Brundage, Stephens and

'Madsen' (Allan et al. 1986) for yield (Tables 3, 6, 17). In irrigated trials, Brundage 96 was equal to Brundage and Madsen for yield (Table 3 and 8). In the Western Regional White Winter Wheat Nursery, Brundage 96 equaled or exceeded the yield of Madsen and Stephens over 2 years of testing (Table 5).

Brundage 96 had test weight equal to Stephens and Madsen under both dryland and irrigated conditions (Tables 4, 5, 6, 7, 8, 9, 10). Its test weight was equal or slightly less than that of Brundage under the same conditions. (Tables 4 and 7).

End-use Quality

Brundage 96 has excellent end-use quality for a soft white winter wheat, similar to that of Brundage. The percent flour protein is similar to that of other soft white winter wheats such as Brundage, Stephens and Madsen (Tables 6 and 11). For kernel hardness, Brundage 96 is most similar to Brundage and is usually lower in hardness compared to Stephens and Madsen (Table 12). Break flour yield for Brundage 96 is similar to Brundage and superior to both Stephens and Madsen under both dryland and irrigated conditions (Table 13). In regional testing, results for Brundage 96 for percent flour protein, kernel hardness percent and break flour were similar to the advanced yield trial results (Table 15). For percent flour ash, Brundage 96 was similar to both Stephens and Madsen (Table 15). For end-use quality, Brundage 96 performed well for both the cookie bake test and the sponge cake test. Brundage 96 equaled or exceeded Brundage, Stephens and Madsen for cookie diameter in both the Advanced Yield Trials (Table 14) and in regional testing (Table 15). For sponge cake volume, Brundage 96 equaled or exceeded Stephens and Madsen (Table 15). In Pacific Northwest Wheat Quality Council testing, Brundage 96 was found to have favorable end-use quality for a soft white winter wheat.

Disease Reactions

Brundage 96 has good resistance to stripe rust based on two years of regional testing (Tables 16 and 17). It is susceptible to dwarf bunt (Table 18) and would require the use of a seed fungicide treatment if grown in a region where dwarf bunt can occur. Brundage 96 appears to have a moderate level of tolerance to Cephalosporium stripe. It does not carry the resistance gene for Cercosporella foot rot so should be considered susceptible to this disease.

Breeder and Foundation seed of Brundage 96 will be maintained by the Idaho Foundation Seed Program under the direction of the Idaho Agricultural Experiment Station, University of Idaho, Moscow, ID 83844.

References

Allan, R.E., C.J. Peterson, Jr., G.L. Rubenthaler, R.F. Line, and D.E. Roberts. 1989. Registration of 'Madsen' wheat. Crop Sci. 29: 1575.

Kronstad, W.E., C.R. Rhode, M.F. Kolding, and R.J. Metzger. 1978. Registration of 'Stephens' wheat. Crop Sci. 18:1097.

Sorrells, M.E., and N.F. Jensen. 1987. Registration of 'Geneva' wheat. Crop Sci. 27:1314.

Zemetra, R.S., E.J. Souza, M. Lauver, J. Windes, S.O. Guy, B. Brown, L. Robertson, and M. Kruk. 1998. Registration of 'Brundage' wheat. Crop Sci. 38:1404.

Table 1. Heading date for Brundage 96 compared to Stephens, Madsen, and Brundage in the Moscow Advanced Yield Trials 1997-1999.

	dryland-97	dryland-98	dryland 00	average
no. of sites	1	1	1	
cultivar				
Stephens	161	166	163	163
Madsen	165	168	167	167
Brundage	155	163	160	159
Brundage 96	162	165	163	163

Table 2. Height for Brundage 96 compared to Stephens, Madsen, and Brundage in the dryland and irrigated Advanced Yield Trials 1997-1999.

	dryland-97	dryland-98	dryland-99	average	irrigated-97	irrigated-98	irrigated-99	average
no. of sites	6	6	6		2	3	2	
cultivar								
Stephens	37	28	33	32.7	40	31	36	35.7
Madsen	37	29	34	33.3	39	32	36	35.7
Brundage	33	27	32	30.7	40	29	34	34.3
Brundage 96	34	28	33	31.7	38	29	33	33.3

Table 3. Yield (bu/acre) for Brundage 96 compared to Stephens, Madsen, and Brundage in the dryland and irrigated Advanced Yield Trials 1997-1999.

	dryland-97	dryland-98	dryland-99	average	irrigated-97	irrigated-98	irrigated-99	average
no. of sites	6	6	6		2	3	3	
cultivar								
Stephens	101	78	112	97	140	154	172	155
Madsen	118	89	115	107	130	149	161	147
Brundage	95	91	113	99	133	147	149	143
Brundage 96	105	99	120	108	129	140	155	141

Table 4. Test weight (lbs/bushel) for Brundage 96 compared to Stephens, Madsen, and Brundage in the dryland and irrigated Advanced Yield Trials 1997-1999.

	dryland-97	dryland-98	dryland-99	average	irrigated-97	irrigated-98	irrigated-99	average
no. of sites	6	6	6		2	3	3	
cultivar								
Stephens	55.6	57.2	59.8	57.5	59.2	59	60.2	59.5
Madsen	58.4	58.1	60.5	59.0	59.4	59.1	60.1	59.5
Brundage	57.2	58.6	59.6	58.5	59.9	61.9	59.9	60.6
Brundage 96	57.5	56.9	60.4	58.3	58.8	58.8	60.1	59.2

Table 5. Mean agronomic data for Brundage 96 compared to Stephens and Madsen in the Western Regional White Winter Wheat Nurseries 1998-1999 and 1999-2000.

cultivar	heading-98 (Julian)	heading-99 (Julian)	height-98 (in.)	height-99 (in.)	yield-98 (bu/acre)	yield-99 (bu/acre)	test wt.-98 (lbs/bu)	test wt.-99 (lbs/bu)
Stephens	163	153	35	34	119	115	59.0	60.8
Madsen	165	156	36	36	121	118	59.1	60.9
Brundage 96	162	153	34	33	125	119	59.4	60.7

Table 6. Agronomic data for Brundage 96 from Northern Idaho 1999 extension trials (5 dryland sites).

cultivar	height (in)	yield (bu/acre)	test wt. (lbs/bu)	% protein
Madsen	39.2	109	61.4	10.5
Stephens	38.8	109	61.4	10.4
Brundage-96	38.8	112	61.1	9.7

Table 7. Agronomic data for Brundage 96 from Southwestern Idaho 1999 extension trials (4 irrigated sites).

cultivar	height (in)	yield (bu/acre)	test wt. (lbs/bu)
Brundage	36.0	144	64.8
Stephens	38.0	156	63.6
Brundage-96	36.2	142	62.3

Table 8. Agronomic data for Brundage 96 from Southeastern Idaho 1999 extension trials (3 irrigated sites).

cultivar	height (in)	head. date (Julian)	yield (bu/acre)	test wt. (lbs/bu)
Madsen	37	151	139	61.6
Stephens	36	147	134	60.5
Brundage-96	34	149	134	61.4

Table 9. Agronomic data for Brundage 96 from Oregon 1999 cereal extension trials (8 sites).

cultivar	yield (bu/acre)	test wt. (lbs/bu)
Madsen	104	61.3
Stephens	112	61.2
Brundage-96	106	61.7

Table 10. Agronomic data for Brundage 96 from Washington 1999 cereal extension trials (17 sites).

cultivar	height (in)	yield (bu/acre)	test wt. (lbs/bu)
Madsen	37	109	60.7
Stephens	36	112	60.5
Brundage-96	35	114	60.5

Table 11. Percent flour protein for Brundage 96 compared to Stephens, Madsen, and Brundage in the dryland and irrigated Advanced Yield Trials 1997-1999.

	dryland-97	dryland-98	dryland-99	average	irrigated-97	irrigated-98	irrigated-99	average
no. of sites	4	4	5		2	3	3	
cultivar								
Stephens	8.7	8.7	7.9	8.4	9.0	8.2	9.9	9.0
Madsen	9.5	9.2	8.2	9.0	9.4	8.3	10.6	9.4
Brundage	8.2	8.4	7.8	8.1	8.9	8.0	10.0	9.0
Brundage 96	8.4	8.3	8.0	8.2	8.8	8.3	9.8	9.0

Table 12. NIR hardness for Brundage 96 compared to Stephens, Madsen, and Brundage in the dryland and irrigated Advanced Yield Trials 1997-1999.

	dryland-97	dryland-98	dryland-99	average	irrigated-97	irrigated-98	irrigated-99	average
no. of sites	5	4	5		1	3	3	
cultivar								
Stephens	21.8	22.5	26.5	23.6	26.1	22.5	22.2	23.6
Madsen	29.9	23.3	27.8	27.0	40.5	25.3	24.2	30.0
Brundage	18.3	18.1	17.2	17.9	19.9	20.7	17.9	19.5
Brundage 96	18.3	16.0	17.0	17.1	21.4	16.5	13.2	17.0

Table 13. Percent break flour yield for Brundage 96 compared to Stephens, Madsen, and Brundage in the dryland and irrigated Advanced Yield Trials 1997-1999.

	dryland-97	dryland-98	dryland-99	average	irrigated-97	irrigated-98	irrigated-99	average
no. of sites	4	4	5		2	3	3	
cultivar								
Stephens	34.9	40.4	40.2	38.5	34.7	38.9	38.4	37.3
Madsen	35.7	40.3	40.1	38.7	37.0	42.2	37.4	38.9
Brundage	41.7	45.2	46.4	44.4	39.6	44.5	42.2	42.1
Brundage 96	41.8	46.6	46.0	44.8	40.5	51.4	41.4	44.4

Table 14. Cookie diameter (cm) for Brundage 96 compared to Stephens, Madsen, and Brundage in the dryland and irrigated Advanced Yield Trials 1997-1999.

	dryland-97	dryland-98	dryland-99	average	irrigated-97	irrigated-98	irrigated-99	average
no. of sites	4	4	5		1	3	3	
cultivar								
Stephens	8.6	8.7	8.8	8.7	8.5	8.6	8.8	8.6
Madsen	8.5	8.4	8.6	8.5	8.6	8.5	8.6	8.6
Brundage	9.4	8.7	8.8	9.0	8.7	8.8	8.7	8.7
Brundage 96	8.9	8.7	9.1	8.9	8.8	8.7	8.9	8.8

Table 15. Quality data for Brundage 96 compared to Stephens and Madsen in the Western Regional White Winter Wheat Nursery 1998-1999.

	NIR hard.	flour protein	flour yield	bk fl. yield	flour ash	RVA	cookie dia.	cake vol.
cultivar		(%)	(%)	(%)	(%)		(cm)	(cc)
Stephens	18	7.5	69.2	47.2	0.35	116	9.45	1210
Madsen	27	7.7	68.3	48.4	0.37	104	9.43	1240
Brundage 96	17	7.4	69.0	50.8	0.35	106	9.51	1270

Table 16. Response of Brundage 96 to stripe rust compared to Stephens, Madsen and Brundage from the 1998-1999 Western Regional White Winter Wheat Nursery.

location	Pullman, Wa	Walla Walla, Wa	Mt. Vernon, Wa
stage	7	7	7
cultivar			
Stephens	0%, 0	0%, 0	40%, 2=8
Madsen	0%, 0	0%, 0	5%, 2=5
Brundage	5%, 8	2%, 2=5	99%, 8
Brundage 96	0%, 0	0%, 0	20%, 2=8

Table 17. Response of Brundage 96 to stripe rust compared to Stephens, Madsen and Brundage from the 1999-2000 Western Regional White Winter Wheat Nursery.

location	Pullman, Wa	Mt. Vernon, Wa
stage	6	4
cultivar		
Stephens	0%, 0	20%, 2=8
Madsen	0%, 0	5%, 2=5
Brundage	10%, 8	80%, 8
Brundage 96	0%, 0	10%, 2=8

Table 18. Response of Brundage 96 compared to dwarf bunt compared to Brundage and Madsen in the Western Regional White Winter Wheat Nursery 1998-1999.

cultivar	% dwarf bunt
Madsen	26%
Brundage	26%
Brundage 96	67%

September 14, 2001

MEMORANDUM

TO: Kathy Stewart- Williams
Idaho Foundation Seed

FROM: R.S. Zemetra
Professor
Plant Breeding and Genetics

SUBJECT: Brundage 96 Foundation Seed

Regarding the presence of red seed in Foundation Brundage 96 foundation seed lots KAM-3-01F and 01 KRE W3:

1. Brundage 96 is a direct selection out of Brundage, a soft white winter wheat and red seed has not been found in Brundage or have the parents of Brundage, Stephens and Geneva been known to produce red variants.

2. The potential for out-crossing is low in wheat but red wheat was present on the farm beyond the 90 foot buffer zone required for breeder seed the year breeder seed was produced. Environmental conditions that year could have increased the potential for out-crossing.

3. The possibility of contamination of both lots of Foundation Brundage 96 (KAM-3-01F and 01 KRE W3 would be remote since they were grown in different parts of the state and harvested/process by different crews/facilities. I also walked the field grown at the Kambitsch farm and did not observe any major variants in the field.

4. The level of red seed should not substantially increase in the registered and certified seed classes. If the source of seed was produced by an out-cross the number of red seed should stay relatively constant or decrease through both registered / certified seed production and subsequent generations due to segregation assuming equal survival and reproduction. Due to the low level of red seed the performance of the cultivar should not be reduced.

Recommended action:

1. Allow a variance of five (5) red seed/lb in Foundation Brundage 96, lots KAM-3-01F and 01 KRE W3. This variance would then allow six (6) red seed/lb in Registered and seven (7) red seed/lb in Certified Brundage 96 produced from those Foundation seed lots.

2. Screen breeder seed for red seed and produce new breeder and foundation seed of Brundage 96 in the 2001-2002 growing season.

cc. Dr. Richard Heimsch