

Wheat, Hard Red Spring Jim Anderson, Jochum Wiersma, Gary Linkert, Catherine Springer and Susan Reynolds



Spring wheat varieties are compared in trial plots at Waseca, Lamberton, Morris, Crookston, Stephen, Roseau and St. Paul. Wheat varieties are grown in replicated plots at each location and plots are handled so that factors affecting yield and other characteristics are as nearly the same for all varieties at each location as possible.

These hard red spring wheat trials are not designed for crop (species) comparisons, because the various crops are grown on different fields or with different management. The data should only be used to compare varieties within a table.

Variety Selection Criteria

While grain yield is an important economic trait, return per acre also is affected by grain quality. Because Fusarium Head Blight (FHB), or scab, can reduce grain quality and yield dramatically, it is an important consideration. The foliar disease rating, which represents the total complex of leaf diseases other than leaf and stripe rust, includes the Septoria complex, tan spot, powdery mildew and bacterial blight. Although varieties may differ for their response to each of those diseases, the rating does not differentiate among them. Consequently, the rating should be used as a general

indication and only for varietal selection in areas where these diseases have been a problem or if the previous crop was wheat or barley.

Control of fungal leaf diseases with fungicides may be warranted, even for varieties with an above-average rating. Disease ratings are now on a 1-9 scale where 1 = most resistant and 9 = most susceptible. Rating differences of 2 or more should be considered significant.

Variety selection for 2009 continues to be a balance between yield potential, disease responses and grain quality. Leading varieties in Minnesota, based on acres planted, include Knudson, Freyr, Glenn, Oklee, and Briggs. New releases for 2008 are Breaker (WestBred) and Tom (MAES). Albany is a 2008 release from Trigen.

Table 1. Origin and agronomic characteristics of hard red spring wheat varieties in Minnesota in single-year (2008) and multiple-year comparisons (2006-2008).

Variety	Origin ¹	PVP Status	Days to Heading ²	Height Inches ²	Straw Strength ³
Ada	2006 MN	PVP (94)	62.3	31.1	4
Albany	2008 Trigen	Pending	65.1	30.6	5
Alsen	2000 NDSU	PVP (94)	61.7	32.9	4
Bigg Red	2004 WestBred	PVP (94)	62.6	35.1	6
Blade	2007 WestBred	PVP (94)	63.0	32.7	4
Breaker	2008 WestBred	Pending	62.6	32.5	3
Briggs	2002 SDSU	PVP (94)	60.3	32.5	7
Cromwell	2007 Thunder Seed	PVP (94)	63.6	32.3	5
Faller	2007 NDSU	PVP (94)	63.4	31.9	5
Freyr	2004 AgriPro	PVP (94)	63.0	32.9	6
Glenn	2005 NDSU	PVP (94)	60.6	34.2	4
Granger	2004 SDSU	PVP (94)	61.8	35.4	7
Hat Trick	2006 Trigen	PVP (94)	62.7	31.3	5
Howard	2006 NDSU	PVP (94)	61.9	34.2	7
Kelby	2006 AgriPro	PVP (94)	60.1	29.0	4
Knudson	2001 AgriPro	PVP (94)	62.7	31.1	5
Kuntz	2007 AgriPro	PVP (94)	63.0	30.1	4
Marshall	1982 MN	—	64.8	30.1	4
Oklee	2003 MN	PVP (94)	60.3	31.7	6
RB07	2007 MN	PVP (94)	60.5	31.6	5
Rush	2006 WestBred	PVP (94)	60.8	31.7	2
Samson	2007 WestBred	PVP (94)	62.8	29.6	2
Steele-ND	2004 NDSU	PVP (94)	62.0	34.1	7
Tom	2008 MN		61.9	32.9	7
Traverse	2006 SDSU	PVP (94)	60.3	34.6	6
Vantage	2007 WestBred	PVP (94)	66.3	32.1	2
Mean			62.3	32.2	

¹ Abbreviations: MN = Minnesota Agricultural Experiment Station, NPSAS/FBC = Northern Plains Sustainable Agriculture Society/Farmer Breeder Club, N. Star G. = North Star Genetics, NDSU = North Dakota State University Research Foundation, SDSU = South Dakota Agricultural Experiment Station, Trigen = Trigen Seed Services LLC.

² 2008 data.

³ 1-9 scale in which 1 is the strongest straw and 9 is the weakest. Based on 2004-2008 data. The rating of newer entries may change by as much as one rating point as more data are collected.

Table 2. Grain quality of hard red spring wheat varieties in Minnesota in single-year (2008) and multiple-year comparisons (2007-2008).

Variety	Test Weight (Lb/Bu)		Protein (%) ¹		Baking Quality ²	Pre-Harvest Sprouting ³
	2008	2 yr.	2008	2 yr.		
Ada	61.9	61.7	14.1	14.2	Medium-High	2
Albany	59.7	59.9	13.7	13.7	—	4
Alsen	61.5	61.1	14.7	15.0	High	2
Bigg Red	63.2	62.5	14.0	13.7	Medium-Low	4
Blade	62.5	62.6	14.5	14.7	—	5
Breaker	62.7	—	14.3	—	—	—
Briggs	61.2	61.3	14.4	14.7	Medium	2
Cromwell	61.9	61.8	14.6	14.7	—	3
Faller	60.8	60.9	14.3	14.3	Medium	2
Freyr	60.0	60.0	14.2	14.3	Medium	2
Glenn	63.5	63.4	15.3	15.5	High	1
Granger	60.9	60.8	14.9	14.7	Medium	4
Hat Trick	62.0	61.6	14.0	14.0	Medium-Low	4
Howard	60.8	61.2	14.7	14.9	Medium-High	1
Kelby	61.4	61.2	14.6	14.7	Medium	1
Knudson	61.1	61.0	13.6	13.8	Medium-High	3
Kuntz	60.4	60.3	13.9	13.9	—	2
Marshall	58.4	57.8	13.6	13.5	Low	2
Oklee	62.0	61.4	15.0	14.9	Low-Medium	3
RB07	60.8	60.6	14.4	14.8	Medium-High	2
Rush	62.5	62.0	14.7	14.7	Medium-High	2
Samson	60.2	59.9	13.9	13.9	—	4
Steele-ND	61.5	61.5	14.8	15.0	High	2
Tom	61.2	61.0	14.2	14.3	Medium	1
Traverse	58.9	58.5	13.9	13.8	Low	4
Vantage	62.6	62.2	15.4	15.3	—	2
Mean	61.3	61.0	14.4	14.4		

¹ 12% moisture basis.

² 2003-2007 crop years.

³ 1-9 scale in which 1 is best and 9 is worst.

Values of 1-3 should be considered as resistant.

Leaf rust caused substantial damage across the trials on susceptible varieties in 2007 and again in Lamberton in 2008. Varieties with ratings of 5 or higher should be closely monitored during the season for rust development. Varieties with ratings of 4 or better should not experience economic levels of damage in most years.

Stripe rust was a serious problem on susceptible varieties in some locations in 2004. This disease is not as widespread and does not occur as regularly as leaf rust, but can be very damaging when temperatures remain unseasonably cool into early July. Most varieties are resistant or moderately resistant.

Stem rust ratings are included in the disease tables because there are differences in variety reaction. However, the levels of this disease have been very low in production fields in recent years, even on susceptible varieties.

Table 3. Disease reactions¹ of hard red spring wheat varieties in Minnesota in multiple-year comparisons (2006-2008).

Variety	Leaf Rust	Stripe Rust	Stem Rust ²	Leaf Diseases ³	Scab
Ada	5	1	2	5 ⁴	6
Albany	3	—	3	5	4
Alsen	5	1	1	6	4
Bigg Red	8	—	2	7	3
Blade	2	—	2	3	4
Breaker	2	—	2	3	—
Briggs	1	1	2	5	5
Cromwell	4	—	1	4	4
Faller	1	—	1	3	4
Freyr	4	1	4	4	4
Glenn	1	1	1	4	3
Granger	3	1	1	4	5
Hat Trick	5	—	4	5 ⁴	4
Howard	1	—	1	4	6
Kelby	3	—	1	4	5
Knudson	2	3	3	3	6
Kuntz	3	—	1	4	6
Marshall	8	1	1	7	7
Oklee	4	1	1	5	5
RB07	1	1	1	5	5
Rush	5	—	4	5	5
Samson	5	—	1	6	7
Steele-ND	1	1	1	4	6
Tom	4	—	1	5	4
Traverse	5	—	2	5	5
Vantage	5	—	3	6	5

¹ 1-9 scale where 1 = most resistant, 9 = most susceptible.

² Stem rust levels have been very low in production fields in recent years, even on susceptible varieties.

³ Includes tan spot, septoria, bacterial leaf blight and powdery mildew.

⁴ These varieties are more susceptible to powdery mildew.

Due to the increased use of fungicides on wheat in Minnesota, we initiated an additional variety trial in 2004 in which fungicides are applied at the time of herbicide application (Feekes 5), flag leaf emergence (Feekes 9), and at the onset of flowering (Feekes 10.51). The practice of three fungicide applications during the growing season is not recommended. This fungicide regime was implemented to measure the performance of vari-

eties when fungal diseases were controlled to the maximum extent possible. A grower's decisions regarding fungicide applications should be based on the available decision support systems, and only if and when disease levels are forecasted to reach economic damaging levels.

The additional performance evaluations were carried out adjacent to the conventional (no fungicides applied) trials, so results can be compared directly. The trials were conducted in

Lamberton, Crookston and Roseau in 2008. The fungicide regime as applied in these 2008 trials increased grain yield on average by more than 4 bu/acre, compared to about 9 bu/acre in 2007. The 3-year comparisons showed an increase in grain yield of about 5 bu/acre. Rather than the average increases in grain yield, the responses of individual varieties provide the most useful information; varieties rated susceptible to leaf rust and other leaf diseases benefited most from fungicide applications.

Hard red spring wheat planting rate and date.

Calculating and seeding the appropriate amount of seed is an important first step towards maximizing yield. The seeding rate is a function of the number of kernels per pound of seed, the percent germination of the lot, the expected stand loss as a function of the quality of the seedbed, and the desired stand. In Minnesota, an average optimum stand for hard red spring wheat when planted early is between 28 to 30 plants per square foot or approximately 1.25 million plants per acre. This number should increase by 1 to 2 plants per square foot for every week planting is delayed past the early, optimum, seeding date. Expected stand loss even under good seedbed conditions is between 10% to 20% and will increase with a poor seedbed or improper seed placement due to poor depth control.

The general formula for calculating a seeding rate is:

$$\text{Seeding Rate (Pounds/ Acre)} = \frac{\text{Desired Stand (Plants/ Acre)} \div (1 - \text{Expected Stand Loss})}{(\text{Seeds/ Pound}) \times \text{Percentage Germination}}$$

Calculate the seeding rate for every single seed lot and calibrate the drill accordingly.

Example: Early variety.

Desired Stand, (Plants/Acre)	Expected Stand Loss	Seeds per Pound	Percentage Germination	Seeding Rate, (Lb/Acre)
1.25 million	0.20	14,000	0.95	117

Table 4. Relative grain yield, percent of the mean, of hard red spring wheat varieties in northern Minnesota locations in single-year (2008) and multiple-year comparisons (2006-2008).

Variety	Crookston			Roseau			Stephen			On-Farm (5 Locations)		
	2008	2-Year	3-Year	2008	2-Year	3-Year	2008	2-Year	3-Year	Average	2-Year	3-Year
Ada	99	97	97	93	98	98	99	98	94	99	100	99
Albany	112	121	—	94	96	—	88	105	—	112	—	—
Alsen	95	92	93	91	85	92	87	88	91	96	94	95
Bigg Red	92	92	93	105	89	94	88	90	91	96	91	93
Blade	101	101	—	101	104	—	93	100	—	99	103	—
Breaker	102	—	—	104	—	—	106	—	—	101	—	—
Briggs	96	100	105	97	112	108	87	94	98	98	101	104
Cromwell	102	101	—	103	110	—	95	97	—	99	103	—
Faller	114	123	117	123	125	121	103	115	110	106	112	—
Freyr	105	107	104	95	99	99	95	98	98	99	103	101
Glenn	94	97	95	103	100	104	105	98	98	95	99	100
Granger	95	95	95	93	99	101	85	88	93	103	101	104
Hat Trick	100	97	92	104	96	94	100	108	98	100	103	100
Howard	98	99	103	103	105	107	95	102	103	98	—	—
Kelby	101	101	102	104	112	103	108	103	98	96	95	97
Knudson	100	104	106	98	103	104	100	106	106	104	108	108
Kuntz	106	109	—	105	100	—	107	103	—	102	107	—
Marshall	96	84	89	89	81	85	86	84	83	82	72	76
Oklee	94	95	95	105	104	99	103	99	97	100	99	101
RB07	106	108	108	94	90	91	112	109	112	102	105	105
Rush	88	89	88	99	103	96	103	98	99	93	95	94
Samson	110	112	—	112	111	—	108	112	—	104	108	—
Steele-ND	96	99	101	93	99	104	96	96	100	99	105	106
Tom	99	101	103	100	105	105	118	107	110	104	101	102
Traverse	103	107	108	110	115	115	118	115	116	104	111	111
Vantage	89	96	—	117	104	—	91	98	—	91	93	—
Mean (Bu/Acre)	97.5	88.2	83.9	67.6	59.2	65.5	79.3	74.4	73.2	90.8	80.6	74.7
LSD (0.05)	5.7	10.4	11.5	11.9	17.9	14.8	17.3	17.2	12.6	17.1	13.6	10.4

Table 5. Relative grain yield, percent of the mean, of hard red spring wheat varieties in southern Minnesota locations in single-year (2008) and multiple-year comparisons (2006-2008).

Variety	Lamberton			Morris ¹	St. Paul			Waseca		
	2008	2-Year	3-Year	2-Year	2008	2-Year	3-Year	2008	2-Year	3-Year
Ada	85	95	100	99	74	77	86	104	82	87
Albany	83	112	—	—	105	100	—	123	114	—
Alsen	103	97	96	89	103	98	96	90	92	96
Bigg Red	111	102	101	99	99	100	98	92	99	98
Blade	106	108	—	—	101	103	—	96	100	—
Breaker	100	—	—	—	103	—	—	105	—	—
Briggs	100	111	110	108	110	110	107	83	92	95
Cromwell	88	87	—	—	99	99	—	90	90	—
Faller	104	119	117	115	87	97	102	93	106	105
Freyr	99	100	101	109	104	108	105	95	95	97
Glenn	92	98	95	82	100	101	95	88	95	92
Granger	129	124	120	105	99	99	98	76	100	102
Hat Trick	96	104	100	105	76	78	83	94	105	103
Howard	117	114	112	107	112	114	110	115	118	111
Kelby	99	100	96	84	121	127	119	97	106	103
Knudson	123	124	119	109	91	89	93	109	104	103
Kuntz	86	94	—	—	105	103	—	94	96	—
Marshall	59	61	67	83	74	73	82	65	56	69
Oklee	89	89	90	95	111	112	106	98	108	105
RB07	99	103	105	100	109	110	107	111	105	102
Rush	92	92	91	88	112	104	99	95	95	91
Samson	96	102	—	—	108	105	—	110	109	—
Steele-ND	100	107	106	111	104	109	105	118	119	111
Tom	101	98	95	91	105	107	106	86	90	91
Traverse	129	123	124	115	98	99	103	117	119	117
Vantage	93	96	—	—	100	90	—	100	95	—
Mean (Bu/Acre)	40.2	43.8	45.9	69.2	69.6	65.0	73.9	58.9	56.3	59.8
LSD (0.05)	23.8	22.3	14.2	17.1	9.6	12.4	13.8	23.3	21.6	17.0

¹ The Morris 2008 trial was abandoned due to herbicide drift damage. The 2-year data is from 2006-2007.

Table 6. Relative grain yield, percent of the mean, of hard red spring wheat varieties in Minnesota in single-year (2008) and multiple-year comparisons (2006-2008).

Variety	State			North			South		
	2008	2-Year	3-Year	2008	2-Year	3-Year	2008	2-Year	3-Year
Ada	93	93	94	97	98	96	84	86	91
Albany	102	108	—	99	108	—	106	109	—
Alsen	94	92	93	91	89	92	98	95	95
Bigg Red	96	95	96	94	90	92	99	99	99
Blade	99	102	—	98	102	—	100	103	—
Breaker	103	—	—	104	—	—	103	—	—
Briggs	95	103	104	93	102	104	98	104	104
Cromwell	97	98	—	100	103	—	93	93	—
Faller	105	114	112	113	121	116	93	106	107
Freyr	99	101	102	99	102	100	99	101	102
Glenn	98	97	95	100	98	99	94	96	92
Granger	95	101	101	91	94	96	100	107	106
Hat Trick	95	98	96	101	100	95	87	95	96
Howard	103	106	106	96	101	103	114	113	110
Kelby	105	107	102	104	105	101	107	109	103
Knudson	102	105	105	99	105	105	105	105	105
Kuntz	102	102	—	106	104	—	96	99	—
Marshall	81	75	81	91	83	86	67	65	74
Oklee	100	101	99	100	99	97	101	102	100
RB07	106	104	104	108	104	105	107	104	104
Rush	98	97	94	98	97	95	101	98	94
Samson	108	109	—	109	111	—	106	106	—
Steele-ND	100	104	105	95	98	101	108	110	108
Tom	102	102	101	106	105	106	97	98	96
Traverse	111	112	113	110	112	113	112	112	114
Vantage	98	96	—	97	98	—	98	95	—
Mean (Bu/Acre)	68.9	65	67.3	81.5	74.0	74.3	56.3	57.5	61.4
LSD (0.05)	9.1	6.9	5.3	10.1	8.1	6.7	15.6	11.3	8.0
No. Environments	6	13	20	3	6	9	3	7	11

Table 7. Grain yield (bu/acre) of hard red spring wheat varieties grown under conventional (Conv) and intensive (Int) management.

Variety	North						South						State					
	2008		2-year		3-year		2008		2-year		3-year		2008		2-year		3-year	
	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int
Ada	79.4	82.9	70.4	79.7	70.9	81.8	34.0	46.2	51.8	57.0	53.9	59.1	64.3	70.6	62.4	69.9	63.2	71.5
Albany	85.0	89.4	—	—	—	—	33.4	48.6	—	—	—	—	67.8	75.8	—	—	—	—
Alsen	76.8	75.3	65.2	69.1	69.3	72.3	41.4	47.0	48.7	56.3	49.8	55.9	65.0	65.8	58.1	63.6	60.5	64.9
Bigg Red	81.2	80.7	67.2	74.7	—	—	44.5	50.8	51.8	63.4	—	—	69.0	70.8	60.6	69.8	—	—
Blade	83.4	83.8	74.1	74.8	—	—	42.8	43.3	54.5	58.5	—	—	69.9	70.3	65.7	67.8	—	—
Breaker	84.8	86.3	—	—	—	—	40.3	45.2	—	—	—	—	70.0	72.6	—	—	—	—
Briggs	79.7	83.0	74.9	80.0	78.1	83.2	40.1	45.3	56.8	59.2	58.3	60.1	66.5	70.4	67.1	71.1	69.1	72.7
Cromwell	84.6	88.9	76.0	81.0	—	—	35.2	39.8	47.4	51.1	—	—	68.1	72.5	63.7	68.2	—	—
Faller	98.0	100.1	89.5	91.7	—	—	41.9	46.6	62.0	64.6	—	—	79.3	82.2	77.7	80.1	—	—
Freyr	82.8	87.3	74.7	82.0	75.2	82.7	39.8	46.5	52.5	59.5	55.9	61.6	68.5	73.7	65.2	72.3	66.4	73.1
Glenn	81.3	85.4	71.7	76.5	74.2	75.5	36.9	39.7	47.8	52.3	47.6	51.3	66.5	70.1	61.5	66.1	62.1	64.5
Granger	77.5	81.6	69.7	74.5	72.2	76.1	51.8	52.9	61.4	64.9	60.8	65.5	68.9	72.0	66.1	70.4	67.0	71.3
Hat Trick	84.3	87.1	70.8	77.2	—	—	38.6	39.3	53.3	57.1	—	—	69.1	71.1	63.3	68.6	—	—
Howard	83.0	85.7	73.6	80.0	77.7	80.5	46.9	51.6	55.0	62.4	57.9	63.7	71.0	74.3	65.6	72.4	68.7	72.9
Kelby	84.7	82.0	76.4	78.0	75.1	77.4	39.8	54.1	50.5	57.5	48.6	55.9	69.7	72.7	65.3	69.2	63.0	67.6
Knudson	81.8	81.2	74.9	78.1	77.3	81.0	49.4	53.4	61.5	66.8	61.1	64.4	71.0	71.9	69.2	73.2	69.9	73.5
Kuntz	87.1	87.5	76.6	82.0	—	—	34.4	44.9	51.9	55.3	—	—	69.5	74.0	66.0	70.5	—	—
Marshall	76.6	83.0	60.8	80.4	65.3	82.0	23.8	41.8	33.7	54.7	39.4	56.8	59.0	69.3	49.2	69.3	53.5	70.5
Oklee	82.0	84.8	71.9	78.6	71.9	76.7	35.7	45.1	47.1	56.2	49.5	56.9	66.6	71.6	61.3	69.0	61.7	67.7
RB07	82.5	87.6	72.7	76.6	—	—	39.9	48.1	49.8	56.1	—	—	68.3	74.4	62.9	67.8	—	—
Rush	77.1	72.7	69.0	70.4	67.6	70.9	37.0	43.0	47.9	50.5	48.0	49.3	63.8	62.8	59.9	61.9	58.7	61.1
Samson	91.4	98.3	80.8	89.6	—	—	38.6	54.0	53.7	64.4	—	—	73.8	83.5	69.2	78.8	—	—
Steele-ND	77.7	83.6	71.2	77.2	75.6	80.6	40.3	45.6	55.2	57.2	57.8	57.5	65.2	70.9	64.4	68.6	67.5	70.1
Tom	82.3	87.1	—	—	—	—	40.6	43.8	—	—	—	—	68.4	72.6	—	—	—	—
Traverse	88.1	82.9	79.9	79.8	82.3	81.4	52.0	58.6	61.4	71.7	64.1	70.5	76.1	74.8	71.9	76.3	74.0	76.4
Vantage	85.1	89.3	73.2	78.9	—	—	37.5	49.6	49.9	61.3	—	—	69.2	76.1	63.2	71.4	—	—
Mean (Bu/Acre)	82.6	85.4	73.3	78.7	73.8	78.7	40.3	47.4	52.4	59.0	53.8	59.2	68.5	72.8	64.3	70.3	64.7	69.8
LSD (0.05)	10.5	9.2	7.5	7.7	6.2	6.3	9.6	7.0	6.8	8.2	5.5	5.9	8.6	7.2	5.4	6.1	4.3	4.5
No. Environments	2		4		6		1		3		5		3		7		11	