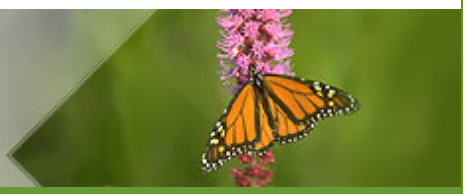
Minnesota Agricultural Experiment Station
University of Minnesota



Hard Red Spring Wheat

J.A. Anderson, G.L. Linkert and J.J. Wiersma

Varietal Trials Results, January 2006

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. These plots are handled so that the 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. Tested hard red spring wheat varieties are listed in the order of their flowering date in the tables.

Variety Selection Criteria

While grain yield is an important economic trait, return per acre also is affected by grain quality. Fusarium Head Blight (FHB), or scab, is an important consideration because it can dramatically reduce grain quality and yield.

The foliar disease rating, which represents the total complex of leaf diseases other than leaf rust, includes the Septoria complex and tan spot. 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 leaf diseases with fungicides may be warranted, even for varieties with an above-average rating.

The varietal response to FHB is presented as a severity rating, similar to the rating for leaf and stem rust. Resistance to spread in the head, the basis for this severity rating, is one of the resistance mechanisms to the disease. A second rating is provided to characterize ability to maintain sound, plump kernels despite visual disease symptoms on the head. This ability to maintain sound kernels, and thus test weight is another component to resistance.

Variety selection for 2006 continues to be a balance between yield potential, disease responses and grain quality. Leading varieties in Minnesota, based on acres planted, include Oxen, Knudson, Oklee, Granite, Briggs and Alsen. New releases for 2005 are Glenn (NDSU) and Ulen (MN). The variety Express was tested for the first time in the 2005 Minnesota variety trial.

Leaf rust continues to be a yearly problem on varieties with ratings of MS or worse. Varieties with ratings of MR or better should not experience economic levels of damage to this fungus 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. Trooper and Walworth are more susceptible, and sustained economic levels of damage in 2004.

Falling number data, an important end-use quality trait that can be determined at most local elevators, has been added to the grain-quality table. Falling number is measured in seconds, and values of 300 or higher are required for milling quality wheat. Falling number is related to preharvest sprouting because sprouted grain will always have low falling numbers. In the absence of visual sprouting, falling numbers are generally greater than 400, except in certain varieties.

Due to the increasing popularity of fungicide applications on wheat, we have been testing varietal response to application of fungicides at the time of herbicide application (Feekes 5), flag leaf emergence (Feekes 9), and at 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 varieties' yield potential when fungal diseases were controlled.

Growers' decisions regarding fungicide application should be based on the available decision support systems, and only if and when disease levels are forecasted to reach

economic damaging levels. These tests were carried out in the same field as the conventional (no-fungicide-applied) trials, so the results can be compared directly.

Three locations (Crookston, Morris and Roseau) and two locations (Crookston and Morris) were included in the conventional vs. intensive comparison in 2004 and 2005, respectively. Over the two years, there was a 5- to 8-bushel/acre yield increase in response to fungicide treatment.

Varieties most susceptible to leaf and stripe rust diseases benefited most from the fungicide applications.

Variety descriptions published in editions prior to 2005 have been discontinued because all of the information they contained is now included in the tables.

Origin, characteristics, and disease reactions of hard red spring wheat varieties.

									Scab	
Variety	Origin[1]	PVP Status[2]	Days to Heading[3]	Height cm[3]	Straw Strength[4]	Leaf Rust[5]	Stripe Rust[5]	Other Leaf Diseases[5]	Disease Severity[5]	Grain Soundness[6]
Oklee	2003 MN	PVP (94)	64	80	Medium	MR-MS	R	MR	MR-MS	2.5
Glenn	2005 NDSU	PVP (pnd)	64	87	Strong	R	R	—	MR	1.5
Ulen	2005 MN	PVP (pnd)	64	81	Medium	MR	R	MR-MS	MS	3.5
Trooper	2004 Westbred	PVP (pnd)	65	75	V Strg	MR	MS-S	—	MR-MS	2.5
Briggs	2002 SDSU	PVP (94)	65	83	Medium	R	R	MR	MR-MS	3.0
Walworth	2001 SDSU	PVP (94)	65	84	Medium	MS	MS	MS-S	MR-MS	2.5
Banton	2004 Trigen	PVP (pnd)	65	83	Strong	R-MR	R	—	MR-MS	2.5
Granger	2004 SDSU	PVP (94)	65	88	Medium	MR	R	MR	MR-MS	2.5
Dapps	2003 NDSU	PVP (94)	66	92	Medium	R	MR	MR-R	MS	3.0
Oxen	1995 SDSU	PVP (94)	66	79	M Strg	MS-S	R	MS	MS-S	3.0
Express	1992 Westbred	PVP (94)	66	68	V Strg	MR	R	—	—	—
Steele-ND	2004 NDSU	PVP (94)	66	81	Medium	R	R	MR	MS	2.5
Reeder	1999 NDSU	PVP (94)	66	79	Strong	MS-S	R	MR	MS	3.5
Mercury	1999 N. Star G.	PVP (94)	66	72	Strong	MR	R	MR-R	S	5.0
Parshall	1999 NDSU	PVP (94)	67	90	Strong	MS-S	R	MR-R	MR-MS	2.0
Alsen	2000 NDSU	PVP (94)	67	82	Strong	MR	R	MR-MS	MR	2.0
Knudson	2001 AgriPro	PVP (94)	67	79	M Strg	R	MR	MR-R	MR-MS	2.5
Freyr	2004 AgriPro	PVP (94)	67	82	Medium	MR-MS	R	—	MR	2.0
Hanna	2002 AgriPro	PVP (94)	68	91	M Strg	MS-S	R	MR-MS	MR	2.0
Norpro	1999 AgriPro	PVP (94)	69	75	Strong	MR-MS	MR	MR-R	MS	3.5
Granite	2002 Westbred	PVP (94)	69	78	V Strg	MS	MR	MR-MS	MR-MS	2.5
Marshall	1982 MN	—	71	77	Strong	S	R	MS	MS	3.5
Saturn	2004 N. Star G.	PVP (94)	72	87	V Strg	MR-MS	R	—	MS	3.5
Polaris	2004 N. Star G.	PVP (94)	73	85	V Strg	MS	R	—	MS	3.5
Mean			67	94						

1 Abbreviations: MN = Minnesota Agricultural Expt. Station and USDA-ARS, North Station; N. Star G. = North Star Genetics; NDSU = North Dakota State University Research foundation; SDSU = South Dakota Agricultural Expt. Stn.; Trigen = Trigen Seed Services LLC.

2 PVP = plant variety protection. When the letters are followed by (94), seed of that variety may not be sold by a grower to anyone without express permission of the variety's developer/owner. If the PVP designation is followed by (pnd) consider that the variety has PVP (94) protection.

3 2005 data. Days to heading is approximate because not all locations are included.

4 2002-2005 data.

5 R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible.

6 Ability to maintain plump, sound kernels under scab epidemics; 1 = good, 5 = poor.

Grain quality of hard red spring wheat varieties.

	Test Weight (Lb/Bu)		Protein (%)[1]		Baking	Falling	Pre-Harvest
Variety	2005	2-Year	2005	2-Year	Quality[2]	Number[3]	Sprouting
Oklee	59.8	60.4	15.2	15.0	Low-Med.	6,0,0,1	R
Glenn	61.5	62.0	15.9	15.5	—	—	R
Ulen	58.5	59.3	15.2	15.0	Med.	6,1,0,0	MS
Trooper	59.9	59.9	14.4	14.1	—	—	R
Briggs	59.5	60.1	14.9	14.8	Med.	5,1,1,0	R
Walworth	58.1	58.4	14.8	14.6	Med.-High	6,1,0,0	R
Banton	60.9	60.9	14.6	14.6	—	6,0,0,1	—
Granger	59.2	59.6	14.8	14.7	—	4,3,0,0	MR
Dapps	57.6	58.8	16.3	16.0	High	4,2,1,0	R
Oxen	55.6	56.7	14.6	14.5	High-Med.	5,2,0,0	R
Express	55.4	—	14.7	—	—	—	–
Steele-ND	59.8	60.6	15.4	15.3	—	7,0,0,0	R
Reeder	56.7	58.3	14.0	14.2	Med.-High	7,0,0,0	R
Mercury	57.5	58.6	14.7	14.2	Med.	4,2,1,0	MS
Parshall	60.2	60.7	14.9	14.7	High-Med.	7,0,0,0	R
Alsen	59.7	60.1	15.4	15.1	High	7,0,0,0	R
Knudson	59.1	59.5	14.5	14.3	Med.-High	5,2,0,0	R
Freyr	58.5	58.8	14.9	14.7	—	—	R
Hanna	58.8	59.5	14.9	14.7	High	5,2,0,0	R
Norpro	56.8	57.5	14.8	14.5	Med.	6,0,1,0	R
Granite	60.4	61.1	15.4	15.4	Med.Low	3,3,1,0	R
Marshall	54.8	55.9	14.1	13.9	Low	5,2,0,0	R
Saturn	55.5	56.2	15.4	15.2	—	—	R
Polaris	57.2	58.0	13.9	13.6	—	—	R
Mean	58.7	59.2	14.4	14.7			

[1] 12% moisture basis.

[2] 2001-2003 crop years.

[3] Falling Number is the number of trials in which the variety had falling numbers greater than 400, 350-400, 300-350, and less than 250. Based on 7 environments in 2003 and 2004. A variety that had falling numbers of greater than 400 in all 7 environments (i.e., 7,0,0,0) is best.

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 as poor seedbed or improper seed placement due to poor depth control.

The general formula for calculating a seeding rate is:

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

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	113

Grain yield (percent of the mean) of hard red spring wheat varieties in Minnesota, northern locations.

	Crookston			Roseau[1]	Stephen		
Variety	2005	2-Year	3-Year	2-Year	2005	2-Year	3-Year
Oklee	109	103	101	99	99	101	99
Glenn	103	101	–	104	109	102	–
Ulen	98	93	99	108	87	91	92
Trooper	95	100	–	–	101	106	–
Briggs	97	97	95	110	92	97	100
Walworth	98	100	98	101	115	108	103
Banton	95	100	–	–	100	101	–
Granger	117	99	95	97	116	110	106
Dapps	96	95	96	100	93	90	93
Oxen	100	92	92	103	106	100	99
Express	82	–	–	–	84	–	–
Steele-ND	100	95	97	99	95	99	103
Reeder	82	85	87	102	87	93	97
Mercury	96	97	99	109	111	110	105
Parshall	86	84	89	98	86	88	87
Alsen	98	101	98	96	91	92	94
Knudson	115	115	111	98	111	105	105
Freyr	111	106	–	94	119	101	–
Hanna	104	102	101	94	95	97	99
Norpro	101	101	98	96	96	98	101
Granite	109	110	105	98	101	96	98
Marshall	91	89	92	88	75	85	92
Saturn	112	104	–	–	94	100	–
Polaris	123	115	–	–	138	121	–
Mean (Bu/Acre)	62.3	74.5	77.3	91.3	83.3	77.4	76.5
LSD	11.7	15.5	13.2	17.2	17.7	25.9	14.8

[1]Roseau was abandoned in 2005 due to flooding. The 2-year data are 2003 and 2004.

Grain yield (percent of the mean) of hard red spring wheat varieties in Minnesota, southern locations.

	Lamberton			Morris			St. Paul			Waseca		
Variety	2005	2-Year	3-Year	2005	2-Year	3-Year	2005	2-Year	3-Year	2005	2-Year	3-Year
Oklee	117	106	103	99	103	97	95	99	94	126	114	110
Glenn	91	89	—	87	95	—	123	113	—	119	104	—
Ulen	115	109	104	101	102	101	114	121	112	131	127	120
Trooper	71	81	—	112	98	—	102	116	—	79	83	—
Briggs	118	108	104	118	113	105	105	101	99	109	105	102
Walworth	110	106	102	116	98	102	111	107	108	119	113	108
Banton	112	100	—	107	106	—	102	105	—	102	93	—
Granger	122	115	110	105	107	102	95	96	97	155	123	118
Dapps	127	117	107	93	99	94	109	104	101	104	106	102
Oxen	76	81	91	78	86	96	70	89	97	103	100	103
Express	117	—	—	104	—	—	119	—	—	74	—	—
Steele-ND	126	113	109	98	99	99	131	126	115	126	119	112
Reeder	59	75	85	78	92	98	108	111	110	84	91	93
Mercury	152	133	123	152	132	126	126	131	123	128	126	119
Parshall	84	74	75	90	87	88	95	105	106	97	86	90

Grain yield (percent of the mean) of hard red spring wheat varieties in Minnesota, southern locations (continued).

	Lamberton			Morris			St. Paul			Waseca		
Variety	2005	2-Year	3-Year	2005	2-Year	3-Year	2005	2-Year	3-Year	2005	2-Year	3-Year
Alsen	84	89	91	104	101	97	100	93	94	92	91	89
Knudson	89	102	106	113	115	111	127	116	114	101	111	111
Freyr	122	115	—	109	108	—	89	96	—	101	101	—
Hanna	103	107	98	96	92	93	62	70	79	86	80	84
Norpro	82	95	101	100	97	98	66	70	82	92	98	99
Granite	120	116	118	101	99	103	93	95	96	90	94	97
Marshall	36	57	69	48	59	73	46	45	60	30	47	61
Saturn	112	102	—	101	101	—	121	125	—	98	102	—
Polaris	59	78	—	85	97	—	99	102	—	70	81	—
Mean (Bu/Acre)	35.8	45.4	47.2	43.6	63.3	68.2	51.0	58.9	67.8	39.8	52.9	65.0
LSD	31.0	25.9	22.5	23.7	21.8	20.4	18.7	22.1	20.6	23.9	25.9	16.8

Grain yield (percent of the mean) of hard red spring wheat varieties in Minnesota.

	State			North			South		
Variety	2005	2-Year	3-Year	2005	2-Year	3-Year	2005	2-Year	3 -Year
Oklee	108	104	101	104	102	100	109	106	101
Glenn	105	101	—	106	102	—	105	100	—
Ulen	108	108	105	92	97	99	115	115	110
Trooper	94	96	—	98	98	—	91	95	—
Briggs	107	104	102	94	100	101	113	107	102
Walworth	111	105	103	107	103	101	114	106	105
Banton	103	100	—	97	99	—	105	101	—
Granger	118	108	104	116	103	100	119	111	107
Dapps	103	102	99	94	95	96	108	106	101
Oxen	89	92	97	103	98	98	82	89	96
Express	97	—	—	83	—	—	104	—	—
Steele-ND	112	108	105	97	97	100	120	114	109
Reeder	83	92	96	84	92	95	82	92	97
Mercury	127	121	115	104	106	104	139	131	123
Parshall	90	88	90	86	89	90	92	88	90
Alsen	95	95	94	94	97	96	95	93	93
Knudson	109	109	109	113	106	106	107	111	110
Freyr	108	104	—	115	101	—	105	105	—
Hanna	91	92	92	100	98	98	87	87	88
Norpro	90	93	96	99	99	99	85	90	95
Granite	102	102	102	105	105	101	101	101	103
Marshall	54	65	76	83	85	91	40	52	66
Saturn	106	105	—	103	102	—	108	107	—
Polaris	96	99	—	131	114	—	78	89	—
Mean (Bu/Acre)	51.9	64.2	67.8	72.8	78.6	76.3	42.5	55.1	62.1
LSD	17.0	9.3	6.6	19.0	12.6	8.2	20.7	12.5	9.7
No. Environments	6	13	20	2	5	8	4	8	12

Grain yield (percent of the mean) of hard red spring wheat varieties grown under conventional (Con) and intensive (Int) management.[1]

	Grain Yield (Bu/Acre)				Test Weight (Lb/Bu)				Protein (%)			
	2004		2005		2004		2005		2004		2005	
Variety	Con[1]	Int[1]	Con	Int	Con	Int	Con	Int	Con	Int	Con	Int
Alsen	88	90	53	56	61.2	61.9	59.9	59.2	14.5	14.6	15.3	15.3
Banton	92	92	53	57	61.4	61.2	60.6	59.7	14.3	14.6	14.6	14.8
Briggs	94	94	56	59	61.7	61.5	59.3	58.4	14.2	14.5	14.8	14.8
Dapps	91	86	50	51	60.9	60.0	57.5	57.1	14.8	15.5	16.0	15.5
Express	—	—	48	43	—	—	55.2	54.4	—	—	14.4	14.8
Freyr	87	92	58	58	60.3	60.7	58.9	58.6	14.0	14.5	14.6	15.2
Glenn	—	—	51	57	—	—	60.9	60.7	—	—	15.6	15.7
Granger	90	89	59	65	61.0	61.2	56.9	58.2	14.4	14.4	14.6	14.8
Granite	87	100	56	62	62.5	62.9	60.7	60.9	14.8	15.1	14.7	15.2
Hanna	81	94	53	59	61.5	61.2	59.5	59.3	14.2	14.5	14.6	15.0
HJ98	87	100	—	—	59.3	60.4	—	—	13.4	13.7	—	—
Ingot	81	88	—	—	62.7	62.7	—	—	14.0	14.9	—	—
Knudson	93	96	61	64	60.1	60.3	59.3	58.8	13.9	14.0	14.3	14.4
Marshall	71	96	39	64	58.2	60.8	55.6	58.3	13.5	13.6	13.4	14.1
Mercury	94	108	63	65	60.5	60.8	57.2	56.7	13.5	13.7	14.2	14.2
Norpro	83	100	53	60	58.9	59.9	57.4	56.2	13.6	13.7	14.5	14.5
Oklee	88	94	55	58	61.9	62.5	59.9	59.5	14.7	14.8	15.2	15.0
Oxen	89	94	48	58	59.0	60.3	55.6	56.4	14.0	13.9	14.3	14.8
P 2375	89	93	—	—	61.5	61.9	—	—	14.5	14.2	—	—
Parshall	80	93	46	52	61.5	62.2	60.1	59.6	14.3	14.9	14.1	15.0
Polaris	90	96	57	72	60.2	60.5	58.3	59.6	13.7	13.4	13.4	14.2
Reeder	88	98	43	52	60.6	61.5	56.4	57.4	14.3	14.6	13.6	14.2
Saturn	88	92	57	70	57.9	59.5	56.7	57.6	14.6	14.4	15.1	15.5
Steele-ND	88	87	52	52	61.8	62.0	59.6	58.7	14.7	14.6	14.9	15.1
Trooper	77	105	54	57	59.7	62.4	59.4	59.7	13.3	14.0	14.2	14.5
Ulen	—	—	52	58	—	—	57.9	57.9	—	—	15.3	15.2
Verde	90	93			59.6	60.3	—	—	13.9	13.9	—	—
Walworth	80	96	56	61	59.7	60.7	58.1	57.8	14.2	14.7	14.5	14.9
Mean	86.6	94.6	53.1	58.7	60.5	61.2	58.4	58.4	14.1	14.4	14.6	14.9
LSD	6.2	6.2	7.1	7.1	1.9	1.9	0.7	0.7	1.0	1.0	0.3	0.3

[1] Intensive trials received fungicide treatments at Feekes 5 (Stratego @ 5 fl.oz/acre), Feekes 9 (Tilt @ 4 fl.oz/acre), and Feekes10.51 (Folicur @ 4 fl.oz./acre). Conventional trials received no fungicide.