HARD RED SPRING WHEAT

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 and year of release within variety categories. Only new varieties or those varieties with better than susceptible reaction to scab are being tested.

Variety Selection Criteria

Although all data presented should be considered when choosing wheat varieties, the scab epidemics in the hard red spring wheat growing areas of the state have demonstrated the clear need to give greater weight to selecting varieties for their tolerance to this devastating disease. Scab evaluations include *disease severity*, based on visual spread of the disease on the spike and *grain soundness*, which reflects the variety's ability to maintain plump, sound kernels. These ratings should be considered together to reduce risk of loss. The use of more than one variety to provide different days to

Characteristics of hard red spring wheat varieties.

Variety	Days to Heading [1]	Height cm [1]	Straw Strength [2]	Test Weight (Lb/Bu) 2001	Test Weight (Lb/Bu) 2-year	Protein (%) [3] 2001	Protein (%) [3] 2-year	Baking Quality [4]
Forge	52	84	Strong	61.7	61.7	14.4	14.3	Medium
BacUp	53	85	Medium	62.4	62.4	16.9	16.9	High
Ingot	53	90	M. Strong	62.1	62.4	15.0	15.0	Medium-high
Walworth	53	83	Medium	60.2	60.2	14.7	14.8	Medium-high
Ember	54	83	M. Strong	61.6	61.8	13.6	13.7	Low-medium
McKenzie	54	93	Medium	60.1	60.6	14.7	15.0	High-medium
Oxen	54	80	M. Strong	59.5	59.8	14.7	14.8	High-medium
Russ	54	87	M. Strong	59.8	60.1	14.1	14.2	High-medium
2375	55	82	Medium	61.4	61.1	14.6	14.4	Medium
Alsen	55	81	Strong	61.3	61.7	15.2	15.2	High
Hanna	55	92	M. Strong	60.6	–	14.9	–	–
Keystone	55	87	M. Strong	61.3	–	13.9	–	–
Norm	55	80	Strong	59.7	60.1	14.1	14.0	Medium-high
Parshall	55	90	Strong	62.2	62.3	14.9	15.1	High-medium
Reeder	55	85	Strong	60.2	60.6	14.8	14.9	Medium-high
CDC Bounty	56	95	Medium	61.4	–	15.4	–	–
Dandy	56	78	V. Strong	60.7	60.7	13.9	14.4	Low
Gunner	56	88	M. Strong	61.5	60.8	15.6	15.6	High-medium
HJ98	56	79	Medium	58.7	59.1	14.3	14.2	Medium-low
Knudson	56	78	M. Strong	60.8	–	14.5	–	–
Mercury	56	73	Strong	60.3	60.4	14.2	14.3	Medium
NorPro	56	78	Strong	59.8	59.7	14.4	14.4	Medium-low
Amazon	57	95	Medium	59.7	–	14.7	–	–
Aurora	57	69	V. Strong	59.3	59.0	14.0	13.8	Medium-low
Ivan	57	76	V. Strong	59.7	59.8	13.8	13.8	Low
Marshall	57	76	Strong	60.1	59.8	14.0	13.9	Low
Verde	57	82	M. Strong	59.7	60.1	14.5	14.3	Low-medium
McVey	58	85	Medium	58.1	58.2	13.3	13.3	Low
Mean	55	83		60.7	60.5	14.6	14.7	
LSD	1	4		1.0	0.8	0.5	0.3	

[1] 2001 data. [2] 1999-2001 data. [3] 12% moisture basis. [4] 1999-2000 data.

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

	Crookston			Roseau		Stephen		
Variety	2001	2-year	3-year	2001	2-year	2001	2-year	3-year
Forge	91	98	100	107	88	99	98	93
BacUp	77	71	76	72	70	85	67	73
Ingot	99	98	98	109	95	100	99	97
Walworth	109	103	–	107	97	116	106	–
Ember	93	101	96	105	92	103	106	100
McKenzie	92	92	–	95	87	103	99	–
Oxen	104	103	104	106	105	106	107	109
Russ	100	95	96	89	102	107	113	108
2375	106	101	103	101	104	116	106	110
Alsen	95	90	–	106	101	111	103	–
Hanna	93	–	–	92	–	118	–	–
Keystone	94	–	–	97	–	110	–	–
Norm	108	104	103	98	98	91	93	96
Parshall	98	98	100	112	103	104	103	96
Reeder	114	107	103	116	110	109	103	97
CDC Bounty	73	–	–	92	–	103	–	–
Dandy	112	108	–	109	112	104	100	–
Gunner	93	85	80	97	91	92	100	95
HJ98	93	93	97	85	99	94	111	110
Knudson	103	–	–	111	–	98	–	–
Mercury	116	113	111	120	116	97	102	104
NorPro	100	103	103	100	104	86	99	101
Amazon	83	–	–	91	–	104	–	–
Aurora	108	102	102	105	99	99	104	105
Ivan	108	106	110	110	113	100	97	105
Marshall	85	91	93	100	103	94	98	90
Verde	108	104	103	84	93	101	100	104
McVey	95	97	98	94	99	101	112	113
LSD	13	13	12	15	22	18	22	1
Mean, Bu/Acre	69.2	70.1	62.3	52.9	57.1	32.5	40	42.3

heading and use of different seeding dates is highly recommended to reduce risk. Variety descriptions do not provide information on scab resistance. Table information should be used.

General Purpose Varieties

Aurora – Awned, late maturity, semidwarf. Resistant to stem rust and moderately resistant to leaf rust. Moderately resistant to other leaf diseases. High to medium yield and low to medium test weight. Very strong straw. Low to medium protein percent. Released by NorthStar Genetics in 1999.

Ember – Awned, early-midseason maturity, medium height. Resistant to stem rust and moderately susceptible to leaf rust. Moderately susceptible to other leaf diseases. Medium yield and high test weight. Moderately strong straw. Low to medium protein percent. Released by S.D. AES in 1999. PVP **(pending)**

McVey – Awned, late maturity, medium height. Resistant to stem rust and moderately resistant to leaf rust. Moderately resistant to other leaf diseases. High to medium yield and low test weight. Medium straw strength. Low protein percent. Released by Minn. AES and USDA-ARS in 1999. PVP **(pending)**

NorPro – Awned, midseason-late, semidwarf. Resistant to stem rust and moderately resistant to leaf rust. Moderately resistant to other leaf diseases. Very high yield and medium test weight. Strong straw. Medium protein percent. Released by AgriPro in 1999. PVP **(94)**

Parshall – Awned, midseason maturity, tall. Resistant to stem rust and moderately resistant to leaf rust. Moderately resistant to other leaf diseases. Medium to high yield and very high test weight. Strong straw. High protein percent. Released by N.D. AES in 1999. PVP **(94)**

Reeder – Awned, midseason maturity, medium height. Resistant to stem rust and moderately resistant to leaf rust. Moderately resistant to other leaf diseases. Very high yield and medium to high test weight. Strong straw. Medium to high protein percent. Released by N.D. AES in 1999. PVP **(94)**

HJ98 – Awned, midseason-late maturity, semidwarf. Resistant to stem rust and moderately resistant to leaf rust. Moderately susceptible to other leaf diseases. High to medium yield and medium test weight. Medium straw strength. Medium to low protein percent. Released by Minn. AES and USDA-ARS in 1998. PVP **(94)**

Ingot – Awned, early, tall. Resistant to stem rust and moderately susceptible to leaf rust. Moderately susceptible to other leaf diseases. High to medium yield and very high test weight. Moderately strong straw. Medium to high protein percent. Released by the S.D. AES in 1998. PVP **(pending)**

Ivan – Awned, late maturity, semidwarf. Resistant to stem rust and to leaf rust. Moderately resistant to other leaf diseases. Very high yield and medium test weight. Very strong straw. Low to medium protein percent. Released by AgriPro in 1998. PVP **(94)**

Forge – Awned, very early, medium height. Resistant to stem rust and moderately susceptible to leaf rust. Moderately susceptible to other leaf diseases. High to medium yield and high test weight. Strong straw. Medium to low protein percent. Released by S.D. AES in 1997. PVP **(94)**

Mercury – Awned, midseason-late maturity, semidwarf. Resistant to stem rust and moderately resistant to leaf rust. Moderately resistant to other leaf diseases. Very high yield and medium test weight. Strong straw. Medium to low protein percent. Released by NorthStar Genetics in 1997.

Gunner – Awned, midseason-late maturity, tall. Resistant to stem rust and moderately susceptible to leaf rust. Moderately resistant to other leaf diseases. Low yield and high to medium test weight.

Moderately strong straw. High protein percent. Released by AgriPro in 1996. PVP (94)

Oxen – Awned, early-midseason, semidwarf. Resistant to stem rust and moderately resistant to leaf rust. Moderately susceptible to other leaf diseases. Very high yield and medium test weight. Moderately strong straw. Medium protein percent. Released by S.D. AES in 1996. PVP (94)

Russ – Awned, early-midseason maturity, medium height. Resistant to stem rust and moderately susceptible to leaf rust. Moderately susceptible to other leaf diseases. High yield and medium test weight. Moderately strong straw. Medium to low protein percent. Released by S.D. AES in 1995. PVP (94)

Verde – Awned, late maturity, semidwarf. Resistant to stem rust and moderately resistant to leaf rust. Moderately resistant to other leaf diseases. High to medium yield and medium test weight. Moderately strong straw. Medium to low protein percent. Released by Minn. AES and USDA-ARS in 1995. PVP (94)

Norm – Awned, midseason, semidwarf. Resistant to stem rust and to leaf rust. Moderately resistant to other leaf diseases. High to medium yield and medium test weight. Strong straw. Low to medium protein percent. Included in trials as a scab-susceptible check. Released by Minn. AES and USDA-ARS in 1992. PVP

2375 – Awned, midseason maturity, medium height. Resistant to stem rust and moderately susceptible to leaf rust. Susceptible to other leaf diseases. High to medium yield and high test weight. Medium straw strength. Tolerant to loose smut. Moderately susceptible to shattering. Medium to low protein percent. Released by Pioneer Hi-Bred in 1988. Sold by N.D. State University Research Foundation 1990. PVP (94)

Marshall – Awned, late maturity, semidwarf. Resistant to stem rust and moderately susceptible to leaf rust. Moderately susceptible to other leaf diseases. Medium yield and test weight. Strong straw. Low to medium protein percent. Released by Minn. AES and USDA-ARS in 1982. PVP

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

	State			North			South			On-Farm		
Variety	2001	2 yr	3 yr	2001	2 yr	3 yr	2001	2 yr	3 yr	2001	2 yr	3 yr
Forge	99	96	95	98	94	95	99	97	95	101	98	99
BacUp	72	69	70	77	70	73	70	68	68	–	–	–
Ingot	98	97	97	103	97	97	95	96	97	99	99	101
Walworth	108	108	–	110	102	–	107	112	–	–	–	–
Ember	95	95	92	100	99	96	92	91	90	108	104	99
McKenzie	91	91	–	95	92	–	88	91	–	89	89	–
Oxen	109	108	109	105	104	106	112	112	111	109	105	111
Russ	104	105	106	98	102	101	108	108	109	99	98	105
2375	105	101	101	06	103	105	103	100	98	102	100	102
Alsen	98	99	–	102	97	–	95	101	–	96	94	–
Hanna	93	–	–	98	–	–	90	–	–	–	–	–
Keystone	98	–	–	98	–	–	98	–	–	–	–	–
Norm	104	100	101	101	99	100	106	102	103	–	–	–
Parshall	96	96	96	104	101	99	92	93	94	96	94	97
Reeder	110	107	106	114	107	103	108	107	108	105	104	106
CDC Bounty	80	–	–	86	–	–	76	–	–	–	–	–
Dandy	106	105	–	109	108	–	103	104	–	106	104	–
Gunner	94	86	87	94	90	87	93	84	86	93	91	86
HJ98	102	102	103	91	99	101	109	105	104	95	103	102
Knudson	106	–	–	105	–	–	106	–	–	–	–	–
Mercury	113	111	113	114	111	110	113	111	114	108	108	–
NorPro	110	107	107	97	102	102	118	111	110	105	107	–
Amazon	95	–	–	91	–	–	–	–	–	–	–	–
Aurora	102	101	102	105	102	102	100	100	102	–	–	–
Ivan	107	105	110	107	106	109	107	105	110	101	106	112
Marshall	99	96	93	92	97	95	104	96	92	96	99	97
Verde	100	102	104	98	99	101	101	104	106	96	100	102
McVey	106	102	103	96	101	102	112	103	103	100	106	106
LSD	11	7	6	15	10	9	14	10	8	–	–	–
Mean, Bu/Acre	57	58	55.2	51.5	55.7	53.5	61.2	59.6	56.4	59.8	65.9	59.9

Special Purpose Varieties

BacUp – Awned, early, medium height. Resistant to stem rust and moderately susceptible to leaf rust. Susceptible to other leaf diseases. Low yield and very high test weight. Medium straw strength. Very high protein percent. Specialty variety release for scab tolerance with recommendation that it not be used on over 15 to 20% of acreage. Released by Minn. AES and USDA-ARS in 1996.

Varieties Not Adequately Tested

Hanna – Awned, midseason maturity, tall. Resistant to stem rust and moderately resistant to leaf rust. Medium yield and test weight. Moderately strong straw. Medium protein percent. Released by AgriPro in 2001. PVP (pending)

Keystone – Awned, midseason maturity, medium height. Resistant to stem rust and moderately resistant to leaf rust. Medium yield and medium to high test weight. Moderately strong straw. Low protein percent. Released by Western Plant Breeders in 2001. PVP (pending)

Knudson – Awned, midseason-late maturity, semidwarf. Resistant to stem rust and to leaf rust. High yield and medium test weight. Moderately strong straw. Medium protein percent. Released by AgriPro in 2001. PVP (pending)

Walworth – Awned, early maturity, medium height. Resistant to stem rust and moderately resistant to leaf rust. Moderately susceptible to other leaf diseases. Very high yield and medium test weight. Medium straw strength. Medium protein percent. Released by S.D. AES in 2001. PVP (pending)

Alsen – Awned, midseason maturity, semidwarf. Resistant to stem rust and leaf rust. Moderately resistant to other leaf diseases. High to medium yield and high test weight. Strong straw. High protein percent. Released by N.D. AES in 2000. PVP (94)

Dandy – Awned, midseason-late maturity, semidwarf. Resistant to stem rust and moderately resistant to leaf rust. Moderately resistant to other leaf diseases. Very high yield and high to medium test weight. Very strong straw. Medium to low protein percent. Released by NorthStar Genetics in 1999. PVP (94)

Amazon – Awned, late maturity, tall. Resistant to stem rust. Medium to low test weight. Medium straw strength. Medium protein percent. Developed by the University of Manitoba, marketed by Canterra Seeds Ltd.

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 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:

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

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, southern locations.

	Lamberton			Morris			St. Paul			Waseca		
Line	2001	2-year	3-year	2001	2-year	3-year	2001	2-year	3-year	2001	2-year	3-year
Forge	106	102	99	79	86	88	102	98	91	109	109	103
BacUp	70	71	69	62	64	68	74	66	64	72	75	70
Ingot	108	106	103	96	101	101	79	78	82	95	99	99
Walworth	103	113	–	111	109	–	110	110	–	106	121	–
Ember	86	84	84	92	91	82	95	96	96	97	98	99
McKenzie	82	88	–	105	100	–	79	80	–	87	94	–
Oxen	112	114	113	106	105	108	118	117	116	111	112	109
Russ	106	107	110	120	115	110	102	101	104	108	105	111
2375	100	96	95	105	103	100	107	99	98	102	101	97
Alsen	106	112	–	75	91	–	101	99	–	97	105	–
Hanna	88	–	–	93	–	–	84	–	–	96	–	–
Keystone	109	–	–	96	–	–	92	–	–	94	–	–
Norm	116	105	106	101	101	102	104	100	101	104	99	102
Parshall	99	98	98	99	96	98	82	86	87	88	90	92
Reeder	111	112	113	116	107	109	104	106	107	102	100	102
CDC Bounty	67	–	–	85	–	–	71	–	–	83	–	–
Dandy	110	110	–	100	105	–	104	103	–	97	96	–
Gunner	106	90	91	88	89	90	81	75	79	96	78	84
HJ98	108	103	101	106	107	107	109	106	105	113	101	104
Knudson	108	–	–	94	–	–	119	–	–	103	–	–
Mercury	119	105	107	99	104	109	128	125	124	105	115	118
NorPro	115	119	118	122	108	106	129	116	114	108	99	102
Amazon	–	–	–	108	–	–	–	–	–	–	–	–
Aurora	95	89	96	106	109	108	100	105	106	100	93	98
Ivan	105	109	114	116	101	108	106	108	111	105	100	108
Marshall	101	93	92	102	94	90	106	107	104	106	87	82
Verde	90	95	101	116	107	105	101	107	110	100	105	109
McVey	83	82	86	136	121	118	116	98	100	116	110	107
LSD	16	18	14	18	18	14	24	17	16	14	25	18
Mean, Bu/A	65.8	62.8	57.2	56.1	72.7	67.7	62.2	57.3	50.1	60.4	45.7	50.4

CDC Bounty – Awnless, midseason-late maturity, tall. Resistant to stem rust. Low yield and medium to high test weight. Medium straw strength. High protein percent. Developed by Crop Development Centre, University of Saskatchewan, marketed by Canterra Seeds Ltd.

McKenzie – Awned, early-midseason maturity, tall. Resistant to stem rust and leaf rust. Medium yield and medium to high test weight. Moderately resistant to other leaf diseases. Medium straw strength. Medium to high protein percent. Developed by AgPro/Saskatchewan Wheat Pool in 1997. Marketed by Croplan Genetics.

Disease reactions of hard red spring wheat varieties.

			Other	Scab	
Variety	Leaf Rust [1]	Stem Rust [1]	Leaf Diseases [1]	Disease Severity [1]	Grain Soundness [2]
Forge	MS	R	MS	MR-MS	2.5
BacUp	MS	R	S	MR	1.5
Ingot	MS	R	MS	MR-MS	2.0
Walworth	MR	R	MS	MR-MS	2.5
Ember	MS	R	MS	MR	2.5
McKenzie	R	R	MR	MR-MS	2.5
Oxen	MR-MS	R	MS	MS-S	3.0
Russ	MS	R	MS	MR-MS	3.0
2375	MS	R	S	MR-MS	2.5
Alsen	R	R	MR-R	MR	1.5
Hanna	MR-MS	R	–	–	–
Keystone	MR-MS	R	–	–	–
Norm	R	R	MR-R	S	5.0
Parshall	MR-MS	R	MR-R	MR-MS	2.0
Reeder	MR-MS	R	MR-R	MS	3.5
CDC Bounty	–	R	–	–	–
Dandy	MR-MS	R	MR	MS	3.0
Gunner	MS	R	MR	MR-MS	2.5
HJ98	MR-MS	R	MS	MS	3.0
Knudson	R	R	–	–	–
Mercury	MR	R	MR	S	5.0
NorPro	MR	R	MR-R	MS	3.5
Amazon	–	R	–	–	–
Aurora	MR-MS	R	MR	S	5.0
Ivan	R	R	MR-R	MS-S	4.0
Marshall	MS	R	MS	MS	3.5
Verde	MR-MS	R	MR-R	MS	3.5
McVey	MR-MS	R	MR	MR-MS	2.5

[1] R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible.

[2] Ability to maintain plump, sound kernels under scab epidemics: 1=good, 5=poor.