

2017 Hard Red Spring Wheat Field Crop Trials Results



Minnesota Agricultural Experiment Station and the College of Food, Agricultural and Natural Resource Sciences

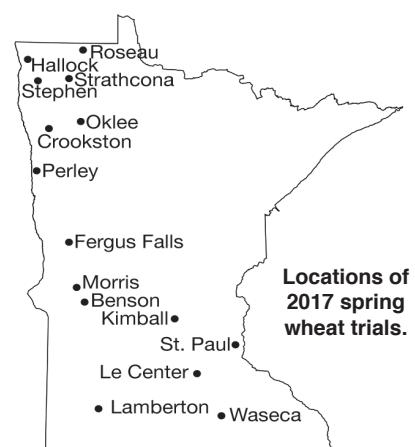
Spring wheat varieties were sown in trial plots at Crookston, Lamberton, Morris, Roseau, St. Paul and Waseca and on-farm sites near Benson, Fergus Falls, Hallock, Le Center, Kimball, Oklee, Perley, Stephen and Strathcona. These plots are handled so that the factors affecting yield and other characteristics 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 alphabetical order in the tables.

Variety Selection Criteria

While grain yield is an important economic trait, return per acre is also

affected by grain quality. Because Fusarium Head Blight (FHB), or scab, can reduce grain quality and yield dramatically, it is an important consideration. Disease ratings are on a 1-9 scale where 1 = most resistant and 9 = most susceptible. Rating differences of 2 or more should be considered significant.

During the past few years, leaf rust pressure throughout Minnesota has been low. Stripe rust was observed at several locations in 2015 and to a lesser extent, 2016. The majority of varieties are resistant or moderately resistant, but a few are moderately susceptible. Stripe rust can be very damaging when temperatures remain unseasonably cool into early July. Carefully consider a variety's rating for leaf and stripe rust and plan to use a fungicide if a variety is rated 5 or higher and disease levels warrant treat-



ment. Varieties with ratings of 4 or better should not experience economic levels of damage in most years. 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

Hard red spring wheat seeding rate calculator.

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 1.3 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:

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

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)
1.3 million	0.20	14,000	0.95	121

on susceptible varieties.

Bacterial leaf streak ratings of all varieties that have been evaluated for at least three years are presented in the disease table. This disease cannot be controlled with fungicides. Selection of more resistant varieties is the only recommended practice at this time to reduce losses due to this disease. The rating of newer varieties may change

by as much as one rating point as more data is collected.

The “Other Leaf Diseases” rating represents a combined reaction to two different Septoria leaf blotches 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 indica-

tion 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.

Linkert was the no. 1 variety in Minnesota in 2017, sown on 28.2% of the state’s wheat acres. Bolles was the 2nd most popular variety at 14.4%, followed by WB-Mayville (13.5%), SY Valda (6.6%) and Shelly (5.6%). The 2017 releases Lang-MN (U of MN), Dyna-Gro Caliber (Dyna-Gro), LCS Rebel (Limagrain Cereal Seeds), ND-VitPro (NDSU) and TCG-Climax (21st Century Genetics) were included in the 2017 trials and their data (multi-year for Lang-MN and ND-VitPro) is presented for the first time this year. Testing of Elgin-ND, Focus, Norden, TCG-Wildfire and WB9507 was discontinued.

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 (Feeke’s 5), flag leaf emergence (Feeke’s 9) and at the onset of flowering (Feeke’s 10.51). The practice of three fungicide applications during the growing season is not recommended. This fungicide regime was implemented to measure the varieties’ performance when fungal diseases were controlled to the maximum extent possible. Decisions regarding fungicide applications should be based on the available decision support systems, and used only if and when disease levels are forecasted to reach economically damaging levels. The additional performance evaluations were carried out adjacent to the conventional (no fungicides applied) trials, so results can be compared directly. Data from trials conducted in Lamberton, Morris, Crookston and Roseau are included in the 2017 and multi-year summaries. In the two northern locations, the

Table 1. Origin and agronomic characteristics of hard red spring wheat varieties in Minnesota in single-year (2017) and multiple-year comparisons.

Entry	Origin ¹	Legal Status	Days to Heading ²	Height Inches ²	Straw Strength ³
Bolles	2015 MN	PVP (94)	63.9	32.9	4
Boost	2016 SDSU	PVP (94)	63.9	33.8	5
Chevelle	2014 Meridian Seeds	PVP (94)	60.1	29.9	4
Dyna-Gro Ambush	2016 Dyna-Gro	PVP (94) (pending)	59.9	30.5	5
Dyna-Gro Caliber	2017 Dyna-Gro	PVP (94) (pending)	62.2	27.1	2
Faller	2007 NDSU	PVP (94)	62.3	34.1	5
Forefront	2012 SDSU	PVP (94)	58.7	34.8	7
HRS 3361	2013 CROPLAN by WinField	PVP (94)	62.5	30.6	3
HRS 3419	2014 CROPLAN by WinField	PVP (94)	64.9	31.9	3
HRS 3504	2015 CROPLAN by WinField	Patented	63.7	30.2	3
HRS 3530	2015 CROPLAN by WinField	Patented	62.7	34.3	5
HRS 3616	2016 CROPLAN by WinField	PVP (94) (pending)	61.9	31.3	4
Lang-MN	2017 MN	PVP (94) (pending)	61.3	31.7	5
LCS Albany	2009 Limagrain Cereal Seeds	PVP (94)	64.1	30.1	5
LCS Anchor	2016 Limagrain Cereal Seeds	PVP (94) (pending)	59.3	28.5	5
LCS Breakaway	2012 Limagrain Cereal Seeds	PVP (94)	59.7	29.8	4
LCS Iguacu	2014 Limagrain Cereal Seeds	PVP (94)	63.6	31.7	4
LCS Nitro	2015 Limagrain Cereal Seeds	PVP (94)	63.4	29.3	5
LCS Prime	2016 Limagrain Cereal Seeds	PVP (94) (pending)	59.7	33.1	5
LCS Rebel	2017 Limagrain Cereal Seeds	PVP (94) (pending)	60.2	33.5	6
Linkert	2013 MN	PVP (94)	60.8	29.4	2
ND-VitPro	2017 NDSU	PVP (94) (pending)	60.2	31.9	5
Prevail	2014 SDSU	PVP (94)	58.7	32.1	4
Prosper	2011 NDSU	PVP (94)	62.8	33.3	6
RB07	2007 MN	PVP (94)	59.7	31.1	5
Rollag	2011 MN	PVP (94)	60.2	30.4	3
Shelly	2016 MN	PVP (94) (pending)	62.3	30.2	5
Surpass	2016 SDSU	PVP (94) (pending)	58.9	32.5	7
SY Ingmar	2014 AgriPro/Syngenta	PVP (94)	62.3	30.8	4
SY Rowyn	2013 AgriPro/Syngenta	PVP (94)	60.3	29.8	6
SY Soren	2011 AgriPro/Syngenta	PVP (94)	60.4	28.6	4
SY Valda	2015 AgriPro/Syngenta	PVP (94)	61.1	30.9	4
TCG-Climax	2017 21st Century Genetics	PVP (94) (pending)	66.6	31.2	2
TCG-Cornerstone	2016 21st Century Genetics	PVP (94)	61.7	29.6	3
TCG-Spitfire	2016 21st Century Genetics	PVP (94)	64.3	32.1	3
WB-Mayville	2011 WestBred	PVP (94)	60.2	28.4	3
WB9479	2017 Westbred	Patented, PVP(94) (pending)	59.9	28.4	4
WB9590	2017 Westbred	Patented, PVP(94) (pending)	60.1	27.3	4
WB9653	2015 Westbred	Patented, PVP (94)	62.5	30.1	4
Mean			61.5	31.2	

¹Abbreviations: MN = Minnesota Agricultural Experiment Station; NDSU = North Dakota State University Research Foundation; SDSU = South Dakota Agricultural Experiment Station
²2017 data.

³1-9 scale in which 1 is the strongest straw and 9 is the weakest. Based on 2014-2017 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 (2017) and multiple-year comparisons.

Entry	Test Weight (lb/Bu)		Protein (%) ¹		Baking Quality ²	Pre-Harvest Sprouting ³
	2017	2 Yr	2017	2 Yr		
Bolles	60.3	59.3	15.5	15.6	1	1
Boost	60.5	59.6	14.8	14.7	3	5
Chevelle	60.5	59.8	13.3	13.1	—	3
Dyna-Gro Ambush	61.8	61.0	14.6	14.6	—	3
Dyna-Gro Caliber	60.3	—	15.0	—	—	2
Faller	60.5	59.6	13.2	13.2	5	1
Forefront	61.0	60.4	14.5	14.6	5	3
HRS 3361	59.8	59.2	14.2	14.0	3	2
HRS 3419	60.1	59.3	13.3	13.1	6	4
HRS 3504	59.7	59.3	13.7	13.5	6	1
HRS 3530	60.7	60.1	14.3	14.3	—	2
HRS 3616	60.1	59.4	15.1	15.0	—	3
Lang-MN	61.7	60.9	14.7	14.7	3	1
LCS Albany	60.6	59.9	13.4	13.3	6	4
LCS Anchor	60.9	59.7	14.9	14.9	—	2
LCS Breakaway	62.4	60.9	14.4	14.7	4	2
LCS Iguacu	61.1	60.6	13.1	12.8	7	3
LCS Nitro	60.0	59.3	13.2	13.1	4	4
LCS Prime	61.2	59.6	13.2	13.0	6	1
LCS Rebel	61.5	—	14.3	—	—	4
Linkert	60.9	60.2	15.4	15.1	1	2
ND-VitPro	62.1	61.4	15.0	15.1	—	1
Prevail	60.3	59.9	14.0	14.0	5	4
Prosper	60.9	59.9	13.1	13.3	5	2
RB07	60.3	59.5	14.5	14.5	3	2
Rollag	61.3	60.6	15.1	14.9	6	1
Shelly	61.4	60.4	13.6	13.5	5	1
Surpass	60.4	59.6	14.4	14.5	3	1
SY Ingmar	61.3	60.6	14.8	14.5	2	2
SY Rowyn	60.7	60.2	13.8	13.7	3	3
SY Soren	61.3	60.2	14.7	14.6	4	1
SY Valda	60.5	60.0	14.0	13.8	6	3
TCG-Climax	62.4	—	15.4	—	—	2
TCG-Cornerstone	60.4	59.6	14.5	14.5	—	3
TCG-Spitfire	60.2	59.0	13.8	13.7	—	3
WB-Mayville	61.3	60.1	14.7	14.7	3	3
WB9479	61.3	—	15.0	—	—	3
WB9590	60.8	—	14.5	—	—	2
WB9653	60.0	59.5	13.6	13.4	5	1
Mean	60.8	60.0	14.3	14.1		
No. Environments	9	11	9	11		

¹12% moisture basis.²2014-2016 crop years.³1-9 scale in which 1 is best and 9 is worst. Values of 1-3 should be considered as resistant.

fungicide regime as applied in these trials increased grain yield on average by 5.9 bu/acre in 2017 and by 8.1 bu/acre over the past three years. The two southern locations, Lamberton and Morris, averaged 3.8 and 5.8 bu/acre higher grain yield when fungicide protected in 2017 and over the 3-year average, respectively. Rather than the average increases in grain yield, the responses of individual varieties provide the most useful information; varieties rated susceptible to leaf rust, stripe rust and other fungal leaf diseases usually benefited most from fungicide applications.

Project Leaders

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Test Plot Research

Test plot establishment and management were supervised by Matt Bickell, Robert Bouvette, Dave Grafstrom, Mark Hanson, Tom Hoverstad, Houston Lindell, Steve Quiring, Curtis Reese, Susan Reynolds, Nate Stuart, Donn Vellekson and Joe Wodarek.

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

Entry	Leaf Rust	Stripe Rust ²	Stem Rust ³	Bacterial Leaf Streak ⁴	Other Leaf Diseases ⁵	Scab
Bolles	1	1	2	5	4	4
Boost	2	2	4	2	5	4
Chevelle	3	1	1	5	6	5
Dyna-Gro Ambush	2	—	2	—	4	4
Dyna-Gro Caliber	3	—	2	—	4	—
Faller	5	5	2	4	4	4
Forefront	2	2	5	4	6	3
HRS 3361	3	3	3	4	4	5
HRS 3419	4	1	1	5	3	5
HRS 3504	2	2	3	3	4	6
HRS 3530	3	3	1	4	4	4
HRS 3616	2	—	3	—	5	5
Lang-MN	1	1	2	3	5	3
LCS Albany	2	3	3	7	5	4
LCS Anchor	2	—	1	—	7	6
LCS Breakaway	3	2	2	4	5	5
LCS Iguacu	5	5	3	5	4	4
LCS Nitro	3	2	5	5	4	5
LCS Prime	3	4	2	5	6	4
LCS Rebel	5	—	2	—	4	—
Linkert	3	1	1	4	4	5
ND-VitPro	3	—	1	—	5	3
Prevail	2	1	5	2	7	4
Prosper	5	5	2	5	4	5
RB07	2	2	2	6	6	4
Rollag	4	1	2	4	5	3
Shelly	3	1	2	5	4	4
Surpass	3	2	5	3	6	4
SY Ingmar	2	2	2	3	5	4
SY Rowyn	3	1	1	2	6	4
SY Soren	2	2	1	5	4	5
SY Valda	1	2	1	3	4	4
TCG-Climax	4	—	5	—	4	—
TCG-Cornerstone	3	—	1	—	5	7
TCG-Spitfire	5	—	3	—	4	5
WB-Mayville	3	3	3	6	7	7
WB9479	3	—	3	—	5	—
WB9590	3	—	3	—	7	—
WB9653	1	2	2	3	4	5

¹1-9 scale where 1=most resistant, 9=most susceptible.

²Based on natural infections in 2015 at Kimball, Lamberton, and Waseca.

³Stem rust levels have been very low in production fields in recent years, even on susceptible varieties.

⁴Bacterial leaf streak symptoms are highly variable from one environment to the next. The rating of newer entries may change by as much as one rating point as more data is collected.

⁵Combined rating of tan spot and septoria.

Table 4. Relative grain yield of hard red spring wheat varieties in northern Minnesota locations in single-year (2017) and multiple-year comparisons (2015-2017).

Entry	Crookston			Fergus Falls			Hallock			Oklee			Perley ¹			Roseau			Stephen ¹		
	2017	2 Yr	3 Yr	2017	2 Yr	3 Yr	2017	2 Yr	3 Yr	2017	2 Yr	3 Yr	2017	2 Yr	2017	2 Yr	3 Yr	2017	2 Yr	2017	2 Yr
Bolles	99	97	95	86	92	94	92	91	92	103	100	100	102	98	101	100	99	98	95		
Boost	109	103	98	95	97	94	100	94	95	101	97	98	97	93	103	95	97	97	94		
Chevelle	107	105	104	108	107	103	107	104	100	107	105	104	109	102	99	93	89	108	104		
Dyna-Gro Ambush	98	102	—	94	97	—	103	105	—	104	103	—	100	—	92	96	—	98	—		
Dyna-Gro Caliber	100	—	—	91	—	—	95	—	—	88	—	—	87	—	89	—	—	93	—		
Faller	117	107	103	110	103	107	114	109	109	107	105	103	112	107	113	111	108	107	105		
Forefront	97	95	97	82	86	88	90	94	96	102	98	95	99	100	100	101	98	97	93		
HRS 3361	110	108	105	91	96	99	95	96	96	87	95	96	98	96	96	99	96	100	95		
HRS 3419	111	109	110	106	100	102	99	104	107	121	114	112	108	106	118	122	118	111	110		
HRS 3504	116	109	106	107	109	107	111	110	105	105	102	101	105	102	110	103	99	101	103		
HRS 3530	104	103	103	105	100	104	104	108	109	93	100	100	107	110	108	110	106	117	114		
HRS 3616	95	97	—	99	102	—	100	99	—	97	96	—	100	—	98	92	—	97	—		
Lang-MN	94	94	96	96	97	98	105	100	100	96	100	101	90	93	98	102	103	92	96		
LCS Albany	131	121	115	107	106	107	99	101	103	115	112	109	102	103	112	114	110	105	103		
LCS Anchor	84	90	—	89	92	—	90	92	—	91	93	—	91	—	72	72	—	92	—		
LCS Breakaway	83	94	96	109	104	102	98	100	96	96	95	95	102	104	89	89	93	94	97		
LCS Iguacu	119	113	109	93	93	93	103	107	105	114	106	104	103	106	107	108	108	107	108		
LCS Nitro	107	106	105	96	99	100	99	101	100	96	99	100	108	103	106	108	104	103	101		
LCS Prime	87	92	90	115	109	112	115	105	105	114	111	109	112	109	108	106	106	102	103		
LCS Rebel	105	—	—	97	—	—	106	—	—	104	—	—	95	—	99	—	—	99	—		
Linkert	95	96	99	94	95	94	102	100	100	94	95	95	96	95	95	90	93	88	95		
ND-VitPro	91	91	—	86	91	—	96	98	—	86	94	—	93	—	93	95	—	90	—		
Prevail	88	92	94	98	98	98	101	104	102	100	99	98	94	98	99	100	102	95	95		
Prosper	112	106	104	108	103	105	115	110	109	110	106	103	108	106	111	113	110	110	107		
RB07	101	103	101	106	102	99	101	97	95	93	96	97	101	97	89	86	87	107	101		
Rollag	96	99	101	96	97	98	94	100	100	95	95	94	97	99	87	84	85	98	92		
Shelly	109	106	106	118	112	105	103	103	102	104	106	106	108	108	110	113	109	112	103		
Surpass	96	99	99	102	100	100	109	106	103	98	101	100	100	100	100	100	100	102	106		
SY Ingmar	89	94	94	96	101	100	95	100	99	103	103	100	97	98	89	92	95	97	99		
SY Rowyn	105	103	102	108	104	105	100	101	101	112	105	104	109	102	103	102	98	104	102		
SY Soren	102	102	102	97	102	97	99	101	97	96	98	98	93	93	97	92	98	98	97		
SY Valda	117	113	111	115	111	110	110	115	115	116	113	111	108	109	105	111	106	113	111		
TCG-Climax	108	—	—	96	—	—	87	—	—	108	—	—	89	—	96	—	—	95	—		
TCG-Cornerstone	88	92	—	98	99	—	89	89	—	85	89	—	93	—	89	89	—	89	—		
TCG-Spitfire	103	103	—	111	111	—	98	100	—	114	108	—	102	—	102	104	—	103	—		
WB-Mayville	85	90	92	97	102	99	97	95	95	92	95	95	95	95	91	88	90	100	96		
WB9479	103	—	—	92	—	—	93	—	—	102	—	—	99	—	95	—	—	105	—		
WB9590	101	—	—	102	—	—	101	—	—	99	—	—	103	—	88	—	—	113	—		
WB9653	101	102	100	108	109	108	114	111	102	102	99	100	103	97	112	105	101	101	106		
Mean (Bu/Acre)	108	105	98	90	89	96	95	87	89	80	90	94	115	113	101	83	84	107	97		
LSD (0.10)	12.3	6.3	5.1	8.1	5.1	4.1	12.7	6.6	4.5	10.5	4.9	3.0	6.2	6.3	9.9	6.4	5.6	6.9	6.8		

¹Data from 2016 sites at Perley (hail) and Stephen (excessive water) were excluded from analyses. 2-year data for these locations is from 2015 and 2017.

Table 5. Relative grain yield of hard red spring wheat varieties in southern Minnesota locations in single-year (2017) and multiple-year comparisons (2015-2017).

Entry	Benson			Kimball			Le Center			Lamberton			Morris			St. Paul			Waseca		
	2017	2 Yr	3 Yr	2017	2 Yr	3 Yr	2017	2 Yr	3 Yr	2017	2 Yr	3 Yr	2017	2 Yr	3 Yr	2017	2 Yr	3 Yr	2017	2 Yr	3 Yr
Bolles	78	85	90	102	100	99	89	95	92	88	94	93	101	99	98	100	101	103	96	97	97
Boost	86	90	91	103	97	96	95	95	93	90	97	94	92	97	95	91	97	96	99	101	103
Chevelle	82	96	102	96	93	100	109	102	102	113	106	104	112	110	110	95	100	102	107	107	103
Dyna-Gro Ambush	105	99	—	98	98	—	101	100	—	100	100	—	108	108	—	96	97	—	109	102	—
Dyna-Gro Caliber	101	—	—	94	—	—	90	—	—	88	—	—	87	—	—	101	—	—	78	—	—
Faller	105	103	102	98	96	92	92	95	98	111	110	109	97	92	93	108	93	95	87	89	93
Forefront	109	98	96	102	103	102	99	96	99	89	93	97	99	94	98	113	104	97	103	100	100
HRS 3361	97	100	95	99	97	97	106	106	105	99	103	101	102	99	101	104	100	100	103	107	108
HRS 3419	118	114	108	99	111	116	112	122	120	96	105	107	109	112	113	104	109	112	109	112	112
HRS 3504	114	114	111	94	97	98	106	102	105	109	108	108	116	116	115	105	103	103	115	114	110
HRS 3530	106	111	111	100	103	100	116	111	109	106	105	105	92	99	95	101	105	105	110	114	119
HRS 3616	79	90	—	103	102	—	98	104	—	93	93	—	95	100	—	91	98	—	91	93	—
Lang-MN	96	97	97	105	102	99	89	90	97	103	104	100	110	109	105	106	106	104	103	107	108
LCS Albany	103	105	107	108	110	112	102	110	108	102	107	105	101	104	103	99	103	108	92	96	99
LCS Anchor	88	91	—	96	101	—	103	90	—	89	82	—	84	85	—	91	91	—	84	84	—
LCS Breakaway	102	97	96	103	106	100	92	90	92	99	94	93	102	101	96	97	101	101	106	99	99
LCS Iguacu	99	99	99	99	106	105	107	112	107	97	99	100	104	101	100	84	98	106	92	97	92
LCS Nitro	102	105	104	99	106	109	107	117	114	94	101	102	117	112	112	88	106	112	104	107	104
LCS Prime	114	112	110	98	96	100	110	102	102	116	107	107	110	104	99	98	92	90	101	95	90
LCS Rebel	93	—	—	95	—	—	92	—	—	100	—	—	96	—	—	100	—	—	91	—	—
Linkert	99	96	94	93	101	99	99	93	96	100	93	92	100	96	97	107	108	106	97	95	96
ND-VitPro	86	88	—	101	100	—	85	85	—	89	88	—	83	90	—	101	93	—	96	95	—
Prevail	104	103	98	106	109	111	101	100	102	90	97	99	89	90	93	99	99	102	100	108	110
Prosper	114	109	110	107	100	98	104	101	100	110	110	106	92	94	92	107	98	98	95	96	97
RB07	87	94	95	100	98	99	97	92	91	91	90	92	94	95	95	90	93	95	98	91	93
Rollag	98	96	97	98	97	97	100	96	94	95	90	91	92	96	98	93	94	93	90	83	84
Shelly	94	100	103	106	100	104	106	107	101	109	111	109	109	115	113	108	111	113	104	109	108
Surpass	108	102	102	108	96	93	90	83	88	101	101	100	92	99	99	108	94	88	113	113	110
SY Ingmar	96	103	102	90	103	105	104	109	108	100	104	103	88	99	97	94	103	98	100	103	97
SY Rowyn	109	109	105	96	99	102	97	103	101	94	101	103	104	107	108	94	103	102	95	103	102
SY Soren	87	95	94	110	109	105	105	106	99	99	94	93	98	100	94	98	106	103	93	102	96
SY Valda	117	115	112	100	98	100	119	116	115	114	113	111	107	110	111	102	103	105	112	109	106
TCG-Climax	91	—	—	95	—	—	81	—	—	98	—	—	110	—	—	91	—	—	94	—	—
TCG-Cornerstone	97	96	—	96	96	—	102	102	—	102	97	—	101	98	—	99	102	—	91	92	—
TCG-Spitfire	101	98	—	102	102	—	110	105	—	117	108	—	110	106	—	110	107	—	101	96	—
WB-Mayville	120	109	102	108	108	102	106	104	104	103	101	98	110	104	107	98	102	104	96	95	98
WB9479	110	—	—	102	—	—	93	—	—	97	—	—	108	—	—	98	—	—	102	—	—
WB9590	119	—	—	103	—	—	93	—	—	97	—	—	114	—	—	96	—	—	107	—	—
WB9653	111	109	109	97	94	100	110	105	106	109	107	107	100	105	110	109	106	107	119	116	114
Mean (Bu/Acre)	94	104	104	95	80	86	90	85	86	83	78	84	60	69	68	72	69	75	95	84	73
LSD (0.10)	15.0	6.4	5.3	13.4	7.876	6.4	11.4	7.6	6.0	11.3	6.816	4.752	17.7	5.5	5.0	12.9	9.4	6.8	11.1	6.6	6.5

Table 6. Relative grain yield of hard red spring wheat varieties in Minnesota in single-year (2017) and multiple-year comparisons (2015-2017).

Entry	State			North			South		
	2017	2 Yr	3 Yr	2017	2 Yr	3 Yr	2017	2 Yr	3 Yr
Bolles	95	96	96	97	97	96	93	95	95
Boost	98	97	96	100	97	96	94	96	95
Chevelle	104	103	102	107	104	101	101	102	103
Dyna-Gro Ambush	100	100	—	98	100	—	102	101	—
Dyna-Gro Caliber	92	—	—	92	—	—	91	—	—
Faller	106	102	102	112	107	106	99	97	98
Forefront	98	97	97	95	95	95	102	98	98
HRS 3361	99	100	99	97	99	98	101	102	101
HRS 3419	109	111	111	110	110	109	107	113	113
HRS 3504	108	107	105	108	106	104	108	108	107
HRS 3530	106	106	106	106	105	106	105	107	107
HRS 3616	95	97	—	98	97	—	93	97	—
Lang-MN	98	99	100	96	97	99	101	102	101
LCS Albany	106	107	107	110	110	108	101	105	106
LCS Anchor	89	89	—	87	89	—	91	89	—
LCS Breakaway	98	97	97	96	97	98	100	98	96
LCS Iguacu	102	104	103	107	106	104	98	102	101
LCS Nitro	102	105	105	103	103	102	101	107	108
LCS Prime	107	103	103	107	105	105	107	102	100
LCS Rebel	98	—	—	101	—	—	95	—	—
Linkert	97	96	96	95	95	96	99	97	97
ND-VitPro	91	92	—	91	93	—	92	91	—
Prevail	98	99	100	96	97	98	99	101	102
Prosper	108	105	103	111	108	106	105	101	101
RB07	97	96	96	100	98	97	94	93	94
Rollag	95	94	95	95	96	96	95	93	94
Shelly	107	108	106	109	108	106	105	107	107
Surpass	102	100	99	101	101	101	103	98	97
SY Ingmar	96	101	100	95	98	98	96	104	102
SY Rowyn	102	104	103	106	104	102	98	104	103
SY Soren	98	100	98	97	98	98	99	101	98
SY Valda	111	111	109	112	112	110	110	110	109
TCG-Climax	95	—	—	97	—	—	94	—	—
TCG-Cornerstone	94	94	—	90	91	—	98	98	—
TCG-Spitfire	106	104	—	105	105	—	107	103	—
WB-Mayville	99	99	98	94	95	95	106	103	102
WB9479	100	—	—	99	—	—	101	—	—
WB9590	102	—	—	101	—	—	104	—	—
WB9653	107	105	105	106	105	102	108	106	107
Mean (Bu/Acre)	92	87	88	99	94	95	84	81	82
LSD (0.10)	4.1	3.2	2.6	4.9	3.9	3.2	6.4	4.9	4.0
No. Environments	14	26	40	7	12	19	7	14	21

Table 7. Grain yield (bushels per acre) of hard red spring wheat varieties grown under conventional and intensive management.

Entry	North						South						State					
	2017		2-year		3-year		2017		2-year		3-year		2017		2-year		3-year	
	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int
Bolles	104.3	110.2	91.9	98.3	88.3	96.3	66.8	67.6	70.6	75.0	72.2	76.6	85.6	88.9	81.3	86.7	80.2	86.5
Boost	110.9	113.9	93.4	95.9	88.3	95.8	65.0	71.0	71.3	75.1	72.0	77.1	88.0	92.4	82.3	85.5	80.1	86.4
Chevelle	108.0	122.5	93.6	105.1	88.3	103.6	80.2	80.1	79.2	82.4	81.2	84.7	94.1	101.3	86.4	93.8	84.7	94.1
Dyna-Gro Ambush	99.6	107.5	93.0	99.4	—	—	73.7	78.3	76.1	77.6	—	—	86.6	92.9	84.5	88.5	—	—
Dyna-Gro Caliber	98.9	99.6	—	—	—	—	62.4	63.1	—	—	—	—	80.6	81.4	—	—	—	—
Faller	119.9	129.2	102.0	111.1	95.5	109.1	75.3	84.2	74.5	85.9	77.6	88.1	97.6	106.7	88.3	98.5	86.5	98.6
Forefront	102.7	101.7	91.7	94.7	88.5	90.9	66.5	72.8	68.6	73.6	74.1	77.7	84.6	87.3	80.2	84.2	81.3	84.3
HRS 3361	107.7	111.6	97.4	101.5	91.5	98.3	71.6	72.3	74.1	79.4	76.7	79.4	89.6	91.9	85.7	90.5	84.1	88.8
HRS 3419	119.3	126.5	107.9	113.6	103.5	108.5	72.3	78.5	79.6	83.6	83.4	88.0	95.8	102.5	93.7	98.6	93.4	98.2
HRS 3504	118.3	122.0	99.9	102.5	93.8	102.5	80.2	79.2	81.8	84.6	84.7	86.8	99.2	100.6	90.8	93.6	89.2	94.6
HRS 3530	110.7	114.1	99.0	101.9	95.2	101.0	71.8	80.8	75.1	85.6	76.3	86.4	91.2	97.5	87.1	93.8	85.7	93.7
HRS 3616	100.3	103.3	88.7	93.6	—	—	67.2	73.7	70.7	77.6	—	—	83.8	88.5	79.7	85.6	—	—
Lang-MN	100.5	107.0	91.2	96.2	90.4	95.8	75.8	79.1	77.8	79.9	77.9	81.3	88.1	93.1	84.5	88.0	84.2	88.5
LCS Albany	127.2	125.1	110.8	112.0	102.5	108.4	72.5	83.4	77.4	85.1	78.9	88.5	99.8	104.3	94.1	98.5	90.7	98.5
LCS Anchor	81.7	94.4	77.0	84.9	—	—	62.1	67.5	61.4	68.6	—	—	71.9	80.9	69.2	76.8	—	—
LCS Breakaway	89.5	97.7	86.0	92.0	86.0	94.8	71.7	76.8	71.4	76.2	71.5	78.6	80.6	87.2	78.7	84.1	78.8	86.7
LCS Iguacu	118.4	120.2	104.1	106.3	99.0	101.8	71.1	72.3	73.4	79.8	75.7	83.2	94.7	96.3	88.7	93.1	87.4	92.5
LCS Nitro	111.3	117.5	100.2	107.6	95.0	102.1	74.1	77.8	77.8	79.9	80.7	81.8	92.7	97.7	89.0	93.7	87.9	91.9
LCS Prime	101.5	117.7	91.8	103.7	88.5	103.9	81.0	83.6	77.4	84.4	78.5	88.4	91.3	100.7	84.6	94.0	83.5	96.1
LCS Rebel	106.6	116.8	—	—	—	—	70.2	75.2	—	—	—	—	88.4	96.0	—	—	—	—
Linkert	99.2	104.5	87.7	92.3	87.4	94.2	71.5	73.2	69.3	75.9	71.5	77.6	85.4	88.9	78.5	84.1	79.4	85.9
ND-VitPro	96.0	97.2	86.9	90.8	—	—	61.7	65.6	65.1	67.9	—	—	78.9	81.4	76.0	79.3	—	—
Prevail	97.3	99.3	89.7	92.7	89.0	95.7	64.3	72.1	68.5	78.3	73.1	81.4	80.8	85.7	79.1	85.5	81.1	88.5
Prosper	116.5	132.8	102.6	111.1	96.8	106.8	73.2	84.0	74.9	85.7	75.9	87.6	94.9	108.4	88.7	98.4	86.4	97.2
RB07	99.6	112.2	89.3	98.3	86.2	99.0	65.8	66.8	67.5	67.3	70.8	74.0	82.7	89.5	78.4	82.8	78.5	86.5
Rollag	95.6	99.4	86.6	93.2	84.8	95.0	67.2	67.1	67.9	70.2	71.4	73.7	81.4	83.3	77.3	81.7	78.1	84.4
Shelly	114.4	119.3	102.3	108.1	97.6	106.9	78.1	82.9	82.5	88.5	84.2	88.8	96.2	101.1	92.4	98.3	90.9	97.9
Surpass	102.7	110.5	93.2	97.2	91.2	96.9	69.6	70.1	73.3	75.4	75.6	79.2	86.2	90.3	83.2	86.3	83.4	88.0
SY Ingmar	93.1	95.1	87.4	92.9	85.6	95.3	67.9	72.8	74.5	80.1	76.1	81.2	80.5	84.0	81.0	86.5	80.8	88.3
SY Rowyn	108.7	113.4	96.2	101.3	90.8	100.9	70.3	74.4	75.9	82.4	79.9	83.9	89.5	93.9	86.1	91.8	85.3	92.4
SY Soren	104.2	108.2	91.7	98.4	90.9	98.0	70.2	70.2	71.0	75.7	71.0	78.4	87.2	89.2	81.3	87.1	81.0	88.2
SY Valda	116.3	121.4	104.9	108.0	98.4	105.1	79.5	83.7	81.8	86.9	84.4	88.9	97.9	102.6	93.3	97.4	91.4	97.0
TCG-Climax	106.8	113.6	—	—	—	—	73.8	74.1	—	—	—	—	90.3	93.8	—	—	—	—
TCG-Cornerstone	92.2	99.5	84.9	91.7	—	—	72.7	73.3	71.5	75.0	—	—	82.5	86.4	78.2	83.4	—	—
TCG-Spitfire	107.3	110.8	96.8	100.9	—	—	81.3	81.1	78.5	80.8	—	—	94.3	95.9	87.6	90.9	—	—
WB-Mayville	91.5	104.0	83.8	96.8	82.7	98.4	75.7	76.5	75.1	80.2	77.5	80.3	83.6	90.3	79.5	88.5	80.1	89.3
WB9479	103.8	113.6	—	—	—	—	72.7	75.0	—	—	—	—	88.2	94.3	—	—	—	—
WB9590	98.9	113.9	—	—	—	—	74.5	79.3	—	—	—	—	86.7	96.6	—	—	—	—
WB9653	111.4	116.4	97.0	100.5	91.4	101.7	75.0	80.2	77.9	87.1	82.3	90.2	93.2	98.3	87.5	93.8	86.8	95.9
Mean (Bu/Acre)	104.4	110.3	93.7	99.0	90.9	99.0	71.5	75.3	73.3	78.8	76.0	81.8	87.9	92.8	83.5	88.9	83.4	90.4
LSD (0.10)	10.7	11.6	7.4	8.7	6.3	7.0	7.4	7.8	5.6	5.6	5.6	5.3	7.5	7.3	4.9	5.2	4.3	4.4
No. Environments	2	2	4	4	6	6	2	2	4	4	6	6	4	4	8	8	12	12