



# 2019 Spring Wheat Field Crop Trials Results

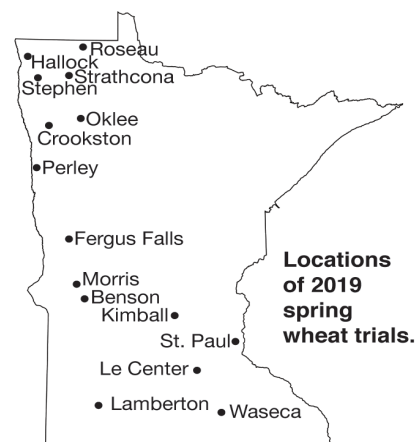
Minnesota Agricultural Experiment Station and the College of Food, Agricultural and Natural Resource Sciences

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, but seed providers are allowed to choose a preferred seeding rate for each variety. The standard seeding rate is designed to achieve a desired stand of 1.3 million plants/acre, assuming a 10% stand loss and adjusting for the germination percentage and seed weight of each variety. Lang-MN was tested at two seeding rates, the standard rate and 70% of the standard rate and the performance of both are reported. As expected, the reduced seeding rate improved the

straw strength of Lang-MN from a '5' to a '4', while no significant effects on other traits, including grain yield, were found. 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. Data for new varieties are based on their reaction in two misted, inoculated nurseries in 2019. This data, in combination with data from past years was used to assign a rating to all varieties. For some newer varieties, the initial scab rating is expressed as a range and the final rat-

### 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:

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

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)
1.3 million	0.10	14,000	0.95	109

ing is expected to fall within this range after more observations are made in the coming years.

Leaf and stripe rust pressure throughout Minnesota has been low the past three seasons. 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 treatment. 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 on susceptible varieties.

**Table 1. Origin and agronomic characteristics of hard red spring wheat varieties in Minnesota in single-year (2019) and multiple-year comparisons.**

Entry	Origin <sup>1</sup>	Legal Status	Desired Stand (Plants/Acre) <sup>2</sup>	Days to Heading <sup>3</sup>	Height Inches <sup>3</sup>	Straw Strength <sup>4</sup>
Bolles	2015 MN	PVP (94)	1.3	57.8	32.3	4
Boost	2016 SDSU	PVP (94)	1.3	58.0	32.7	5
CP3530	2015 CROPLAN by WinField United	Patented	1.3	56.7	34.4	5
CP3888	2018 CROPLAN by WinField United	Patented	1.3	56.0	31.3	3-4
CP3910	2019 CROPLAN by WinField United	Patent pending	1.3	52.8	30.2	3
CP3915	2019 CROPLAN by WinField United	Patent pending	1.3	54.9	30.8	4
CP3939	2019 CROPLAN by WinField United	Patent pending	1.3	54.9	31.0	3-4
Dyna-Gro Ambush	2016 Dyna-Gro	PVP (94)	1.4	53.8	30.9	4
Dyna-Gro Ballistic	2018 Dyna-Gro	PVP (94)	1.1	56.1	33.0	5
Dyna-Gro Caliber	2017 Dyna-Gro	PVP (94) (pending)	1.8	55.4	26.4	2
Dyna-Gro Commander	2019 Dyna-Gro	PVP (94) (pending)	1.4	53.1	30.7	4-5
Dyna-Gro Velocity	2019 Dyna-Gro	PVP (94) (pending)	1.4	55.0	30.2	3
Lang-MN	2017 MN	PVP (94) (pending)	1.3	57.3	32.7	5
Lang-MN (0.7X) <sup>5</sup>	see Lang-MN	see Lang-MN	0.9	56.5	32.0	4
LCS Breakaway	2012 Limagrain Cereal Seeds	PVP (94)	1.3	52.8	29.5	4
LCS Cannon	2018 Limagrain Cereal Seeds	PVP (94) (pending)	1.3	52.0	29.3	4
LCS Rebel	2017 Limagrain Cereal Seeds	PVP (94) (pending)	1.3	53.4	33.1	6
LCS Trigger	2016 Limagrain Cereal Seeds	PVP (94)	1.3	60.0	33.1	5
Linkert	2013 MN	PVP (94)	1.3	55.2	28.5	2
MN-Washburn	2019 MN	PVP (94) (pending)	1.3	56.8	30.0	3
MS Barracuda	2018 Meridian Seeds	PVP (94) (pending)	1.3	52.3	28.1	3
MS Camaro	2017 Meridian Seeds	PVP (94) (pending)	1.3	53.4	27.4	5
MS Chevelle	2014 Meridian Seeds	PVP (94)	1.3	53.9	30.1	5
ND-VitPro	2017 NDSU	PVP (94) (pending)	1.3	54.2	32.2	4
Prosper	2011 NDSU	PVP (94)	1.3	56.5	33.1	6
Rollag	2011 MN	PVP (94)	1.3	55.2	29.8	3
Shelly	2016 MN	PVP (94)	1.3	57.4	29.5	5
Surpass	2016 SDSU	PVP (94)	1.3	52.4	32.5	7
SY 611 CL26	2019 AgriPro/Syngenta	PVP (94) (pending)	1.3	54.5	29.4	5
SY Ingmar	2014 AgriPro/Syngenta	PVP (94)	1.3	55.8	29.2	4
SY Longmire <sup>7</sup>	2019 AgriPro/Syngenta	PVP (94) (pending)	1.3	56.1	30.2	3
SY McCloud	2019 AgriPro/Syngenta	PVP (94) (pending)	1.3	53.8	30.7	4
SY Valda	2015 AgriPro/Syngenta	PVP (94)	1.3	54.6	31.3	5
TCG-Climax	2017 21st Century Genetics	PVP (94)	1.5	60.0	31.6	3
TCG-Heartland	2019 21st Century Genetics	Patent pending	1.5	53.8	29.7	3
TCG-Spitfire	2016 21st Century Genetics	PVP (94)	1.5	57.9	31.3	3
WB-Mayville	2011 WestBred	PVP (94)	1.3	52.7	28.0	3
<b>Mean</b>				<b>55.2</b>	<b>30.7</b>	

<sup>1</sup>Abbreviations: Minnesota Agricultural Experiment Station (MN), North Dakota State University Research Foundation (NDSU) and South Dakota Agricultural Experiment Station (SDSU).

<sup>2</sup>Our standard seeding rate is designed to achieve a desired stand of 1.3 million plants/acre, assuming a 10% stand loss and adjusting for the germination percentage and seed weight of each variety.

<sup>3</sup>2019 data.

<sup>4</sup>1-9 scale where 1 = strongest straw and 9 = weakest. Based on 2013-2019 data. The rating of newer entries may change by as much as one rating point as more data are collected.

<sup>5</sup>Lang-MN (0.7X) is a 30% lower seeding rate to achieve a stand of 0.9 million plants per acre vs. 1.3 million plants per acre.

<sup>6</sup>SY 611 CL2 has tolerance to Beyond<sup>®</sup> herbicide.

<sup>7</sup>SY Longmire has solid stems.

Bacterial leaf streak was assessed at three locations in 2019. This data, in combination with data from past years was used to assign a rating to all varieties. This disease cannot be controlled with fungicides. Selection of more resistant varieties is the only recommended practice at this time to reduce losses caused by this disease. The rating of newer varieties may change by as much as one rating point once 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 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.

Linkert was the no. 1 variety in Minnesota in 2019, sown on 22.3% of the state’s wheat acres. SY Valda was the 2nd most popular variety at 15.5%, followed by WB9590 (13.8%), WB9479 (9.2%), Shelly (7.1%), WB-Mayville (5.4%) and Bolles (4.4%).

Varieties tested for the first time in 2019 were new releases from CROPLAN by WinField United: CP3888, CP3910, CP3915 and CP3939; two from Dyna-Gro: Dyna-Gro Commander and Dyna-Gro Velocity; two from AgriPro/Syngenta: SY 611 CL2 and SY Longmire and TCG-Heartland from 21st Century Genetics. MN-Washburn (2019 MN) and SY McCloud (2019 AgriPro/Syngenta) are also new releases in 2019 and had been tested in previous years. Their multi-year data is reported for the first time this year.

Testing of CP3419, CP3504, CP3616, Faller, Forefront, Prevail, SY Rowyn,

**Table 2. Grain quality of hard red spring wheat varieties in Minnesota in single-year (2019) and multiple-year comparisons.**

Entry	Test Weight (lb/bu)		Protein (%) <sup>1</sup>		Baking Quality <sup>2</sup>	Pre-Harvest Sprouting <sup>3</sup>
	2019	2 Yr	2019	2 Yr		
Bolles	59.6	59.2	15.5	16.1	1	1
Boost	59.3	59.2	14.1	14.6	2	5
CP3530	60.0	59.5	13.8	14.6	3	2
CP3888	59.0	—	14.1	—	—	2
CP3910	60.3	—	13.9	—	—	3
CP3915	60.2	—	14.0	—	—	1
CP3939	59.9	—	14.5	—	—	2*
Dyna-Gro Ambush	61.3	60.5	14.4	14.9	2	3*
Dyna-Gro Ballistic	59.3	58.9	13.6	13.9	—	3*
Dyna-Gro Caliber	60.2	59.6	14.9	15.5	2	3*
Dyna-Gro Commander	60.3	—	14.2	—	—	1
Dyna-Gro Velocity	61.1	—	14.6	—	—	2
Lang-MN	61.0	60.6	14.3	14.8	3	1
Lang-MN 0.7X	61.1	—	14.4	—	—	—
LCS Breakaway	61.4	61.0	14.6	15.0	5	2
LCS Cannon	61.5	61.2	13.7	14.2	—	3
LCS Rebel	61.3	61.0	14.4	14.9	3	5
LCS Trigger	60.0	59.9	11.9	12.4	—	2
Linkert	60.5	59.9	14.9	15.4	1	1
MN-Washburn	60.1	59.8	13.6	14.0	3	1
MS Barracuda	60.4	60.0	14.5	15.0	—	3
MS Camaro	59.6	59.3	14.7	15.1	—	2
MS Chevelle	59.6	59.5	13.2	13.6	5	4
ND-VitPro	61.8	61.4	14.8	15.2	2	1
Prosper	59.9	59.7	13.1	13.7	5	1
Rollag	60.8	60.2	14.9	15.6	6	2
Shelly	59.4	59.4	13.5	14.1	5	1
Surpass	59.4	59.0	14.3	14.7	3	1
SY 611 CL2	60.9	—	14.1	—	—	2*
SY Ingmar	60.1	60.1	14.8	15.1	2	2
SY Longmire	59.2	—	14.3	—	—	2*
SY McCloud	61.5	61.1	14.6	15.0	—	2*
SY Valda	60.3	60.0	13.6	14.0	6	2
TCG-Climax	61.5	61.4	15.1	15.6	3	3
TCG-Heartland	60.9	—	14.9	—	—	2
TCG-Spittfire	58.3	58.7	13.5	13.9	2	3*
WB-Mayville	60.4	59.8	14.8	15.4	2	3
<b>Mean</b>	<b>60.2</b>	<b>60.0</b>	<b>14.1</b>	<b>14.6</b>		
<b>No. of Environments</b>	<b>11</b>	<b>27</b>	<b>12</b>	<b>29</b>		

<sup>1</sup>12% moisture basis.

<sup>2</sup>1-9 scale where 1 = best and 9 = worst. 2014-2018 crop years, where applicable.

<sup>3</sup>1-9 scale where 1 = best and 9 = worst. Values of 1-2 should be considered as resistant. Falling number data was collected from four 2019 locations. Varieties with an \* following their pre-harvest sprouting rating had lower than expected falling numbers based on their rating.

SY Soren, TCG-Glennville, WB9479, WB9590, WB9653 and WB9719 was discontinued in 2019. WestBred opted to not submit any HRSW varieties for testing. WB Mayville, however, was included in the testing as it occupied more than 5% of the state’s acreage in 2018.

Since 2004 we have been conducting an “intensive” management trial

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 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 Crookston, Lamberton, Morris, and Roseau are included in the 2019 and multi-year summaries. In the two northern locations, the fungicide regime as applied in these trials increased grain yield on average by 2.3 bu/acre in 2019 and by 4.7 bu/acre over the past three years. The two southern locations, Lamberton and Morris, averaged 6.6 bu/acre higher grain yield when fungicide protected in 2019 and 4.6 bu/acre from 2017-2019. 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.

### Authors and Researchers

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**Table 3. Disease reactions<sup>1</sup> of hard red spring wheat varieties in Minnesota in multiple-year comparisons.**

Entry	Leaf Rust	Stripe Rust <sup>2</sup>	Stem Rust <sup>3</sup>	Bacterial Leaf Streak <sup>4</sup>	Other Leaf Diseases <sup>5</sup>	Scab
Bolles	2	1	2	5	3	4
Boost	2	2	4	2	4	4
CP3530	3	3	1	4	4	4
CP3888	5	—	1-2	5-6	5	5-6
CP3910	3	—	1-2	6-7	5	4-6
CP3915	—	—	1-2	2-3	5	4-6
CP3939	—	—	1-2	4-5	5	4-5
Dyna-Gro Ambush	2	—	2	5	4	4
Dyna-Gro Ballistic	4	—	1-2	3	5	4-5
Dyna-Gro Caliber	3	—	2	4	3	7
Dyna-Gro Commander	—	—	1-2	4	6	4-6
Dyna-Gro Velocity	—	—	1-2	6-7	7	5-6
Lang-MN	1	1	2	3	4	3
Lang-MN (0.7X)	1	1	2	3	4	3
LCS Breakaway	3	2	2	6	5	5
LCS Cannon	3	—	2	6	7	4-6
LCS Rebel	6	—	2	3	4	4
LCS Trigger	1	—	1-2	2	3	3-4
Linkert	3	1	1	5	4	5
MN-Washburn	1	2	1	3	3	4
MS Barracuda	5	—	2	7	5	5-6
MS Camaro	2	—	1-2	7	5	7
MS Chevelle	3	1	1	6	6	5
ND-VitPro	3	—	1	3	5	3
Prosper	6	5	2	4	4	4
Rollag	4	1	2	7	5	3
Shelly	3	1	2	6	3	4
Surpass	3	2	5	3	6	4
SY 611 CL2	3	—	4-5	4	3-4	3-4
SY Ingmar	2	2	2	3	5	4
SY Longmire	4	—	1-2	2-4	5	7-8
SY McCloud	3	—	1	5	5	4-5
SY Valda	1	2	1	3	4	4
TCG-Climax	4	—	5	6	4	4
TCG-Heartland	2	—	1-2	5-6	3-4	5-6
TCG-Spitfire	5	—	3	3	4	5
WB-Mayville	3	3	3	7	7	8

<sup>1</sup>1-9 scale where 1 = most resistant, 9 = most susceptible.

<sup>2</sup>Based on natural infections in 2015 at Kimball, Lamberton and Waseca.

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

<sup>4</sup>Bacterial leaf streak symptoms are highly variable from one environment to the next. The rating of entries may change as more data is collected.

<sup>5</sup>Combined rating of tan spot and septoria.

**Table 4. Relative grain yield of hard red spring wheat varieties in northern Minnesota locations in single-year (2019) and multiple-year comparisons (2017-2019).**

Entry	Crookston			Fergus Falls			Hallock			Oklee			Perley			Roseau			Stephen			Strathcona <sup>1</sup>	
	2019	2 Yr	3 Yr	2019	2 Yr	3 Yr	2019	2 Yr	3 Yr	2019	2 Yr	3 Yr	2019	2 Yr	3 Yr	2019	2 Yr	3 Yr	2019	2 Yr	3 Yr	2019	2 Yr
Bolles	101	99	100	93	93	92	99	94	93	92	91	96	92	91	97	86	91	96	97	91	95	94	93
Boost	96	98	104	99	95	96	88	97	98	100	102	103	101	102	101	103	101	103	95	94	96	97	97
CP3530	101	98	102	104	104	105	103	101	102	95	96	96	111	108	109	101	99	103	99	97	106	98	98
CP3888	95	—	—	105	—	—	100	—	—	106	—	—	81	—	—	101	—	—	99	—	—	99	—
CP3910	108	—	—	102	—	—	109	—	—	112	—	—	104	—	—	113	—	—	101	—	—	101	—
CP3915	107	—	—	108	—	—	100	—	—	106	—	—	97	—	—	109	—	—	111	—	—	101	—
CP3939	98	—	—	102	—	—	100	—	—	92	—	—	91	—	—	83	—	—	97	—	—	94	—
Dyna-Gro Ambush	103	98	99	103	100	99	99	101	102	105	106	106	87	92	97	87	93	94	94	100	100	103	103
Dyna-Gro Ballistic	109	104	—	114	114	—	110	108	—	115	108	—	104	107	—	110	109	—	107	108	—	105	103
Dyna-Gro Caliber	92	91	96	98	93	94	82	84	88	97	97	95	85	84	86	95	90	90	96	93	94	96	97
Dyna-Gro Commander	101	—	—	103	—	—	106	—	—	101	—	—	121	—	—	108	—	—	101	—	—	100	—
Dyna-Gro Velocity	91	—	—	95	—	—	97	—	—	87	—	—	89	—	—	101	—	—	94	—	—	90	—
Lang-MN	95	97	97	102	101	100	95	97	100	105	98	98	104	99	96	104	106	104	104	100	98	104	98
Lang-MN (0.7X)	97	—	—	98	—	—	96	—	—	100	—	—	102	—	—	97	—	—	98	—	—	106	—
LCS Breakaway	96	97	92	95	98	103	104	105	103	96	94	96	79	86	94	113	104	99	101	101	99	99	95
LCS Cannon	102	102	—	105	105	—	106	106	—	106	104	—	121	112	—	104	102	—	109	108	—	101	107
LCS Rebel	105	102	104	93	95	97	99	99	102	102	101	103	110	110	104	104	101	101	102	102	102	104	99
LCS Trigger	119	114	—	112	112	—	112	106	—	122	114	—	117	118	—	118	115	—	111	111	—	118	109
Linkert	92	91	94	90	92	94	100	99	100	93	92	93	88	91	94	88	90	93	94	92	92	91	96
MN-Washburn	100	99	98	105	105	105	101	99	103	104	98	102	105	108	106	97	100	106	100	100	101	101	99
MS Barracuda	101	100	—	93	97	—	97	100	—	107	104	—	107	97	—	98	101	—	100	101	—	105	109
MS Camaro	91	94	—	93	96	—	103	100	—	88	90	—	95	88	—	77	79	—	104	102	—	93	98
MS Chevelle	108	105	107	103	102	105	105	109	108	100	103	105	93	99	104	105	103	103	103	107	108	94	101
ND-VitPro	98	96	95	91	94	92	94	97	97	87	94	92	95	100	98	89	91	93	93	92	92	90	91
Prosper	110	104	109	109	108	109	102	106	109	105	108	109	93	104	107	101	106	109	103	107	109	111	105
Rollag	96	89	93	93	89	92	103	99	97	92	91	93	100	95	97	80	83	86	94	94	97	87	91
Shelly	107	106	109	115	113	115	111	107	106	107	105	106	100	98	103	113	109	111	107	108	110	107	104
Surpass	100	102	101	95	94	98	100	105	106	106	100	100	105	112	107	92	97	99	106	105	105	100	97
SY 611 CL2	103	—	—	105	—	—	106	—	—	102	—	—	95	—	—	98	—	—	111	—	—	108	—
SY Ingmar	95	98	95	95	98	99	96	99	98	97	98	101	111	102	100	100	95	94	99	98	98	96	100
SY Longmire	103	—	—	106	—	—	101	—	—	106	—	—	78	—	—	94	—	—	107	—	—	100	—
SY McCloud	94	97	—	95	99	—	94	97	—	94	96	—	98	93	—	96	96	—	103	100	—	98	102
SY Valda	106	110	114	96	101	106	111	113	112	106	111	114	99	103	106	120	111	110	117	115	115	110	105
TCG-Climax	93	97	103	96	100	100	80	84	85	88	93	99	95	98	95	92	91	94	94	92	94	88	89
TCG-Heartland	97	—	—	93	—	—	91	—	—	94	—	—	110	—	—	88	—	—	96	—	—	93	—
TCG-Spitfire	104	109	107	104	105	108	98	99	99	103	104	109	115	108	106	113	106	106	101	103	104	100	100
WB-Mayville	92	90	89	90	95	97	91	93	95	92	95	95	114	106	102	100	96	95	86	92	96	90	96
<b>Mean (Bu/Acre)</b>	<b>78.81</b>	<b>72.1</b>	<b>83.2</b>	<b>82.8</b>	<b>90.8</b>	<b>89.6</b>	<b>84.8</b>	<b>91.0</b>	<b>92.2</b>	<b>64.4</b>	<b>80.7</b>	<b>79.7</b>	<b>66.3</b>	<b>70.6</b>	<b>84.8</b>	<b>86.4</b>	<b>88.0</b>	<b>91.2</b>	<b>81.9</b>	<b>89.8</b>	<b>94.5</b>	<b>72.1</b>	<b>82.7</b>
<b>LSD (0.10)</b>	<b>7.8</b>	<b>5.6</b>	<b>7.0</b>	<b>10.3</b>	<b>5.3</b>	<b>5.4</b>	<b>9.4</b>	<b>6.4</b>	<b>5.2</b>	<b>9.2</b>	<b>6.1</b>	<b>5.3</b>	<b>7.0</b>	<b>7.8</b>	<b>7.5</b>	<b>10.3</b>	<b>7.7</b>	<b>6.7</b>	<b>8.8</b>	<b>5.2</b>	<b>6.2</b>	<b>6.6</b>	<b>8.0</b>

<sup>1</sup>Strathcona was abandoned in 2017 due to poor growing conditions.

**Table 5. Relative grain yield of hard red spring wheat varieties in southern Minnesota locations in single-year (2019) and multiple-year comparisons (2017-2019).**

Entry	Benson			Kimball			Le Center			Lamberton			Morris <sup>1</sup>		St. Paul			Waseca		
	2019	2 Yr	3 Yr	2019	2 Yr	3 Yr	2019	2 Yr	3 Yr	2019	2 Yr	3 Yr	2019	2 Yr	2019	2 Yr	3 Yr	2019	2 Yr	3 Yr
Bolles	103	98	91	87	91	96	91	79	84	87	95	91	102	102	102	98	100	104	108	102
Boost	99	99	95	94	85	93	102	104	101	123	118	102	104	99	93	93	93	99	109	105
CP3530	121	114	112	108	103	103	124	125	122	113	115	110	113	104	115	110	108	112	115	114
CP3888	101	—	—	106	—	—	97	—	—	86	—	—	107	—	99	—	—	105	—	—
CP3910	99	—	—	106	—	—	98	—	—	101	—	—	109	—	98	—	—	98	—	—
CP3915	108	—	—	99	—	—	96	—	—	101	—	—	95	—	96	—	—	79	—	—
CP3939	96	—	—	105	—	—	87	—	—	96	—	—	104	—	93	—	—	87	—	—
Dyna-Gro Ambush	93	94	98	111	110	106	120	109	106	102	101	100	105	107	117	104	103	117	108	109
Dyna-Gro Ballistic	107	107	—	109	107	—	103	101	—	111	111	—	117	—	101	103	—	112	109	—
Dyna-Gro Caliber	85	83	90	92	95	96	99	92	92	90	86	87	101	95	108	97	100	97	81	80
Dyna-Gro Commander	97	—	—	108	—	—	101	—	—	103	—	—	112	—	110	—	—	107	—	—
Dyna-Gro Velocity	97	—	—	98	—	—	106	—	—	93	—	—	92	—	86	—	—	94	—	—
Lang-MN	98	103	101	103	104	106	108	104	98	106	108	105	107	109	88	98	102	116	126	115
Lang-MN (0.7X)	98	—	—	100	—	—	104	—	—	108	—	—	103	—	103	—	—	109	—	—
LCS Breakaway	92	93	96	100	105	105	110	93	93	66	88	93	102	103	84	89	93	101	87	98
LCS Cannon	91	91	—	118	115	—	111	111	—	101	94	—	99	—	110	112	—	112	110	—
LCS Rebel	101	98	97	104	94	95	98	92	93	103	107	103	100	99	92	94	97	104	100	96
LCS Trigger	122	118	—	110	98	—	121	120	—	122	119	—	108	—	106	110	—	103	118	—
Linkert	89	88	92	102	102	99	86	86	93	86	75	88	90	96	98	100	103	100	82	91
MN-Washburn	96	97	96	92	92	97	97	100	106	113	110	107	102	98	111	105	107	95	98	106
MS Barracuda	94	93	—	115	110	—	106	109	—	69	73	—	88	—	115	108	—	97	88	—
MS Camaro	78	82	—	100	97	—	90	95	—	65	77	—	79	—	92	96	—	98	70	—
MS Chevelle	91	94	90	102	95	97	98	95	102	97	86	99	110	112	99	97	97	100	91	100
ND-VitPro	96	96	93	110	102	103	86	89	88	101	105	96	88	86	105	101	102	93	99	98
Prosper	104	109	111	100	103	106	105	100	103	121	128	118	116	106	98	105	107	91	106	101
Rollag	95	93	95	98	97	98	76	70	84	82	82	89	77	85	78	80	85	89	78	85
Shelly	100	106	102	103	99	103	99	106	107	88	97	103	105	108	111	109	109	108	107	106
Surpass	103	99	103	97	97	102	104	94	93	105	108	104	94	94	79	88	96	104	104	110
SY 611 CL2	111	—	—	107	—	—	100	—	—	87	—	—	107	—	87	—	—	105	—	—
SY Ingmar	100	101	100	100	101	97	91	98	102	115	111	104	85	87	108	107	103	105	108	105
SY Longmire	103	—	—	81	—	—	89	—	—	94	—	—	91	—	89	—	—	66	—	—
SY McCloud	91	97	—	97	103	—	89	90	—	103	98	—	95	—	100	102	—	98	90	—
SY Valda	114	116	117	107	107	105	125	111	116	114	119	116	102	105	102	102	103	113	109	111
TCG-Climax	97	97	95	89	96	96	90	101	93	82	84	91	97	104	95	95	95	101	101	98
TCG-Heartland	101	—	—	106	—	—	89	—	—	83	—	—	97	—	109	—	—	98	—	—
TCG-Spitfire	124	117	112	102	102	103	113	117	115	120	116	116	111	111	107	105	108	96	102	103
WB-Mayville	92	90	101	103	99	104	90	95	100	97	82	92	104	108	110	107	105	109	94	96
<b>Mean (Bu/Acre)</b>	<b>95.8</b>	<b>86.5</b>	<b>88.8</b>	<b>77.0</b>	<b>72.7</b>	<b>79.3</b>	<b>58.3</b>	<b>57.7</b>	<b>67.8</b>	<b>31.83</b>	<b>36.4</b>	<b>52.3</b>	<b>65.26</b>	<b>61.9</b>	<b>70.6</b>	<b>70.1</b>	<b>70.2</b>	<b>42.0</b>	<b>42.9</b>	<b>59.5</b>
<b>LSD (0.10)</b>	<b>7.8</b>	<b>8.3</b>	<b>9.2</b>	<b>8.6</b>	<b>8.5</b>	<b>7.2</b>	<b>7.4</b>	<b>8.8</b>	<b>8.5</b>	<b>5.4</b>	<b>5.5</b>	<b>6.5</b>	<b>10.1</b>	<b>7.2</b>	<b>7.1</b>	<b>8.6</b>	<b>6.6</b>	<b>6.5</b>	<b>10.7</b>	<b>8.7</b>

<sup>1</sup>2018 Morris was discarded due to excessive rainfall and abnormally low grain yields. Two year data is from 2017 and 2019.

**Table 6. Relative grain yield of hard red spring wheat varieties in Minnesota in single-year (2019) and multiple-year comparisons (2017-2019).**

Entry	State			North			South		
	2019	2 Yr	3 Yr	2019	2 Yr	3 Yr	2019	2 Yr	3 Yr
Bolles	96	94	95	94	93	95	97	95	95
Boost	98	99	99	97	99	100	100	99	97
CP3530	107	105	106	101	100	103	115	112	110
CP3888	100	—	—	99	—	—	101	—	—
CP3910	104	—	—	106	—	—	101	—	—
CP3915	102	—	—	105	—	—	98	—	—
CP3939	95	—	—	95	—	—	96	—	—
Dyna-Gro Ambush	102	101	102	98	99	100	108	103	104
Dyna-Gro Ballistic	109	107	—	109	107	—	108	108	—
Dyna-Gro Caliber	94	91	92	93	92	93	96	91	91
Dyna-Gro Commander	105	—	—	105	—	—	105	—	—
Dyna-Gro Velocity	94	—	—	93	—	—	95	—	—
Lang-MN	102	102	101	102	99	99	102	105	104
Lang-MN (0.7X)	101	—	—	99	—	—	103	—	—
LCS Breakaway	97	96	98	98	98	98	95	95	98
LCS Cannon	106	105	—	107	106	—	105	105	—
LCS Rebel	101	99	100	102	101	102	100	97	97
LCS Trigger	115	112	—	116	112	—	113	113	—
Linkert	93	92	95	92	93	94	93	91	95
MN-Washburn	101	100	103	102	101	103	100	100	102
MS Barracuda	100	100	—	101	101	—	100	99	—
MS Camaro	90	91	—	93	93	—	87	88	—
MS Chevelle	101	101	103	102	104	106	99	96	99
ND-VitPro	94	95	95	92	94	94	98	97	96
Prosper	104	107	108	104	106	109	104	108	107
Rollag	90	89	92	93	92	94	86	84	89
Shelly	106	106	107	109	106	108	103	105	106
Surpass	99	100	101	100	102	102	97	96	100
SY 611 CL2	103	—	—	103	—	—	102	—	—
SY Ingmar	99	100	99	98	98	98	100	102	100
SY Longmire	95	—	—	100	—	—	89	—	—
SY McCloud	96	97	—	97	97	—	96	98	—
SY Valda	109	109	111	108	109	111	111	109	110
TCG-Climax	92	94	95	91	92	95	94	97	96
TCG-Heartland	97	—	—	95	—	—	99	—	—
TCG-Spitfire	107	106	107	105	104	105	111	110	109
WB-Mayville	97	96	98	94	95	95	100	96	101
<b>Mean (Bu/Acre)</b>	<b>70.6</b>	<b>73.4</b>	<b>78.7</b>	<b>77.2</b>	<b>82.2</b>	<b>86.9</b>	<b>63.0</b>	<b>64.0</b>	<b>70.2</b>
<b>LSD (0.10)</b>	<b>3.0</b>	<b>2.2</b>	<b>1.9</b>	<b>3.5</b>	<b>2.5</b>	<b>2.3</b>	<b>4.6</b>	<b>3.5</b>	<b>3.1</b>
<b>No. of Environments</b>	<b>15</b>	<b>29</b>	<b>43</b>	<b>8</b>	<b>16</b>	<b>23</b>	<b>7</b>	<b>13</b>	<b>20</b>

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

Entry	North						South						State					
	2019		2 Yr		3 Yr		2019		2 Yr		3 Yr		2019		2 Yr		3 Yr	
	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int
Bolles	77.1	76.8	75.8	74.9	85.3	86.6	47.0	53.3	45.2	49.3	53.9	56.6	62.1	65.0	62.7	63.9	71.0	73.0
Boost	82.4	84.9	79.8	83.3	90.2	93.5	53.5	57.1	51.2	54.5	56.7	61.1	68.0	71.0	67.5	71.0	75.0	78.8
CP3530	83.4	90.6	78.9	86.0	89.5	95.4	54.7	60.9	52.4	56.4	60.1	66.2	69.1	75.7	67.5	73.4	76.2	82.1
CP3888	81.1	85.0	—	—	—	—	48.6	52.5	—	—	—	—	64.9	68.8	—	—	—	—
CP3910	91.0	91.9	—	—	—	—	51.6	53.1	—	—	—	—	71.3	72.5	—	—	—	—
CP3915	89.1	88.0	—	—	—	—	47.0	56.0	—	—	—	—	68.0	72.0	—	—	—	—
CP3939	74.4	84.0	—	—	—	—	49.4	53.0	—	—	—	—	61.9	68.5	—	—	—	—
Dyna-Gro Ambush	78.0	74.8	76.1	76.8	83.9	87.0	50.5	61.3	47.4	54.6	57.9	64.1	64.3	68.0	63.8	67.3	72.1	76.6
Dyna-Gro Ballistic	90.5	98.0	85.5	92.6	—	—	55.9	64.5	52.5	59.9	—	—	73.2	81.3	71.4	78.6	—	—
Dyna-Gro Caliber	77.5	81.5	72.4	76.5	81.2	84.2	47.3	51.3	42.9	45.9	50.7	52.8	62.4	66.4	59.8	63.4	67.4	69.9
Dyna-Gro Commander	86.4	88.8	—	—	—	—	52.8	55.7	—	—	—	—	69.6	72.2	—	—	—	—
Dyna-Gro Velocity	79.7	91.3	—	—	—	—	44.9	51.7	—	—	—	—	62.3	71.5	—	—	—	—
Lang-MN	82.6	84.0	81.6	83.6	87.9	91.4	51.7	63.4	49.4	58.7	60.0	66.9	67.2	73.7	67.8	72.9	75.2	80.2
Lang-MN (0.7X)	80.5	86.6	—	—	—	—	50.8	59.4	—	—	—	—	65.7	73.0	—	—	—	—
LCS Breakaway	86.7	86.5	80.6	83.8	83.5	88.4	43.9	49.9	43.7	45.3	54.9	57.9	65.3	68.2	64.8	67.3	70.5	74.6
LCS Cannon	85.4	87.9	81.8	84.8	—	—	48.4	53.9	44.4	49.0	—	—	66.9	70.9	65.8	69.5	—	—
LCS Rebel	86.0	81.0	81.1	80.1	89.6	92.3	49.0	58.5	47.7	54.1	56.7	62.6	67.5	69.8	66.8	69.0	74.7	78.8
LCS Trigger	97.5	103.1	91.8	99.0	—	—	54.7	66.0	52.5	62.3	—	—	76.1	84.5	74.9	83.3	—	—
Linkert	74.2	80.9	72.4	78.4	81.4	87.1	43.2	46.8	37.9	43.8	51.3	55.6	58.7	63.9	57.6	63.6	67.7	72.8
MN-Washburn	81.4	86.5	79.8	86.2	89.0	93.5	51.2	59.0	48.8	55.8	57.8	64.4	66.3	72.7	66.6	73.2	74.8	80.3
MS Barracuda	82.4	83.7	80.3	81.2	—	—	39.8	48.5	37.0	45.5	—	—	61.1	66.1	61.7	65.9	—	—
MS Camaro	69.4	78.0	68.4	75.8	—	—	36.0	42.9	35.8	40.4	—	—	52.7	60.4	54.4	60.6	—	—
MS Chevelle	88.0	94.8	83.4	89.6	91.6	100.6	51.4	53.3	44.8	50.2	59.0	62.2	69.7	74.0	66.9	72.7	76.8	83.1
ND-VitPro	77.1	79.3	74.6	76.4	81.8	83.3	44.7	49.0	44.7	48.3	51.5	55.2	60.9	64.1	61.8	64.4	68.0	70.6
Prosper	86.7	96.8	84.4	91.4	95.1	105.2	57.2	65.5	56.3	62.9	63.1	71.3	71.9	81.2	72.4	79.2	80.5	89.8
Rollag	72.5	78.9	68.7	74.3	77.6	82.7	38.3	49.1	36.7	45.9	48.9	54.4	55.4	64.0	55.0	62.1	64.6	69.8
Shelly	90.8	91.8	86.2	87.3	95.6	98.0	48.1	59.2	46.4	55.2	59.1	66.3	69.4	75.5	69.1	73.6	79.0	83.6
Surpass	79.0	82.0	79.4	81.8	87.2	91.4	47.2	52.2	46.5	50.2	55.7	58.2	63.1	67.1	65.3	68.3	72.9	76.3
SY 611 CL2	82.8	95.7	—	—	—	—	48.8	52.6	—	—	—	—	65.8	74.2	—	—	—	—
SY Ingmar	80.6	82.2	77.0	81.4	82.4	86.0	45.9	54.6	45.3	51.5	54.3	60.0	63.3	68.4	63.4	68.6	69.6	74.2
SY Longmire	81.2	87.0	—	—	—	—	44.6	52.0	—	—	—	—	62.9	69.5	—	—	—	—
SY McCloud	78.7	84.3	77.2	81.8	—	—	47.6	51.1	44.4	48.7	—	—	63.1	67.7	63.1	67.6	—	—
SY Valda	93.8	96.3	88.5	92.0	97.7	101.8	51.4	57.2	51.0	54.5	62.4	66.2	72.6	76.7	72.4	75.9	81.7	85.6
TCG-Climax	76.4	82.5	75.2	83.5	85.7	93.5	44.7	53.9	41.4	50.1	54.3	59.7	60.5	68.2	60.7	69.2	71.5	78.1
TCG-Heartland	76.2	83.7	—	—	—	—	44.8	52.7	—	—	—	—	60.5	68.2	—	—	—	—
TCG-Spitfire	89.7	93.7	85.7	89.9	92.9	96.9	55.3	60.3	52.2	57.1	63.8	66.7	72.5	77.0	71.4	75.9	79.7	83.2
WB-Mayville	79.3	84.9	74.8	81.0	80.4	88.7	49.6	53.6	42.6	45.8	55.9	58.1	64.4	69.3	61.0	65.9	69.2	74.8
<b>Mean (Bu/Acre)</b>	<b>82.4</b>	<b>86.7</b>	<b>79.3</b>	<b>83.5</b>	<b>87.1</b>	<b>91.8</b>	<b>48.4</b>	<b>55.0</b>	<b>46.0</b>	<b>51.7</b>	<b>56.6</b>	<b>61.2</b>	<b>65.4</b>	<b>70.8</b>	<b>65.0</b>	<b>69.8</b>	<b>73.2</b>	<b>77.9</b>
<b>LSD (0.10)</b>	<b>8.0</b>	<b>8.4</b>	<b>4.9</b>	<b>5.2</b>	<b>5.7</b>	<b>7.0</b>	<b>7.2</b>	<b>7.8</b>	<b>5.3</b>	<b>6.2</b>	<b>4.2</b>	<b>4.7</b>	<b>5.5</b>	<b>6.0</b>	<b>3.8</b>	<b>4.1</b>	<b>3.9</b>	<b>4.5</b>
<b>No. of Environments</b>	<b>2</b>	<b>2</b>	<b>4</b>	<b>4</b>	<b>6</b>	<b>6</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>5</b>	<b>5</b>	<b>4</b>	<b>4</b>	<b>7</b>	<b>7</b>	<b>11</b>	<b>11</b>