

# 2022 Spring Wheat Field Crop Trials Results

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

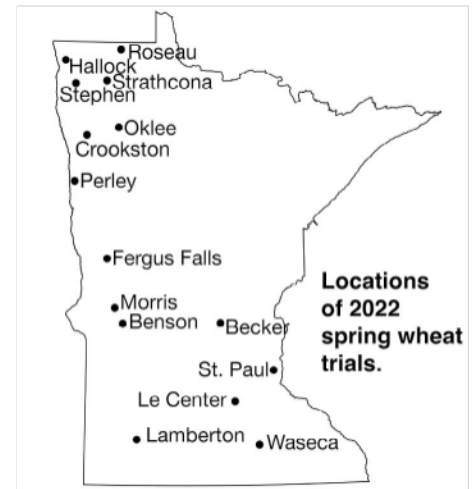
Spring wheat varieties were sown in trial plots at Becker, Crookston, Lamberton, Morris, Roseau, St. Paul, and Waseca and on-farm sites near Benson, Fergus Falls, Hallock, Le Center, Oklee, Perley, Stephen, and Strathcona. These plots are handled so that the factors affecting yield and other characteristics 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. 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. All locations are set up as randomized complete blocks with 3 replications. Spatial analysis is used to adjust plot yields for each location. 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.

Leaf and stripe rust pressure throughout Minnesota has been low the past five 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

### 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

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.

Bacterial leaf streak was assessed at five locations in 2022. This data, in

**Table 1. Origin and agronomic characteristics of hard red spring wheat varieties in Minnesota in single-year (2022) 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>
AP Gunsmoke CL2 <sup>5</sup>	2021 AgriPro/Syngenta	PVP (94)	1.3	49.0	26.5	5
AP Murdock	2020 AgriPro/Syngenta	PVP (94)	1.3	48.8	25.0	5
AP Smith	2021 AgriPro/Syngenta	PVP (94)	1.3	51.7	24.3	2
Ascend-SD	2021 SDSU	PVP (94) pending	1.3	50.0	29.4	5–6
Bolles	2015 MN	PVP (94)	1.3	51.3	28.1	4
CAG Justify	2021 Champions Alliance Group	PVP (94)	1.2	51.1	27.5	5
CAG Reckless	2021 Champions Alliance Group	PVP (94)	1.3	49.8	28.2	5
CAG Recoil	2022 Champions Alliance Group	PVP (94) pending	1.3	55.2	27.2	3–4
CP3099A	2020 CROPLAN	PVP (94) pending	1.3	53.8	28.6	4–5
CP3119A	2021 CROPLAN	PVP (94) pending	1.3	54.8	27.9	2–3
CP3188	2020 CROPLAN	PVP (94) pending	1.3	50.2	28.3	5
CP3530	2015 CROPLAN	Patented	1.3	50.8	29.5	5
CP3915	2019 CROPLAN	PVP (94) pending	1.3	49.9	26.4	3
CPX39120	2023 CROPLAN	PVP (94) pending	1.3	57.6	29.5	5
Driver	2020 SDSU	PVP (94)	1.3	50.5	28.9	4
Dyna-Gro Ambush	2016 Dyna-Gro	PVP (94)	1.5	50.6	27.8	5
Dyna-Gro Ballistic	2018 Dyna-Gro	PVP (94)	1.5	48.2	27.4	5
Dyna-Gro Commander	2019 Dyna-Gro	PVP (94)	1.5	48.5	26.7	4
Lang-MN	2017 MN	PVP (94)	1.3	50.9	27.8	4
LCS Ascent	2022 Limagrain Cereal Seeds	PVP (94)	1.4	47.3	27.9	5
LCS Buster	2020 Limagrain Cereal Seeds	PVP (94)	1.3	52.8	27.5	4–5
LCS Cannon	2018 Limagrain Cereal Seeds	PVP (94)	1.4	46.8	27.8	4
LCS Dual	2021 Limagrain Cereal Seeds	PVP (94)	1.4	48.3	28.1	3–4
LCS Trigger	2016 Limagrain Cereal Seeds	PVP (94)	1.3	53.3	27.4	5
Linkert	2013 MN	PVP (94)	1.3	49.5	25.8	2
MN-Rothsay	2022 MN	PVP (94) pending	1.3	51.4	25.4	3
MN-Torgy	2020 MN	PVP (94)	1.3	50.7	26.1	4
MN-Washburn	2019 MN	PVP (94)	1.3	50.8	26.8	3
MS Barracuda	2018 Meridian Seeds	PVP (94)	1.3	46.8	26.6	3
MS Charger	2023 Meridian Seeds	PVP (94) pending	1.3	48.2	26.7	4–5
MS Cobra	2022 Meridian Seeds	PVP (94)	1.3	48.6	26.7	3–4
MS Ranchero	2020 Meridian Seeds	PVP (94)	1.3	53.3	28.5	6
ND Frohberg	2020 NDSU	PVP (94)	1.3	49.5	28.7	5
ND Heron	2021 NDSU	PVP (94) pending	1.3	47.7	28.7	5–6
Prosper	2011 NDSU	PVP (94)	1.3	50.8	27.5	6
Shelly	2016 MN	PVP (94)	1.3	50.9	25.7	5
SY 611 CL2 <sup>5</sup>	2019 AgriPro/Syngenta	PVP (94)	1.3	48.6	24.9	4
SY Longmire <sup>6</sup>	2019 AgriPro/Syngenta	PVP (94)	1.3	50.0	26.3	3
SY McCloud	2019 AgriPro/Syngenta	PVP (94)	1.3	49.3	26.6	4
SY Valda	2015 AgriPro/Syngenta	PVP (94)	1.3	50.4	25.2	5
TCG-Heartland	2019 21st Century Genetics	PVP (94), Patent pending	1.6	47.8	24.4	3
TCG-Spitfire	2016 21st Century Genetics	PVP (94)	1.5	51.7	27.5	3
TCG-Wildcat	2020 21st Century Genetics	PVP (94), Patent pending	1.5	50.3	26.5	3
WB9479	2017 WestBred	Patented, PVP (94)	1.3	48.6	24.7	3
WB9590	2017 WestBred	Patented, PVP (94)	1.3	48.6	23.9	3
<b>Mean</b>				<b>50.3</b>	<b>27.0</b>	

<sup>1</sup> Abbreviations: MN = Minnesota Agricultural Experiment Station; NDSU = North Dakota State University Research Foundation; SDSU = South Dakota Agricultural Experiment Station

<sup>2</sup> Our standard seeding rate is designed to achieve a desired stand of 1.3 million plants/acre, assuming a 20% stand loss and adjusting for the germination percentage and seed weight of each variety.

<sup>3</sup> 2022 data.

<sup>4</sup> 1–9 scale in which 1 is the strongest straw and 9 is the weakest. Based on 2014–2022 data. The rating of newer entries may change by as much as one rating point as more data are collected.

<sup>5</sup> AP Gunsmoke CL2 and SY 611 CL2 have tolerance to Beyond® herbicide.

<sup>6</sup> SY Longmire has solid stems.

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.

MN-Torgy was the no. 1 variety grown in Minnesota in 2022, on 21.7% of the 1.2 million acres. The next most seeded varieties were WB9590 (19.4%), SY Valda (11.0%), WB9479 (7.9%), AP Murdock (7.6%), and Linkert (6.3%).

Varieties tested for the first time in 2022 were CAG Recoil, CPX39120, LCS Ascent, LCS Dual, MS Charger, and ND-Heron. Ascend-SD (released in 2021) and MN-Rothsay (released in 2022) were both tested in previous years under their experimental designations and 2- and 3-year averages are reported, respectively. WestBred did not submit any HRSW varieties for testing, but WB9479 and WB9590 were both tested in 2022 because each occupied more than 5% of the state’s acreage in 2021. LCS Rebel and PFS-Buns were tested in 2021 but not 2022.

Since 2004 we have been conducting an “intensive” management trial in which fungicides are applied at the

**Table 2. Grain quality of hard red spring wheat varieties in Minnesota in single-year (2022) and multiple-year comparisons.**

Entry	Test Weight (lb/Bu)		Protein (%) <sup>1</sup>		Baking Quality <sup>2</sup>	Pre-Harvest Sprouting <sup>3</sup>
	2022	2 Yr	2022	2 Yr		
AP Gunsmoke CL2	58.7	59.7	15.7	15.3	5	3
AP Murdock	59.4	60.2	14.2	14.5	5	1
AP Smith	58.8	60.2	15.5	15.2	3	4
Ascend-SD	59.1	60.3	15.2	14.8	–	4
Bolles	58.9	60.1	16.8	16.7	1	1
CAG Justify	58.2	58.7	13.8	13.9	–	3
CAG Reckless	59.9	61.1	15.1	15.0	–	4
CAG Recoil	59.2	–	14.6	–	–	1
CP3099A	57.0	58.1	13.1	13.0	6	1
CP3119A	54.5	55.8	13.9	13.6	–	3
CP3188	57.3	58.5	13.8	13.6	–	1
CP3530	59.5	60.1	15.2	15.1	3	1
CP3915	59.0	60.6	15.2	15.1	4	1
CPX39120	52.6	–	13.9	–	–	2
Driver	60.5	61.8	14.8	14.4	6	3
Dyna-Gro Ambush	58.6	60.5	14.4	14.6	2	3
Dyna-Gro Ballistic	60.2	60.6	14.9	14.5	5	3
Dyna-Gro Commander	59.1	60.6	15.2	15.0	6	1
Lang-MN	59.9	60.8	15.2	15.1	3	1
LCS Ascent	59.8	–	14.6	–	–	2
LCS Buster	56.8	57.9	12.6	12.7	7	4
LCS Cannon	60.8	62.1	14.8	14.7	4	3
LCS Dual	59.2	–	14.6	–	–	2
LCS Trigger	59.4	60.2	13.1	13.3	7	2
Linkert	60.0	61.3	15.6	15.7	1	1
MN-Rothsay	59.5	60.7	14.8	14.8	5	2
MN-Torgy	59.5	61.0	15.1	15.2	4	1
MN-Washburn	58.8	60.2	14.8	14.6	3	1
MS Barracuda	58.6	60.4	15.9	15.4	4	3
MS Charger	58.9	–	13.6	–	–	1
MS Cobra	58.9	60.6	15.1	14.9	–	4
MS Rancho	56.9	59.0	15.0	14.5	6	4
ND Froberg	59.8	61.0	15.0	14.9	3	4
ND Heron	60.5	–	15.3	–	–	1
Prosper	59.4	60.2	14.1	14.2	5	1
Shelly	58.9	60.6	14.7	14.4	5	1
SY 611 CL2	59.1	60.7	15.1	14.9	6	2
SY Longmire	58.0	60.0	15.8	15.3	3	3
SY McCloud	60.7	61.8	15.4	15.5	3	2
SY Valda	59.1	60.5	14.7	14.4	6	2
TCG-Heartland	59.2	60.9	15.6	15.5	2	1
TCG-Spitfire	58.2	59.5	14.3	14.2	3	4
TCG-Wildcat	60.0	61.1	15.2	15.0	4	1
WB9479	58.6	60.3	16.1	15.9	2	1
WB9590	58.8	60.4	15.7	15.5	4	1
<b>Mean</b>	<b>58.5</b>	<b>60.1</b>	<b>14.9</b>	<b>14.8</b>		
<b>No. of Environments</b>	<b>6</b>	<b>17</b>	<b>6</b>	<b>17</b>		

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

<sup>2</sup>2014-2021 crop years, where applicable.

<sup>3</sup>1-9 scale in which 1 = best and 9 = worst. Values of 1-2 should be considered as resistant.

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 2022 and multi-year summaries. In the two northern locations, the fungicide regime as applied in these trials increased grain yield on average by 12.1 bu/acre in 2022 and by 6.4 bu/acre over the past three years. The two southern locations, Lamberton and Morris, averaged 7.0 bu/acre higher grain yield when fungicide protected in 2022 and 5.3 bu/acre higher from 2010-2022. 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 Managers

Test plot establishment and management were supervised by Matt Bickell, Dave Grafstrom, Tom Hoverstad, Mike Leiseth, Houston Lindell, Steve Quiring, Curtis Reese, Susan Reynolds, Nathan Stuart, Donn Vellekson, and Joe Wodarek.

**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
AP Gunsmoke CL2	3	–	1	8	7	5
AP Murdock	3	–	1	4	6	7
AP Smith	6	–	1	4	5	6
Ascend-SD	3	–	1	2–3	6	4
Bolles	2	1	2	4	4	5
CAG Justify	3	–	2	4–5	4	4
CAG Reckless	1	–	1	3	5	4
CAG Recoil	2	–	2	2–3	5	–
CP3099A	6	–	8	6–7	4	5–6
CP3119A	5	–	2	6–7	4	5–6
CP3188	1	–	6	6–7	6	5
CP3530	7	3	1	3	6	4
CP3915	1	–	1	2	5	4
CPX39120	7	–	6	4–5	3	–
Driver	3	–	1	3	4	4
Dyna-Gro Ambush	4	–	2	4	4	4
Dyna-Gro Ballistic	4	–	3	3	4	5
Dyna-Gro Commander	2	–	1	4	6	5
Lang-MN	1	–	2	3	4	3
LCS Ascent	4	–	1–2	6–7	5	–
LCS Buster	3	–	1	4	3	3
LCS Cannon	4	–	2	5	7	5
LCS Dual	3	–	1–2	5	4	–
LCS Trigger	1	–	2	2	3	3
Linkert	3	1	1	5	5	5
MN-Rothsay	4	–	2	4	3	4
MN-Torgy	3	–	1	3	4	3
MN-Washburn	1	2	1	3	4	4
MS Barracuda	6	–	2	7	5	5
MS Charger	–	–	2	5	6	–
MS Cobra	2	–	1	4–5	4	5
MS Rancho	3	–	1	6	3	4
ND Froberg	3	–	1	3	5	5
ND Heron	5	–	1–2	5	4	–
Prosper	6	5	2	4	5	5
Shelly	5	1	2	6	4	4
SY 611 CL2	4	–	5	4	4	4
SY Longmire	5	–	1	3	5	7
SY McCloud	3	–	1	6	6	4
SY Valda	4	2	1	4	5	4
TCG-Heartland	3	–	2	5	6	6
TCG-Spitfire	4	–	2	3	5	6
TCG-Wildcat	3	–	3	6	7	7
WB9479	6	–	2	6	6	7
WB9590	6	–	2	6	6	7

<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 (2022) and multiple-year comparisons (2020-2022).**

Entry	Crookston			Fergus Falls			Hallock			Oklee			Perley			Roseau			Stephen			Strathcona		
	2022	2 Yr	3 Yr	2022	2 Yr	3 Yr	2022	2 Yr	3 Yr	2022	2 Yr	3 Yr	2022	2 Yr	3 Yr	2022	2 Yr	3 Yr	2022	2 Yr	3 Yr	2022	2 Yr	3 Yr
AP Gunsmoke CL2	95	100	102	102	101	101	99	100	101	102	105	110	82	94	93	101	101	101	94	97	98	102	104	101
AP Murdock	108	102	103	89	89	92	90	91	94	103	94	102	117	108	108	103	99	102	110	100	106	113	105	111
AP Smith	101	100	100	91	98	98	92	96	94	120	110	105	102	101	99	91	93	97	99	100	102	93	98	95
Ascend-SD	102	97	-	111	109	-	99	101	-	91	100	-	101	99	-	113	107	-	117	111	-	120	109	-
Bolles	96	94	94	91	96	94	90	89	91	89	90	91	89	96	97	91	95	95	100	94	94	87	88	88
CAG Justify	96	94	-	99	105	-	115	112	-	96	101	-	102	104	-	120	110	-	105	104	-	115	108	-
CAG Reckless	91	100	-	95	101	-	101	103	-	93	98	-	97	100	-	106	105	-	104	105	-	104	104	-
CAG Recoil	106	-	-	101	-	-	97	-	-	93	-	-	113	-	-	86	-	-	98	-	-	95	-	-
CP3099A	119	107	-	115	118	-	114	113	-	122	131	-	103	103	-	121	115	-	106	111	-	115	107	-
CP3119A	93	100	-	100	108	-	109	104	-	119	117	-	79	85	-	101	112	-	89	105	-	111	105	-
CP3188	105	108	-	90	99	-	91	96	-	98	102	-	95	101	-	107	106	-	98	103	-	106	105	-
CP3530	97	88	90	94	97	97	109	101	105	96	93	96	102	99	100	117	111	106	107	106	104	112	107	109
CP3915	97	93	96	96	96	98	98	102	99	100	97	94	105	103	101	99	95	103	103	96	98	117	110	102
CPX39120	66	-	-	106	-	-	95	-	-	105	-	-	84	-	-	74	-	-	70	-	-	96	-	-
Driver	105	103	102	107	108	107	102	102	107	108	114	112	106	107	108	116	108	105	99	100	103	102	103	100
Dyna-Gro Ambush	92	102	103	103	105	103	110	103	104	112	101	103	94	98	101	103	103	100	112	101	104	107	105	106
Dyna-Gro Ballistic	99	98	101	103	105	106	100	101	102	94	105	105	87	92	96	95	98	106	107	105	107	104	102	100
Dyna-Gro Commander	102	103	100	87	93	96	97	97	99	100	98	99	106	104	101	99	101	101	98	97	101	102	105	105
Lang-MN	105	104	103	102	98	99	102	100	101	92	91	93	94	95	95	99	93	97	98	100	97	95	94	102
LCS Ascent	97	-	-	95	-	-	105	-	-	104	-	-	91	-	-	110	-	-	105	-	-	105	-	-
LCS Buster	113	104	104	110	109	112	112	109	110	107	109	116	107	108	111	99	100	109	107	107	110	100	99	104
LCS Cannon	97	93	95	96	94	96	87	94	93	99	100	102	104	104	107	109	109	104	104	105	102	104	106	105
LCS Dual	102	-	-	102	-	-	105	-	-	84	-	-	102	-	-	97	-	-	99	-	-	98	-	-
LCS Trigger	111	106	108	107	102	108	117	109	116	119	110	114	125	115	118	116	105	110	110	108	110	114	107	110
Linkert	100	104	100	84	88	91	88	95	96	88	83	87	89	89	89	91	89	90	93	96	92	91	94	90
MN-Rothsay	106	111	110	98	100	103	114	107	106	107	107	107	105	107	106	108	104	105	109	104	105	100	100	102
MN-Torgy	105	105	105	99	99	102	106	102	100	82	88	95	103	103	101	103	97	100	116	108	111	93	96	99
MN-Washburn	101	97	97	113	102	101	99	100	100	80	88	92	103	101	100	93	98	90	106	98	99	101	97	90
MS Barracuda	97	91	92	97	96	96	90	96	96	92	101	102	94	97	93	100	102	98	93	92	93	92	100	103
MS Charger	116	-	-	108	-	-	106	-	-	109	-	-	101	-	-	110	-	-	97	-	-	109	-	-
MS Cobra	102	101	-	90	100	-	99	100	-	99	94	-	93	98	-	97	101	-	95	94	-	94	97	-
MS Ranchero	86	101	101	110	104	101	111	106	107	94	97	100	90	95	97	96	101	105	87	88	97	109	105	113
ND Frohberg	88	100	98	94	95	99	97	93	92	86	95	97	88	92	92	105	102	99	84	88	88	89	95	96
ND Heron	94	-	-	96	-	-	94	-	-	99	-	-	86	-	-	111	-	-	94	-	-	93	-	-
Prosper	92	93	98	115	113	112	106	104	105	109	106	108	94	101	101	98	102	105	109	110	111	104	99	99
Shelly	102	100	102	105	107	108	109	106	108	99	100	103	102	97	96	115	107	102	105	103	101	107	105	108
SY 611 CL2	98	96	98	107	110	108	93	99	97	108	105	108	113	106	104	107	104	105	103	98	101	97	99	98
SY Longmire	94	93	95	92	97	97	98	97	96	93	96	95	97	98	98	84	90	90	96	100	100	103	101	92
SY McCloud	106	107	102	99	98	99	92	97	100	94	97	99	99	97	97	102	104	103	92	91	88	95	97	99
SY Valda	91	92	96	106	101	103	108	107	108	105	107	105	113	105	106	102	105	103	107	107	111	97	99	102
TCG-Heartland	94	97	98	93	93	96	89	91	90	91	93	94	94	87	94	77	90	92	93	89	96	80	88	88
TCG-Spitfire	108	103	105	101	109	109	96	100	98	101	97	100	111	113	111	91	94	97	106	105	103	92	97	98
TCG-Wildcat	108	100	101	88	97	99	99	99	99	99	100	99	100	103	103	109	104	107	105	98	104	105	107	106
WB9479	100	99	103	89	90	92	97	94	97	93	95	99	96	98	94	91	92	92	96	92	96	105	104	104
WB9590	100	99	104	105	104	103	102	98	105	106	98	101	95	97	100	102	101	103	97	92	93	104	102	105
<b>Mean (Bu/Acre)</b>	<b>96.1</b>	<b>76.9</b>	<b>74.6</b>	<b>83.9</b>	<b>79.1</b>	<b>80.1</b>	<b>82.3</b>	<b>77.3</b>	<b>72.8</b>	<b>71.8</b>	<b>70.8</b>	<b>73.5</b>	<b>96.9</b>	<b>91.1</b>	<b>83.1</b>	<b>80.8</b>	<b>86.0</b>	<b>86.0</b>	<b>89.5</b>	<b>79.8</b>	<b>77.1</b>	<b>83.8</b>	<b>72.3</b>	<b>71.3</b>
<b>LSD (0.10)</b>	<b>9.0</b>	<b>9.5</b>	<b>6.2</b>	<b>14.6</b>	<b>6.4</b>	<b>4.3</b>	<b>20.0</b>	<b>6.0</b>	<b>5.1</b>	<b>18.9</b>	<b>7.5</b>	<b>5.7</b>	<b>7.9</b>	<b>7.4</b>	<b>5.9</b>	<b>10.6</b>	<b>7.2</b>	<b>6.2</b>	<b>11.4</b>	<b>7.0</b>	<b>5.6</b>	<b>19.3</b>	<b>9.1</b>	<b>7.1</b>

**Table 5. Relative grain yield of hard red spring wheat varieties in southern Minnesota locations in single-year (2022) and multiple-year comparisons (2020-2022).**

Entry	Becker			Benson <sup>1</sup>	Le Center			Lamberton			Morris			St Paul			Waseca <sup>2</sup>	
	2022	2 Yr	3 Yr	2 Yr	2022	2 Yr	3 Yr	2022	2 Yr	3 Yr	2022	2 Yr	3 Yr	2022	2 Yr	3 Yr	2022	2 Yr
AP Gunsmoke CL2	106	105	105	100	98	103	104	114	110	99	118	111	109	108	98	97	101	103
AP Murdock	95	99	99	93	102	98	102	100	99	101	115	103	104	80	94	100	110	113
AP Smith	102	98	98	104	98	100	99	99	101	101	94	99	104	96	100	97	103	101
Ascend-SD	121	115	–	–	104	103	–	111	108	–	133	124	–	97	99	–	123	–
Bolles	95	88	89	100	90	90	89	88	89	94	95	98	98	88	94	95	96	95
CAG Justify	104	97	–	–	105	97	–	114	107	–	133	130	–	110	108	–	115	–
CAG Reckless	112	118	–	–	96	96	–	109	104	–	118	110	–	113	111	–	99	–
CAG Recoil	75	–	–	–	107	–	–	93	–	–	106	–	–	87	–	–	104	–
CP3099A	94	98	–	–	110	101	–	116	118	–	96	115	–	93	92	–	112	–
CP3119A	90	104	–	–	114	110	–	90	100	–	76	100	–	92	91	–	101	–
CP3188	99	103	–	–	103	106	–	90	106	–	114	119	–	97	102	–	98	–
CP3530	98	97	97	107	107	108	107	101	100	100	107	101	100	108	105	103	108	101
CP3915	101	104	105	94	94	95	96	106	103	105	89	93	96	116	97	92	85	87
CPX39120	63	–	–	–	121	–	–	106	–	–	84	–	–	75	–	–	74	–
Driver	107	106	106	103	103	102	100	107	113	112	111	108	108	122	112	107	96	103
Dyna-Gro Ambush	109	102	102	104	106	108	107	111	103	100	110	88	96	104	110	109	112	112
Dyna-Gro Ballistic	92	101	101	105	99	101	103	105	101	104	105	106	106	113	99	101	104	104
Dyna-Gro Commander	96	103	103	112	96	101	102	90	93	96	107	104	109	110	113	110	112	117
Lang-MN	95	97	97	95	93	96	96	92	94	94	99	99	101	102	108	104	106	104
LCS Ascent	115	–	–	–	101	–	–	99	–	–	112	–	–	117	–	–	97	–
LCS Buster	106	114	115	105	108	104	105	104	103	108	99	97	104	100	105	103	111	116
LCS Cannon	123	114	114	101	98	104	107	106	104	104	116	93	101	137	126	123	111	113
LCS Dual	118	–	–	–	97	–	–	106	–	–	107	–	–	99	–	–	120	–
LCS Trigger	98	105	106	118	109	112	112	110	114	117	112	118	124	100	110	107	116	123
Linkert	104	102	102	97	89	94	93	97	95	94	96	93	93	109	105	102	90	87
MN-Rothsay	101	105	105	107	93	97	98	87	89	95	94	98	104	89	97	99	111	104
MN-Torgy	107	107	107	102	101	103	105	106	101	105	92	98	102	64	87	92	105	100
MN-Washburn	97	96	96	93	99	99	102	103	100	101	100	105	102	101	101	96	84	97
MS Barracuda	113	105	105	95	98	103	105	94	97	99	92	82	85	126	121	116	99	103
MS Charger	124	–	–	–	107	–	–	113	–	–	113	–	–	121	–	–	116	–
MS Cobra	110	105	–	–	98	101	–	103	102	–	87	94	–	116	115	–	104	–
MS Ranchero	83	87	87	102	91	96	95	81	89	91	68	79	87	78	90	99	78	92
ND Frohberg	103	102	103	104	89	95	96	97	97	98	104	103	105	111	106	104	105	105
ND Heron	109	–	–	–	90	–	–	93	–	–	95	–	–	121	–	–	98	–
Prosper	97	103	104	105	102	103	105	105	101	107	118	119	115	96	92	97	92	96
Shelly	91	94	94	107	97	101	104	110	106	104	96	103	107	107	112	105	95	96
SY 611 CL2	116	111	112	98	96	96	93	97	99	97	99	96	95	103	96	97	106	97
SY Longmire	78	90	90	94	95	96	95	89	98	103	89	101	99	98	81	83	77	76
SY McCloud	107	97	97	93	100	102	100	101	100	94	96	89	90	104	98	100	78	84
SY Valda	101	98	99	102	110	108	107	100	102	101	102	100	101	115	108	103	106	107
TCG-Heartland	101	97	97	95	98	98	98	88	93	94	86	87	87	107	99	99	105	104
TCG-Spitfire	112	110	111	109	113	110	107	111	115	119	108	106	114	110	102	100	108	100
TCG-Wildcat	115	112	112	96	103	103	104	104	109	109	123	114	111	92	100	100	104	102
WB9479	100	96	96	92	94	98	98	99	93	92	93	89	90	105	99	97	102	102
WB9590	107	98	99	98	99	100	103	88	96	99	98	92	94	112	104	105	100	103
<b>Mean (Bu/Acre)</b>	<b>58.8</b>	<b>50.5</b>	<b>50.4</b>	<b>72.7</b>	<b>82.7</b>	<b>76.8</b>	<b>77.0</b>	<b>60.3</b>	<b>60.1</b>	<b>60.8</b>	<b>57.0</b>	<b>55.8</b>	<b>52.6</b>	<b>52.4</b>	<b>50.5</b>	<b>58.8</b>	<b>38.1</b>	<b>42.2</b>
<b>LSD (0.10)</b>	<b>18.9</b>	<b>10.9</b>	<b>7.6</b>	<b>6.6</b>	<b>11.8</b>	<b>6.0</b>	<b>3.6</b>	<b>12.8</b>	<b>7.0</b>	<b>5.9</b>	<b>18.4</b>	<b>13.2</b>	<b>8.6</b>	<b>15.8</b>	<b>12.2</b>	<b>7.8</b>	<b>13.9</b>	<b>6.7</b>

<sup>1</sup>2022 was abandoned due to early season flooding. 2 year data is 2020-2021.<sup>2</sup>2021 Waseca was discarded due to excessive within trial variation. 2 year is the mean of 2020 and 2022.

**Table 6. Relative grain yield of hard red spring wheat varieties in Minnesota in single-year (2022) and multiple-year comparisons (2020-2022).**

Entry	State			North			South		
	2022	2 Yr	3 Yr	2022	2 Yr	3 Yr	2022	2 Yr	3 Yr
AP Gunsmoke CL2	100	101	101	97	100	101	107	104	102
AP Murdock	103	98	102	104	99	102	100	98	101
AP Smith	98	100	99	98	99	99	98	100	100
Ascend-SD	109	106	–	107	104	–	114	110	–
Bolles	92	93	93	92	93	93	92	93	94
CAG Justify	108	106	–	106	105	–	113	108	–
CAG Reckless	102	103	–	99	102	–	107	105	–
CAG Recoil	98	–	–	99	–	–	96	–	–
CP3099A	111	110	–	114	113	–	104	106	–
CP3119A	98	104	–	99	104	–	95	102	–
CP3188	99	104	–	99	102	–	100	107	–
CP3530	104	101	102	104	100	101	105	103	103
CP3915	101	98	98	102	99	99	99	97	96
CPX39120	88	–	–	86	–	–	91	–	–
Driver	106	106	105	105	105	105	108	107	105
Dyna-Gro Ambush	105	102	103	104	102	103	108	103	104
Dyna-Gro Ballistic	100	101	103	99	100	103	102	101	104
Dyna-Gro Commander	100	101	102	99	100	100	101	104	106
Lang-MN	98	97	98	98	97	98	97	98	98
LCS Ascent	103	–	–	101	–	–	107	–	–
LCS Buster	106	105	109	107	106	109	105	105	107
LCS Cannon	105	103	103	100	101	100	114	108	109
LCS Dual	102	–	–	99	–	–	107	–	–
LCS Trigger	112	109	113	115	108	112	107	112	115
Linkert	93	94	93	91	92	92	97	96	96
MN-Rothsay	102	103	104	106	105	105	95	98	101
MN-Torgy	100	100	102	101	100	102	96	100	102
MN-Washburn	99	98	97	100	98	96	98	99	99
MS Barracuda	97	98	98	94	97	97	103	100	101
MS Charger	110	–	–	107	–	–	115	–	–
MS Cobra	98	99	–	96	98	–	102	102	–
MS Ranchero	92	96	99	97	99	102	81	90	94
ND Frohberg	94	97	97	91	95	95	100	101	102
ND Heron	97	–	–	96	–	–	100	–	–
Prosper	103	103	105	103	103	105	102	103	105
Shelly	103	103	103	105	103	103	100	102	103
SY 611 CL2	103	102	101	103	102	102	102	100	98
SY Longmire	93	95	94	95	96	95	89	93	93
SY McCloud	98	98	97	98	99	98	99	96	95
SY Valda	104	103	104	104	103	104	106	103	103
TCG-Heartland	92	92	94	89	91	94	97	95	96
TCG-Spitfire	104	105	105	101	103	103	111	109	109
TCG-Wildcat	103	103	103	102	101	102	107	106	105
WB9479	97	95	96	96	95	97	98	95	95
WB9590	101	99	101	101	99	102	100	98	100
<b>Mean (Bu/Acre)</b>	<b>73.9</b>	<b>69.8</b>	<b>69.9</b>	<b>85.6</b>	<b>79.2</b>	<b>77.3</b>	<b>58.2</b>	<b>57.2</b>	<b>59.9</b>
<b>LSD (0.10)</b>	<b>3.1</b>	<b>2.2</b>	<b>1.6</b>	<b>3.6</b>	<b>2.6</b>	<b>2.0</b>	<b>5.3</b>	<b>3.7</b>	<b>2.6</b>
<b>No. of Environments</b>	<b>14</b>	<b>28</b>	<b>42</b>	<b>8</b>	<b>16</b>	<b>24</b>	<b>6</b>	<b>12</b>	<b>18</b>

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

Entry	North						South						State					
	2022		2 Yr		3 Yr		2022		2 Yr		3 Yr		2022		2 Yr		3 Yr	
	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int
AP Gunsmoke CL2	86.6	103.3	81.6	93.4	81.4	90.4	68.0	71.9	64.2	71.2	58.8	64.8	77.3	87.6	72.9	82.3	70.1	77.6
AP Murdock	93.4	108.4	81.6	89.8	82.6	90.4	62.8	65.3	58.7	63.4	58.1	60.6	78.1	86.8	70.1	76.6	70.3	75.5
AP Smith	85.2	97.7	78.4	85.7	78.9	82.8	56.5	65.0	58.1	66.5	57.8	61.4	70.8	81.3	68.2	76.1	68.4	72.1
Ascend-SD	94.4	104.2	83.5	95.5	–	–	71.4	75.3	67.3	72.9	–	–	82.9	89.7	75.4	84.2	–	–
Bolles	82.7	95.5	76.8	85.2	76.0	81.1	53.8	60.1	54.1	60.7	54.4	59.2	68.2	77.8	65.4	72.9	65.2	70.1
CAG Justify	94.8	108.5	83.3	98.6	–	–	72.2	68.4	68.5	69.3	–	–	83.5	88.4	75.9	84.0	–	–
CAG Reckless	86.4	94.1	83.5	88.0	–	–	66.4	68.1	62.2	64.6	–	–	76.4	81.1	72.8	76.3	–	–
CAG Recoil	86.0	95.3	–	–	–	–	58.3	61.2	–	–	–	–	72.2	78.2	–	–	–	–
CP3099A	106.1	116.2	90.5	102.2	–	–	62.3	68.7	67.4	78.1	–	–	84.2	92.4	79.0	90.2	–	–
CP3119A	85.6	104.2	86.4	102.6	–	–	49.0	58.4	58.1	68.0	–	–	67.3	81.3	72.3	85.3	–	–
CP3188	93.7	106.6	87.1	97.9	–	–	59.7	66.3	65.2	70.0	–	–	76.7	86.5	76.1	84.0	–	–
CP3530	93.7	103.3	81.5	89.6	78.9	88.3	60.9	59.9	58.4	62.2	56.7	60.4	77.3	81.6	70.0	75.9	67.8	74.4
CP3915	86.6	103.1	76.7	92.2	80.4	90.3	57.2	64.9	56.9	66.3	57.2	62.8	71.9	84.0	66.8	79.3	68.8	76.6
CPX39120	61.2	92.4	–	–	–	–	55.8	62.7	–	–	–	–	58.5	77.6	–	–	–	–
Driver	97.1	103.1	85.8	95.6	83.1	88.1	63.8	68.1	64.1	66.9	62.4	62.8	80.5	85.6	75.0	81.2	72.8	75.5
Dyna-Gro Ambush	85.6	101.0	83.3	89.7	81.4	85.3	64.6	72.9	55.4	68.6	55.8	64.0	75.1	86.9	69.3	79.2	68.6	74.6
Dyna-Gro Ballistic	85.9	99.5	79.8	93.4	83.0	89.3	61.4	67.5	59.9	67.2	59.7	66.0	73.7	83.5	69.8	80.3	71.4	77.6
Dyna-Gro Com-mander	88.8	101.0	83.0	92.0	80.8	87.1	57.9	63.3	57.2	64.1	58.0	61.8	73.3	82.2	70.1	78.1	69.4	74.5
Lang-MN	90.3	98.5	80.0	85.9	79.9	83.9	55.9	62.8	55.7	63.9	55.0	61.3	73.1	80.6	67.9	74.9	67.5	72.6
LCS Ascent	91.3	104.8	–	–	–	–	61.7	71.9	–	–	–	–	76.5	88.3	–	–	–	–
LCS Buster	94.2	107.6	83.3	97.7	85.5	94.0	59.6	69.0	58.2	73.8	60.4	70.2	76.9	88.3	70.8	85.7	73.0	82.1
LCS Cannon	90.5	102.8	82.8	92.6	80.1	87.9	65.1	69.9	57.1	70.8	58.1	66.2	77.8	86.4	70.0	81.7	69.1	77.1
LCS Dual	88.5	98.8	–	–	–	–	62.6	67.8	–	–	–	–	75.6	83.3	–	–	–	–
LCS Trigger	100.4	111.2	85.8	97.0	87.9	92.9	65.2	75.6	67.0	76.4	67.8	74.8	82.8	93.4	76.4	86.7	77.9	83.9
Linkert	84.9	93.4	78.4	81.5	76.2	80.8	56.4	64.1	54.7	65.2	53.1	60.5	70.6	78.8	66.5	73.4	64.7	70.7
MN-Rothsay	94.6	106.8	87.3	92.8	86.2	89.0	52.9	60.8	54.1	64.7	56.4	61.0	73.7	83.8	70.7	78.8	71.3	75.0
MN-Torgy	92.3	101.6	82.1	87.6	82.3	85.4	58.2	66.1	57.5	66.4	58.9	61.9	75.2	83.8	69.8	77.0	70.6	73.7
MN-Washburn	86.4	100.0	79.4	87.3	75.1	88.3	59.4	67.3	59.4	66.7	57.7	61.9	72.9	83.6	69.4	77.0	66.4	75.1
MS Barracuda	87.1	104.0	78.9	92.0	76.4	85.0	54.6	63.2	51.9	62.3	52.6	58.4	70.9	83.6	65.4	77.1	64.5	71.7
MS Charger	100.3	108.9	–	–	–	–	66.3	73.0	–	–	–	–	83.3	90.9	–	–	–	–
MS Cobra	88.3	98.0	82.1	89.2	–	–	55.9	62.5	56.7	64.6	–	–	72.1	80.2	69.4	76.9	–	–
MS Rancho	79.9	85.2	82.2	83.4	82.8	81.5	44.0	60.8	48.9	62.3	50.6	56.9	62.0	73.0	65.5	72.9	66.7	69.2
ND Frohberg	84.5	90.7	82.1	85.8	79.3	81.7	58.7	65.6	57.9	63.8	57.9	61.0	71.6	78.2	70.0	74.8	68.6	71.4
ND Heron	90.0	94.6	–	–	–	–	55.1	65.4	–	–	–	–	72.5	80.0	–	–	–	–
Prosper	84.0	105.2	79.6	94.4	81.5	91.6	65.1	71.7	63.5	71.7	62.6	68.3	74.6	88.4	71.6	83.0	72.1	80.0
Shelly	95.4	106.7	84.5	94.7	81.9	92.6	60.8	64.6	60.6	69.0	59.9	63.0	78.1	85.6	72.5	81.8	70.9	77.8
SY 611 CL2	90.6	102.1	81.5	90.9	81.7	88.3	57.4	64.3	56.7	65.0	54.8	60.7	74.0	83.2	69.1	77.9	68.3	74.5
SY Longmire	79.4	92.0	74.5	84.4	74.1	82.9	52.1	52.5	57.8	60.8	57.4	59.0	65.8	72.3	66.1	72.6	65.7	70.9
SY McCloud	92.0	100.8	85.8	86.9	82.2	83.9	58.0	65.4	54.8	64.5	52.4	58.7	75.0	83.1	70.3	75.7	67.3	71.3
SY Valda	85.1	102.1	80.4	93.1	79.8	90.2	59.2	72.3	58.7	72.1	57.2	66.0	72.1	87.2	69.6	82.6	68.5	78.1
TCG-Heartland	76.2	92.8	75.7	84.1	76.4	83.6	51.2	61.2	52.2	65.1	51.4	58.9	63.7	77.0	63.9	74.6	63.9	71.2
TCG-Spitfire	88.3	103.5	80.1	94.7	80.8	92.9	64.3	69.6	64.1	72.3	66.5	70.6	76.3	86.5	72.1	83.5	73.7	81.8
TCG-Wildcat	95.9	107.6	83.5	94.6	83.5	91.5	66.4	75.4	64.8	69.2	62.3	65.3	81.1	91.5	74.1	81.9	72.9	78.4
WB9479	84.9	97.1	77.5	85.2	77.8	82.6	56.3	64.4	52.8	63.6	51.8	58.5	70.6	80.8	65.2	74.4	64.8	70.6
WB9590	89.1	105.4	81.8	94.2	83.2	91.9	54.5	66.4	54.6	63.4	54.9	60.8	71.8	85.9	68.2	78.8	69.0	76.4
<b>Mean (Bu/Acre)</b>	<b>88.4</b>	<b>100.5</b>	<b>81.4</b>	<b>90.6</b>	<b>80.3</b>	<b>86.7</b>	<b>58.7</b>	<b>65.7</b>	<b>58.0</b>	<b>66.5</b>	<b>56.8</b>	<b>62.1</b>	<b>73.6</b>	<b>83.1</b>	<b>69.7</b>	<b>78.5</b>	<b>68.5</b>	<b>74.4</b>
<b>LSD (0.10)</b>	<b>6.2</b>	<b>5.3</b>	<b>4.8</b>	<b>4.1</b>	<b>3.5</b>	<b>3.4</b>	<b>4.3</b>	<b>4.3</b>	<b>4.0</b>	<b>3.9</b>	<b>2.8</b>	<b>2.9</b>	<b>3.9</b>	<b>3.4</b>	<b>3.1</b>	<b>2.8</b>	<b>2.3</b>	<b>2.2</b>
<b>No. of Environ-ments</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>4</b>	<b>4</b>	<b>6</b>	<b>6</b>	<b>4</b>	<b>4</b>	<b>8</b>	<b>8</b>	<b>12</b>	<b>12</b>