



2020 Spring Wheat Field Crop Trials Results

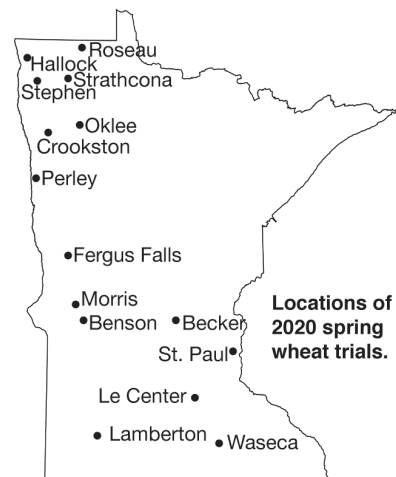
Minnesota Agricultural Experiment Station and the College of Food, Agricultural and Natural Resource Sciences

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. 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 2020. 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 rating 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 four seasons. The majority of

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

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.

Bacterial leaf streak was assessed at three locations in 2020. 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

Table 1. Origin and agronomic characteristics of hard red spring wheat varieties in Minnesota in single-year (2020) and multiple-year comparisons.

Entry	Origin ¹	Legal Status	Desired Stand (Plants/Acre) ²	Days to Heading ³	Height Inches ³	Straw Strength ⁴
AP Murdock	2020 AgriPro/Syngenta	PVP (94) (pending)	1.3	56.5	26.5	5
Bolles	2015 MN	PVP (94)	1.3	59.5	30.0	4
CP3055	2020 CROPLAN by WinField United	PVP (94) (pending)	1.3	62.9	30.1	3-4
CP3530	2015 CROPLAN by WinField United	Patented	1.3	58.9	31.4	5
CP3903	2019 CROPLAN by WinField United	PVP (94) (pending)	1.3	56.0	28.3	4-5
CP3910	2019 CROPLAN by WinField United	PVP (94) (pending)	1.3	54.8	26.7	3
CP3915	2019 CROPLAN by WinField United	PVP (94) (pending)	1.3	58.3	28.2	4
Driver	2020 SDSU	PVP (94) (pending)	1.3	58.2	29.9	4
Dyna-Gro Ambush	2016 Dyna-Gro	PVP (94)	1.4	55.5	28.3	4
Dyna-Gro Ballistic	2018 Dyna-Gro	PVP (94)	1.1	58.1	29.7	5
Dyna-Gro Commander	2019 Dyna-Gro	PVP (94)	1.4	55.8	28.6	4
Dyna-Gro Velocity	2020 Dyna-Gro	PVP (94)	1.4	56.7	27.1	3
Lang-MN	2017 MN	PVP (94)	0.9	58.6	28.9	4
LCS Buster	2020 Limagrain Cereal Seeds	PVP (94) (pending)	1.3	61.2	30.1	5
LCS Cannon	2018 Limagrain Cereal Seeds	PVP (94)	1.3	53.3	26.7	4
LCS Rebel	2017 Limagrain Cereal Seeds	PVP (94)	1.3	55.8	30.6	6
LCS Trigger	2016 Limagrain Cereal Seeds	PVP (94)	1.3	61.2	30.5	5
Linkert	2013 MN	PVP (94)	1.3	57.1	26.4	2
MN-Torgy	2020 MN	PVP (94) (pending)	1.3	57.6	27.8	4
MN-Washburn	2019 MN	PVP (94)	1.3	59.0	27.2	3
MS Barracuda	2018 Meridian Seeds	PVP (94)	1.3	54.1	26.9	3
MS Chevelle	2014 Meridian Seeds	PVP (94)	1.3	56.1	27.0	5
MS Rancho	2020 Meridian Seeds	PVP (94) (pending)	1.3	56.7	28.9	4-5
ND Froberg	2020 NDSU	PVP (94) (pending)	1.3	58.6	29.7	4-5
Prosper	2011 NDSU	PVP (94)	1.3	58.4	29.9	6
Rollag	2011 MN	PVP (94)	1.3	57.2	26.6	3
Shelly	2016 MN	PVP (94)	1.3	58.5	26.3	5
SY 611 CL2 ⁵	2019 AgriPro/Syngenta	PVP (94) (pending)	1.3	57.3	26.4	4
SY Ingmar	2014 AgriPro/Syngenta	PVP (94)	1.3	58.5	27.9	4
SY Longmire ⁶	2019 AgriPro/Syngenta	PVP (94) (pending)	1.3	58.0	28.1	4
SY McCloud	2019 AgriPro/Syngenta	PVP (94) (pending)	1.3	56.4	28.3	4
SY Valda	2015 AgriPro/Syngenta	PVP (94)	1.3	57.6	27.5	5
TCG-Heartland	2019 21st Century Genetics	PVP (94), Patent pending	1.5	55.8	26.4	3
TCG-Spitfire	2016 21st Century Genetics	PVP (94)	1.5	59.9	29.4	3
TCG-Wildcat	2020 21st Century Genetics	Patent pending	1.5	58.5	29.0	3
WB-Mayville	2011 WestBred	PVP (94)	1.3	56.0	25.5	3
WB9479	2017 WestBred	Patented, PVP(94)	1.3	56.1	25.3	3
WB9590	2017 WestBred	Patented, PVP(94)	1.3	55.7	25.3	3
Mean				57.5	28.1	

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

² 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.

³ 2020 data.

⁴ 1-9 scale in which 1 = the strongest straw and 9 = the weakest. Based on 2014-2020 data. The rating of newer entries may change by as much as one rating point as more data are collected.

⁵ SY 611 CL2 has tolerance to Beyond[®] herbicide.

⁶ SY Longmire has solid stems.

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 again in 2020, sown on 19.6% of the state’s wheat acres. SY Valda was the 2nd most popular variety at 15.9%, followed by WB9590 (15.7%), WB9479 (11.9%), Shelly (6.2%) and MN-Washburn (4.4%).

Varieties tested for the first time in 2020 were AP Murdock (which was also tested in 2019 under its experimental designation), CP3055, CP3903, Driver, LCS Buster, MS Ranchero, TCG-Wildcat and ND Frohberg. As in 2019, WestBred opted to not submit any HRSW varieties for testing, but WB9479, WB9590 and WB-Mayville were tested because each occupied more than 5% of the state’s acreage in 2019. Testing of Boost, CP3888, CP3939, Dyna-Gro Caliber, LCS Breakaway, MS Camaro, ND-VitPro, Surpass and TCG-Climax was discontinued.

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)

Table 2. Grain quality of hard red spring wheat varieties in Minnesota in single-year (2020) and multiple-year comparisons.

Entry	Test Weight (lb/Bu)		Protein (%) ¹		Baking Quality ²	Pre-Harvest Sprouting ³
	2020	2 Yr	2020	2 Yr		
AP Murdock	59.7	59.9	14.7	14.2	—	1
Bolles	58.9	59.2	16.7	16.1	1	1
CP3055	55.1	—	13.1	—	—	2–3
CP3530	59.5	59.8	15.2	14.5	3	1
CP3903	60.2	—	15.2	—	—	2–3
CP3910	60.7	60.5	14.9	14.4	—	2*
CP3915	60.5	60.3	14.9	14.4	—	1
Driver	60.5	—	14.7	—	—	2–3
Dyna-Gro Ambush	61.4	61.4	15.2	14.8	2	3*
Dyna-Gro Ballistic	59.3	59.3	14.1	13.9	5	3*
Dyna-Gro Commander	59.9	60.1	15.0	14.6	—	1
Dyna-Gro Velocity	60.7	60.9	15.9	15.2	—	2
Lang-MN	60.3	60.8	15.3	14.9	3	1
LCS Buster	57.3	—	12.7	—	—	5
LCS Cannon	60.8	61.2	14.6	14.1	4	3*
LCS Rebel	61.2	61.2	15.2	14.8	3	5
LCS Trigger	60.0	60.0	12.8	12.3	7	2
Linkert	60.3	60.4	15.7	15.3	1	1
MN-Torgy	60.0	60.3	15.2	14.7	4	1
MN-Washburn	59.7	59.9	14.7	14.2	3	1
MS Barracuda	60.0	60.2	15.3	14.9	4	3
MS Chevelle	59.5	59.5	14.2	13.7	5	4
MS Ranchero	58.4	—	14.7	—	—	4
ND Frohberg	60.4	—	15.1	—	—	4
Prosper	59.5	59.8	14.3	13.7	5	1
Rollag	60.3	60.5	15.7	15.3	6	1
Shelly	59.5	59.5	14.3	13.9	5	1
SY 611 CL2	60.4	60.7	15.2	14.7	—	2*
SY Ingmar	60.0	60.1	15.5	15.1	2	2
SY Longmire	59.5	59.4	15.3	14.8	—	2*
SY McCloud	60.9	61.2	15.6	15.1	3	2*
SY Valda	60.2	60.2	14.7	14.1	6	2
TCG-Heartland	61.0	60.9	15.8	15.3	—	2
TCG-Spitfire	59.9	59.0	14.2	13.8	2	3*
TCG-Wildcat	60.6	—	15.4	—	—	1
WB-Mayville	60.2	60.3	15.7	15.2	2	3*
WB9479	60.4	—	16.0	—	—	2
WB9590	59.9	—	15.5	—	—	2
Mean	59.9	60.2	14.9	14.5		
No. of Environments	10	21	10	22		

¹12% moisture basis.

²2014-2019 crop years, where applicable.

³1-9 scale in which 1 = best and 9 = worst. Values of 1-2 should be considered as resistant. Falling number data was collected from nine 2019 locations. Varieties with an * following their pre-harvest sprouting rating had lower than expected falling numbers based on their PHS rating.

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 2020 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 2020 and by 3.9 bu/acre over the past three years. The two southern locations, Lamberton and Morris, averaged 0.8 bu/acre lower grain yield when fungicide protected in 2020, but 3.5 bu/acre greater from 2018-2020. 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 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 ⁶
AP Murdock	3	—	1	4	6	7
Bolles	2	1	2	4	3	4
CP3055	2	—	2	4	4	5-6
CP3530	3	3	1	4	4	4
CP3903	3	—	1	2-3	4	4-5
CP3910	3	—	1	6	5	6
CP3915	1	—	1	2	5	4-5
Driver	3	—	1	3-4	5	3-4
Dyna-Gro Ambush	2	—	2	5	4	4
Dyna-Gro Ballistic	3	—	3	3	5	4-5
Dyna-Gro Commander	2	—	1	4	6	5
Dyna-Gro Velocity	3	—	1	6	7	6
Lang-MN	1	—	2	3	4	3
LCS Buster	2	—	1	4	3	4
LCS Cannon	3	—	2	5	7	5
LCS Rebel	6	—	2	3	4	4
LCS Trigger	1	—	2	2	3	3
Linkert	3	1	1	5	4	5
MN-Torgy	3	—	1	3	3	4
MN-Washburn	1	2	1	3	3	4
MS Barracuda	6	—	2	7	5	5
MS Chevelle	3	1	1	6	6	5
MS Ranchero	1	—	1	6-7	3	3-5
ND Frohberg	3	—	1	3	4	3-4
Prosper	6	5	2	4	4	4
Rollag	4	1	2	7	6	3
Shelly	3	1	2	6	4	4
SY 611 CL2	3	—	5	4	4	4
SY Ingmar	2	2	2	3	5	4
SY Longmire	5	—	1	3	5	7
SY McCloud	3	—	1	5	5	5
SY Valda	1	2	1	3	4	4
TCG-Heartland	3	—	2	5	5	7
TCG-Spitfire	4	—	2	3	4	5
TCG-Wildcat	3	—	3	6-7	7	6-8
WB-Mayville	3	3	3	7	7	8
WB9479	6	—	2	6	5	7
WB9590	6	—	2	6	6	7

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 entries may change as more data is collected.

⁵Combined rating of tan spot and septoria.

⁶Varieties showing a ratings range are based on initial data. With further testing, a single numerical rating will be assigned.

Table 4. Relative grain yield of hard red spring wheat varieties in northern Minnesota locations in single-year (2020) and multiple-year comparisons (2018-2020).

Entry	Crookston			Fergus Falls			Hallock			Oklee			Perley			Roseau			Stephen			Strathcona		
	2020	2 Yr	3 Yr	2020	2 Yr	3 Yr	2020	2 Yr	3 Yr	2020	2 Yr	3 Yr	2020	2 Yr	3 Yr	2020	2 Yr	3 Yr	2020	2 Yr	3 Yr	2020	2 Yr	3 Yr
AP Murdock	107	108	—	96	99	—	99	106	—	111	110	—	110	112	—	107	108	—	120	111	—	123	118	—
Bolles	94	98	97	90	91	91	94	96	93	90	91	91	100	95	93	94	91	93	94	95	92	87	90	91
CP3055	95	—	—	112	—	—	110	—	—	115	—	—	78	—	—	107	—	—	83	—	—	115	—	—
CP3530	92	96	96	95	99	100	112	106	103	100	98	98	104	106	106	94	98	98	97	98	98	112	105	102
CP3903	93	—	—	97	—	—	108	—	—	90	—	—	108	—	—	92	—	—	90	—	—	84	—	—
CP3910	98	103	—	97	99	—	103	106	—	92	101	—	106	104	—	83	98	—	92	97	—	95	98	—
CP3915	103	104	—	99	103	—	90	95	—	87	95	—	95	95	—	117	114	—	101	106	—	85	93	—
Driver	99	—	—	104	—	—	115	—	—	106	—	—	111	—	—	98	—	—	108	—	—	94	—	—
Dyna-Gro Ambush	105	104	100	98	100	99	104	101	101	103	104	106	107	96	96	92	90	94	108	100	102	108	105	104
Dyna-Gro Ballistic	107	108	105	105	109	111	102	106	106	104	109	107	107	104	106	118	114	113	110	108	108	95	100	100
Dyna-Gro Commander	94	97	—	100	101	—	102	104	—	99	100	—	91	104	—	98	104	—	108	104	—	104	102	—
Dyna-Gro Velocity	93	92	—	96	95	—	95	96	—	89	88	—	90	88	—	99	100	—	90	92	—	79	84	—
Lang-MN	99	98	99	99	98	99	102	98	98	95	98	96	96	98	97	102	100	103	89	94	95	118	112	104
LCS Buster	103	—	—	114	—	—	111	—	—	126	—	—	120	—	—	122	—	—	117	—	—	113	—	—
LCS Cannon	98	100	100	96	100	101	89	98	101	102	104	104	113	115	111	92	99	100	93	101	104	104	103	106
LCS Rebel	97	101	101	101	97	97	106	102	101	91	96	98	109	108	109	110	108	105	97	99	101	107	105	101
LCS Trigger	114	116	114	118	115	113	127	118	111	116	119	115	125	119	119	118	118	117	113	111	112	116	117	110
Linkert	92	92	92	93	92	92	95	97	97	92	93	92	90	88	90	90	89	91	83	88	90	83	87	92
MN-Torgy	106	101	104	105	105	104	93	100	101	106	105	102	94	97	103	102	105	102	115	107	104	106	106	105
MN-Washburn	98	99	99	98	101	102	97	99	98	97	101	98	97	100	104	73	85	92	99	99	100	73	87	91
MS Barracuda	94	97	98	95	94	96	94	95	97	100	103	103	82	93	92	87	93	97	93	96	99	111	108	109
MS Chevelle	95	101	102	97	100	100	115	109	110	97	98	101	98	94	98	114	110	108	84	94	101	85	90	96
MS Rancho	101	—	—	93	—	—	108	—	—	102	—	—	100	—	—	110	—	—	117	—	—	129	—	—
ND Froberg	93	—	—	103	—	—	87	—	—	98	—	—	93	—	—	92	—	—	86	—	—	100	—	—
Prosper	109	109	106	108	109	108	105	103	105	109	108	109	101	96	102	107	104	107	112	107	109	99	105	103
Rollag	77	87	85	89	91	89	91	97	96	94	93	92	92	95	93	84	82	84	111	101	99	100	93	93
Shelly	107	106	106	107	111	110	109	110	107	104	105	105	94	96	96	90	102	103	95	101	104	115	111	107
SY 611 CL2	102	102	—	102	103	—	90	99	—	109	106	—	99	95	—	105	102	—	104	107	—	94	101	—
SY Ingmar	95	95	97	106	100	100	89	92	96	102	100	100	96	102	99	104	102	99	94	96	97	96	96	98
SY Longmire	97	100	—	95	101	—	92	97	—	91	98	—	95	85	—	90	92	—	101	104	—	71	86	—
SY McCloud	91	92	95	99	97	99	103	98	98	101	98	98	97	96	93	97	97	97	78	91	94	105	102	102
SY Valda	103	104	107	103	99	101	107	109	111	100	103	107	108	102	104	96	109	107	120	118	117	110	110	106
TCG-Heartland	102	99	—	100	97	—	87	89	—	92	93	—	114	110	—	95	92	—	108	102	—	89	91	—
TCG-Spitfire	108	106	108	105	104	104	90	94	96	103	104	104	106	109	107	100	107	105	97	99	102	100	100	99
TCG-Wildcat	102	—	—	100	—	—	95	—	—	96	—	—	100	—	—	109	—	—	115	—	—	105	—	—
WB-Mayville	85	88	89	89	90	93	89	89	92	89	91	94	107	109	105	80	90	91	89	87	92	93	91	95
WB9479	110	—	—	96	—	—	103	—	—	104	—	—	83	—	—	91	—	—	103	—	—	104	—	—
WB9590	113	—	—	99	—	—	120	—	—	104	—	—	109	—	—	105	—	—	93	—	—	113	—	—
Mean (Bu/Acre)	70.1	74.7	71.4	83.7	83.4	88.8	66.8	76.3	83.5	81.0	72.5	80.6	67.4	67.7	70.1	88.3	86.9	87.4	72.4	77.4	83.8	68.9	70.5	78.6
LSD (0.10)	7.6	6.5	6.1	6.5	6.6	4.6	17.7	8.0	6.6	12.0	9.7	6.1	18.6	12.3	9.0	18.7	14.0	9.9	18.8	11.4	7.9	18.4	12.2	8.8

Table 5. Relative grain yield of hard red spring wheat varieties in southern Minnesota locations in single-year (2020) and multiple-year comparisons (2018-2020).

Entry	Benson			Kimball ¹	Lamberton			Le Center			Morris ²		St. Paul		
	2020	2 Yr	3 Yr	2 Yr	2020	2 Yr	3 Yr	2020	2 Yr	3 Yr	2020	2 Yr	2020	2 Yr	3 Yr
AP Murdock	95	102	—	—	110	114	—	101	110	—	103	103	109	112	—
Bolles	98	100	97	90	86	88	81	102	96	97	97	99	98	99	97
CP3055	120	—	—	—	96	—	—	99	—	—	127	—	82	—	—
CP3530	110	115	111	102	104	112	116	97	102	106	93	104	102	107	106
CP3903	99	—	—	—	91	—	—	90	—	—	87	—	99	—	—
CP3910	98	98	—	—	106	102	—	88	92	—	102	105	119	108	—
CP3915	90	99	—	—	97	96	—	106	104	—	101	97	85	90	—
Driver	98	—	—	—	96	—	—	108	—	—	103	—	102	—	—
Dyna-Gro Ambush	104	98	97	109	104	111	107	94	96	97	111	107	109	112	105
Dyna-Gro Ballistic	113	109	108	106	105	104	102	110	109	110	104	111	105	102	103
Dyna-Gro Commander	113	104	—	—	102	101	—	101	101	—	114	112	107	107	—
Dyna-Gro Velocity	90	93	—	—	94	99	—	80	84	—	82	88	97	91	—
Lang-MN	99	98	101	102	97	100	99	93	97	101	102	102	101	101	103
LCS Buster	106	—	—	—	108	—	—	115	—	—	115	—	102	—	—
LCS Cannon	94	91	91	114	112	111	111	103	102	98	116	106	120	115	114
LCS Rebel	98	99	97	94	102	100	96	107	105	106	93	97	106	98	97
LCS Trigger	126	123	119	98	110	114	115	121	121	119	133	118	104	104	107
Linkert	100	93	91	101	89	88	87	91	89	82	89	90	100	99	99
MN-Torgy	101	105	106	106	107	107	109	112	111	107	109	109	100	101	100
MN-Washburn	89	92	93	91	105	101	102	102	105	106	90	97	92	100	99
MS Barracuda	94	93	93	109	107	106	107	101	90	86	90	89	113	113	109
MS Chevelle	94	92	93	95	102	100	97	88	90	86	100	105	105	101	98
MS Rancho	94	—	—	—	91	—	—	93	—	—	102	—	114	—	—
ND Frohberg	100	—	—	—	96	—	—	100	—	—	107	—	103	—	—
Prosper	105	104	107	102	108	106	103	116	117	121	101	110	106	101	104
Rollag	92	93	92	96	92	85	78	78	79	79	112	92	93	85	83
Shelly	109	104	106	98	108	104	106	99	95	97	113	108	99	104	104
SY 611 CL2	92	101	—	—	88	92	—	92	90	—	91	100	100	93	—
SY Ingmar	95	97	98	100	92	92	95	99	104	104	91	87	92	99	100
SY Longmire	90	96	—	—	94	92	—	110	104	—	91	91	88	88	—
SY McCloud	91	90	94	102	97	93	92	81	88	89	90	93	105	102	102
SY Valda	105	109	111	106	105	113	108	97	102	108	99	101	98	99	100
TCG-Heartland	100	100	—	—	96	93	—	94	90	—	84	91	100	104	—
TCG-Spitfire	106	115	112	101	101	106	110	126	124	120	129	118	98	101	102
TCG-Wildcat	96	—	—	—	105	—	—	106	—	—	98	—	102	—	—
WB-Mayville	99	95	92	99	93	92	94	103	100	91	92	99	109	108	106
WB9479	89	—	—	—	96	—	—	89	—	—	89	—	97	—	—
WB9590	99	—	—	—	109	—	—	102	—	—	95	—	108	—	—
Mean (Bu/Acre)	85.1	91.0	86.9	73.3	63.2	47.8	45.7	78.0	68.4	64.8	48.1	57.1	74.3	73.1	72.3
LSD (0.10)	16.7	11.1	8.2	11.6	13.4	14.9	12.5	12.8	9.2	9.7	16.8	15.3	8.0	11.5	8.6

¹2020 Kimball (sown at the new UMN Becker site) was discarded due to drought. 2 year data is 2018-2019.

²2018 Morris was discarded due to excessive rainfall and abnormally low grain yields.

Table 6. Relative grain yield of hard red spring wheat varieties in Minnesota in single-year (2020) and multiple-year comparisons (2018-2020).

Entry	State			North			South		
	2020	2 Yr	3 Yr	2020	2 Yr	3 Yr	2020	2 Yr	3 Yr
AP Murdock	107	109	—	109	108	—	105	110	—
Bolles	94	94	93	92	93	93	95	96	94
CP3055	102	—	—	102	—	—	101	—	—
CP3530	101	104	103	100	101	100	101	108	108
CP3903	94	—	—	95	—	—	94	—	—
CP3910	98	101	—	95	101	—	103	102	—
CP3915	96	99	—	97	101	—	94	95	—
Driver	103	—	—	104	—	—	101	—	—
Dyna-Gro Ambush	103	102	101	103	100	100	105	106	103
Dyna-Gro Ballistic	106	107	107	106	108	107	107	107	107
Dyna-Gro Commander	103	103	—	99	102	—	108	106	—
Dyna-Gro Velocity	91	92	—	91	92	—	90	92	—
Lang-MN	99	100	100	100	99	99	98	100	102
LCS Buster	113	—	—	116	—	—	110	—	—
LCS Cannon	102	104	104	98	102	103	109	106	105
LCS Rebel	102	101	100	102	102	101	103	101	98
LCS Trigger	118	116	114	118	117	114	119	115	113
Linkert	91	91	91	90	91	92	93	93	91
MN-Torgy	104	104	104	104	103	103	104	106	106
MN-Washburn	93	97	98	91	96	98	97	98	98
MS Barracuda	97	99	99	94	97	99	102	100	99
MS Chevelle	98	99	99	98	100	102	98	98	96
MS Rancho	104	—	—	107	—	—	99	—	—
ND Frohberg	97	—	—	94	—	—	101	—	—
Prosper	106	105	106	106	105	106	106	104	106
Rollag	92	91	89	92	92	92	92	88	86
Shelly	103	104	104	102	105	105	104	103	104
SY 611 CL2	97	100	—	101	102	—	92	97	—
SY Ingmar	96	97	98	98	98	98	94	96	98
SY Longmire	91	93	—	91	95	—	92	90	—
SY McCloud	95	95	96	96	96	97	93	94	95
SY Valda	104	106	107	105	107	108	102	106	106
TCG-Heartland	98	97	—	98	96	—	97	97	—
TCG-Spitfire	104	105	105	101	103	103	108	109	108
TCG-Wildcat	102	—	—	103	—	—	101	—	—
WB-Mayville	93	95	95	89	92	93	99	99	96
WB9479	96	—	—	99	—	—	93	—	—
WB9590	105	—	—	106	—	—	103	—	—
Mean (Bu/Acre)	71.1	71.1	72.9	74.9	76.2	79.7	66.0	64.8	65.2
LSD (0.10)	4.9	3.2	2.5	6.5	3.9	2.9	7.2	5.1	4.3
No. of Environments	14	29	43	8	16	23	6	13	20

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

Entry	North						South						State					
	2020		2 Yr		3 Yr		2020		2 Yr		3 Yr		2020		2 Yr		3 Yr	
	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int
AP Murdock	84.6	91.5	87.0	90.7	—	—	56.8	55.0	55.5	59.5	—	—	70.7	73.2	71.3	75.1	—	—
Bolles	74.4	72.9	75.8	74.8	75.4	74.2	55.0	56.2	51.0	54.8	49.1	52.1	64.7	64.6	63.4	64.8	63.4	64.1
CP3055	80.6	86.1	—	—	—	—	61.9	68.6	—	—	—	—	71.3	77.3	—	—	—	—
CP3530	73.8	85.8	78.6	88.2	77.2	86.0	53.3	56.7	54.0	58.8	52.7	56.6	63.5	71.3	66.3	73.5	66.1	72.6
CP3903	73.3	81.6	—	—	—	—	49.4	51.9	—	—	—	—	61.4	66.8	—	—	—	—
CP3910	71.0	79.7	81.0	85.8	—	—	52.1	52.1	51.9	52.6	—	—	61.6	65.9	66.4	69.2	—	—
CP3915	87.7	86.4	88.4	87.2	—	—	57.9	55.9	52.4	56.0	—	—	72.8	71.2	70.4	71.6	—	—
Driver	77.9	73.2	—	—	—	—	58.8	54.7	—	—	—	—	68.4	63.9	—	—	—	—
Dyna-Gro Ambush	77.7	76.6	77.9	75.7	76.6	76.7	56.8	54.6	53.7	58.0	51.1	54.6	67.3	65.6	65.8	66.8	65.0	66.7
Dyna-Gro Ballistic	89.4	81.3	89.9	89.7	86.8	88.9	59.5	63.5	57.7	64.0	55.3	61.4	74.4	72.4	73.8	76.8	72.5	76.4
Dyna-Gro Commander	76.3	77.3	81.3	83.1	—	—	59.6	57.3	56.2	56.5	—	—	68.0	67.3	68.8	69.8	—	—
Dyna-Gro Velocity	76.3	68.6	78.0	80.0	—	—	44.8	45.5	44.9	48.6	—	—	60.6	57.0	61.4	64.3	—	—
Lang-MN	79.8	79.9	80.2	83.3	81.0	82.4	53.6	56.2	52.2	57.8	51.1	57.7	66.7	68.0	66.2	70.5	67.4	71.1
LCS Buster	90.1	86.7	—	—	—	—	64.7	62.9	—	—	—	—	77.4	74.8	—	—	—	—
LCS Cannon	74.7	78.5	80.1	83.2	79.4	82.7	60.3	57.1	54.3	55.5	50.8	52.3	67.5	67.8	67.2	69.4	66.4	68.9
LCS Rebel	82.9	77.2	84.4	79.1	81.7	79.1	56.3	56.6	52.7	57.6	51.1	55.1	69.6	66.9	68.5	68.3	67.8	68.2
LCS Trigger	92.1	84.7	94.8	93.9	91.9	94.2	69.4	71.6	62.1	68.8	59.3	66.0	80.8	78.1	78.4	81.3	77.1	81.4
Linkert	71.9	79.5	73.0	80.2	72.2	78.8	49.9	51.2	46.6	49.0	42.7	46.8	60.9	65.4	59.8	64.6	58.8	64.2
MN-Torgy	82.6	80.9	83.4	86.6	81.9	85.9	61.7	53.0	57.7	55.2	54.3	54.3	72.1	67.0	70.5	70.9	69.3	71.5
MN-Washburn	66.6	90.4	74.0	88.5	75.4	87.6	54.4	52.5	52.8	55.7	51.1	54.5	60.5	71.5	63.4	72.1	64.3	72.6
MS Barracuda	71.3	71.0	76.9	77.3	77.3	77.8	54.0	50.6	46.9	49.5	43.8	47.5	62.7	60.8	61.9	63.4	62.1	64.0
MS Chevelle	83.3	79.6	85.7	87.2	83.4	86.3	51.8	57.8	51.6	55.5	47.6	53.2	67.6	68.7	68.7	71.4	67.1	71.2
MS Ranchoero	84.1	77.7	—	—	—	—	54.0	46.1	—	—	—	—	69.0	61.9	—	—	—	—
ND Frohberg	73.5	73.5	—	—	—	—	57.9	55.5	—	—	—	—	65.7	64.5	—	—	—	—
Prosper	85.4	85.9	86.0	91.4	84.7	89.6	60.9	61.7	59.0	63.6	58.1	62.4	73.1	73.8	72.5	77.5	72.6	77.2
Rollag	64.1	75.4	68.3	77.2	67.1	74.7	51.9	51.4	45.1	50.2	42.8	48.1	58.0	63.4	56.7	63.7	56.1	62.6
Shelly	76.9	88.3	83.9	90.0	83.1	87.6	58.4	51.1	53.2	55.1	51.2	53.5	67.7	69.7	68.5	72.6	68.6	72.1
SY 611 CL2	82.2	83.2	82.5	89.5	—	—	51.0	52.0	49.9	52.3	—	—	66.6	67.6	66.2	70.9	—	—
SY Ingmar	79.2	78.5	79.9	80.3	77.7	80.4	53.6	54.4	49.8	54.5	48.6	52.7	66.4	66.4	64.8	67.4	64.5	67.8
SY Longmire	73.4	79.9	77.3	83.4	—	—	56.5	55.4	50.6	53.7	—	—	64.9	67.6	63.9	68.6	—	—
SY McCloud	74.9	77.9	76.8	81.1	76.4	80.5	47.5	46.9	47.6	49.0	45.7	48.0	61.2	62.4	62.2	65.1	62.4	65.7
SY Valda	78.5	84.6	86.2	90.4	85.2	89.5	54.4	53.8	52.9	55.5	52.4	54.2	66.5	69.2	69.5	73.0	70.2	73.5
TCG-Heartland	77.9	82.6	77.0	83.1	—	—	50.0	46.5	47.4	49.6	—	—	63.9	64.5	62.2	66.4	—	—
TCG-Spitfire	82.0	89.4	85.9	91.6	84.5	89.8	71.4	67.3	63.4	63.8	59.9	61.2	76.7	78.4	74.6	77.7	73.3	76.8
TCG-Wildcat	83.7	85.3	—	—	—	—	57.2	57.3	—	—	—	—	70.4	71.3	—	—	—	—
WB-Mayville	65.0	72.8	72.1	78.9	71.5	78.3	55.0	54.1	52.3	53.9	47.6	49.1	60.0	63.5	62.2	66.4	60.7	65.0
WB9479	78.5	77.4	—	—	—	—	49.7	48.4	—	—	—	—	64.1	62.9	—	—	—	—
WB9590	86.0	87.5	—	—	—	—	55.5	55.6	—	—	—	—	70.8	71.5	—	—	—	—
Mean (Bu/Acre)	78.5	80.8	80.9	84.5	79.5	83.4	56.0	55.2	52.6	55.7	50.8	54.3	67.2	68.0	66.7	70.1	66.5	70.2
LSD (0.10)	10.7	11.0	6.6	7.2	4.7	5.1	8.5	7.2	5.7	5.2	5.1	4.8	6.8	6.8	4.4	4.6	3.5	3.6
No. of Environments	2	2	4	4	6	6	2	2	4	4	5	5	4	4	8	8	11	11