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North Dakota Hard Red Winter Wheat

Variety Trial Results for 2022 and Selection Guide

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During the 2021-22 growing season, 100,000 acres of winter wheat were planted and 90,000 acres were harvested. The state's winter wheat yield was estimated at 58 bushels per acre (bu/a), compared to last year's yield of 33 bu/a. The increase in yield is largely due to spring precipitation that came primarily as snow in April blizzards and rain in May 2022. This was in stark contrast to the dry spring of 2021 which worsened into severe drought over most of the state.

Ideal was the most popular variety in 2021-22, occupying 17% of the acres planted. Jerry was second at 15% and SY Wolf fell to third place with 6% of acres. Roughrider and WB Matlock each had about 4% of acres and ND Noreen 3%. The forage variety Willow Creek also occupied about 3% of winter wheat acres. About half of growers surveyed (48%) did not identify the variety they used.

Characteristics of hard red winter wheat varieties adapted for production in North Dakota are described in Table 1. Information on the agronomic and quality performance of selected varieties is summarized in subsequent tables. Yields are expressed on a 13.5% moisture basis and protein on a 12% basis, which are the industry standards.

Successful winter wheat production depends on numerous production practices, including selecting the right variety for a particular area. The information included in this publication is meant to help growers choose that variety or group of varieties. Characteristics to consider when selecting a variety are winter hardiness, yield potential in your area, test weight, protein content when grown with proper fertility, straw strength, plant height, reaction to important diseases and maturity.

The recommended seeding dates for winter wheat are Sept. 1-15 north of North Dakota Highway 200 and Sept. 15-30 in southern regions. Planting after the recommended dates reduces winter survival and grain yield. Planting prior to the recommended date may deplete soil moisture reserves unnecessarily. It also increases the risk of wheat streak mosaic virus and may reduce winter survival.

Winter wheat should be seeded at a rate of 1 million to 1.2 million viable seeds per acre. The higher seeding rates of this recommended range should be used for late seeding or with poor seedbed conditions. Producers should consider only the most winter-hardy varieties available when growing winter wheat in North Dakota. Relative ratings for winter hardiness are found in Table 1.

Phosphorus aids winter survival by stimulating root growth and fall tillering. The secondary root system that develops during tillering is essential for a healthy, deep-rooted plant capable of withstanding stress. If winter wheat is planted on bare soil, an application of phosphorus is recommended if soil phosphorous levels are low. While important, the contribution of phosphorus to winter survival is secondary to varietal hardiness.

Data from several years and locations should be used when selecting varieties. The idea that data from a single location nearest your farm will indicate which variety will perform the best for you next year is incorrect. You should select varieties that, on average, perform the best at multiple trial locations near your farm across several years.

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Table 1. 2022 North Dakota hard red winter wheat variety description and agronomic traits.

Variety	Agent or Origin ²	Year	Reaction to Disease ¹				Days to Heading ³	Straw Strength ⁴	Height ⁵ (inches)	Winter ⁶ Hardiness	
			Stripe Rust	Leaf Rust	Stem Rust	Tan Spot					
AAC Vortex	AAFC	2021	NA	NA	NA	4	8	2	NA	30	2
AAC Wildfire	AAFC	2015	1	5	8	4	6	1	3	29	3
AC Emerson	Meridian	2011	1	6	1	3	5	1	2	30	4
AP Bigfoot	Agripro	2020	NA	7	NA	5	2	-3	4	26	6
Draper	SD	2019	4	7	4	4	5	-2	NA	27	NA
Jerry	ND	2001	8	3	1	8	8	0	5	32	3
Keldin	WB	2011	2	3	3	5	6	0	3	28	5
MS Iceman	Meridian	2021	7	8	5	6	8	0	NA	25	NA
MS Maverick	Meridian	2020	NA	6	NA	8	4	-1	NA	25	4
ND Noreen	ND	2020	3	3	1	3	4	0	4	31	3
Northern	MT	2015	1	8	1	8	6	2	4	27	5
Ray ⁷	MT	2018	1	8	NA	6	6	4	NA	30	NA
SD Andes	SD	2020	2	6	NA	5	6	0	NA	29	NA
SD Midland	SD	2021	1	8	7	NA	8	0	4	30	4
SY Monument	Agripro	2014	3	3	1	8	8	-2	4	27	3
SY Wolverine	Agripro	2019	4	3	1	4	3	-5	4	25	4
WB 4309	WB	2019	4	6	4	7	4	-2	NA	26	NA
WB4510CLP	WB	2020	2	NA	NA	6	8	1	4	28	5
Winner	SD	2019	5	NA	3	4	8	-2	NA	27	NA

¹Disease reaction scores from 1-9, with 1 = resistant and 9 = very susceptible, NA = not available.

²MT = Montana State University; ND = North Dakota State University; SD = South Dakota State University; TCG = Twenty-first Century Genetics; WB = WestBred; AAFC = Agriculture and Agri-Food Canada.

³Days to heading relative to Jerry.

⁴Straw strength: 1 = strongest, 9 = weakest. Based on field observations from limited sites.

⁵Based on the average of several environments, and should be used for comparing varieties. The environment can impact the height of varieties.

⁶Relative winter hardiness rating: 1 = excellent, 10 = no survival. These values are subject to change as additional information becomes available.

⁷Developed primarily for use as a forage winter wheat.

Bold varieties are those recently released or the first time tested, so data are limited and rating values may change.

Table 2. Yield of winter wheat varieties grown at six locations in North Dakota in 2022, with three-year averages (2020-22).

Variety	<u>Casselton</u>		<u>Carrington</u>		<u>Langdon</u>		<u>Hettinger</u>		<u>Minot</u>		<u>Williston</u>		<u>Avg. N.D.</u>	
	2022	3-Yr. Avg.	2022	2-Yr. ¹ Avg.	2022	3-Yr. Avg.	2022	3-Yr. Avg.	2022	3-Yr. Avg.	2022	2-Yr. ¹ Avg.	2022	2-Yr./3-Yr. Avg.
	------(bu/a)-----													
AAC Vortex	86.2	--	83.8	--	90.9	--	101.4	--	65.0	--	33.8	--	76.9	--
AAC Wildfire	74.4	85.5	76.7	65.4	70.4	--	93.8	--	65.4	--	38.7	42.8	69.9	--
AC Emerson	87.8	86.5	79.0	56.1	71.3	66.5	87.3	58.5	55.6	62.7	21.8	30.8	67.1	60.2
AP Bigfoot	86.5	--	90.4	--	60.7	--	93.7	--	62.2	--	16.6	--	68.4	--
Draper	81.8	--	81.5	--	72.1	--	91.0	--	62.9	--	23.0	--	68.7	--
Jerry	89.6	92.3	83.7	64.6	81.1	69.9	88.3	60.4	68.8	65.3	22.9	33.4	72.4	64.3
Keldin	78.6	89.6	94.3	69.3	61.7	62.4	98.4	66.3	71.5	73.7	32.4	35.6	72.8	66.2
MS Iceman	76.1	--	65.2	--	43.9	--	81.7	--	50.1	--	16.9	--	55.7	--
MS Maverick	84.3	--	91.0	--	67.1	--	97.8	--	53.2	--	18.2	--	68.6	--
ND Noreen	103.3	101.1	86.0	65.2	84.9	73.4	94.1	62.2	59.7	67.0	35.7	37.9	77.3	67.8
Northern	80.8	91.1	85.9	68.2	61.8	64.8	94.5	66.9	67.3	63.3	29.1	37.6	69.9	65.3
Ray	86.6	--	78.5	--	63.2	--	77.0	--	56.6	--	29.7	--	65.3	--
SD Andes	93	--	89.5	--	86.8	--	99.2	--	77.1	--	33.2	--	79.8	--
SD Midland	102.5	--	91.4	--	79.0	--	96.8	--	72.0	--	26.9	--	78.1	--
SY Monument	80.5	87.8	83.9	65.2	60.6	60.6	89.7	63.9	72.0	71.7	26.1	35.7	68.8	64.2
SY Wolverine	70.8	89.2	74.2	59.3	50.1	58.1	84.8	58.4	66.2	61.0	19.1	31.8	60.9	59.6
WB4309	86.6	--	87.7	--	69.1	--	81.3	--	53.4	--	24.0	--	67.0	--
WB4510CLP	86.5	--	84.7	--	58.5	--	81.4	--	66.8	--	30.9	--	68.1	--
Winner	79.3	--	88.0	--	81.5	--	95.1	--	65.0	--	24.0	--	72.2	--
Mean	87.0	90.4	84.7	64.2	69.2	65.1	90.1	62.4	63.9	66.4	26.9	35.7	69.9	63.9
CV (%)	8.9	--	6.6	--	9.5	--	6.6	--	5.7	--	15.6	--	9.4	5.9
LSD 0.05	8.9	--	7.8	--	6.3	--	7.0	--	6.0	--	6.9	--	7.6	4.4
LSD 0.10	7.4	--	6.6	--	5.2	--	5.4	--	5.0	--	5.8	--	6.3	3.7

¹Carrington and Williston 2-yr. Avg. (2020 and 2022).

Table 3. Test weight of winter wheat varieties grown at six locations in North Dakota in 2022.

Variety	Casselton	Carrington	Langdon	Hettinger	Minot	Williston	Average
	------(lb/bu)-----						
AAC Vortex	58.9	61.6	61.6	59.7	56.1	60.9	59.8
AAC Wildfire	56.2	60.8	57.4	58.9	55.8	60.4	58.3
AC Emerson	59.4	62.4	61.1	60.3	56.5	61.0	60.1
AP Bigfoot	57.4	62.2	59.8	59.3	58.1	61.1	59.7
Draper	57.8	61.4	60.4	60.8	58.0	61.0	59.9
Jerry	58.7	61.7	60.8	58.8	56.9	60.7	59.6
Keldin	57.5	62.8	58.4	60.4	58.5	61.1	59.8
MS Iceman	58.8	62.6	59.6	60.0	59.1	61.8	60.3
MS Maverick	59.2	63.6	60.8	60.6	59.0	60.7	60.7
ND Noreen	59.5	63.5	62.8	60.6	58.3	62.5	61.2
Northern	56.3	61.8	57.9	58.5	57.8	59.6	58.7
Ray	56.8	59.5	54.1	55.5	55.6	58.9	56.7
SD Andes	59.2	63.3	61.2	61.3	59.8	62.3	61.2
SD Midland	59.1	63.3	61.2	61.2	58.9	60.9	60.8
SY Monument	56.5	61.1	56.4	58.4	57.1	59.8	58.2
SY Wolverine	55.8	61.7	58.5	59.2	58.9	60.9	59.2
WB4309	57.2	62.3	60.0	61.1	57.5	60.7	59.8
WB4510CLP	60.2	64.0	60.9	59.2	59.6	62.4	61.1
Winner	56.9	62.3	61.9	60.4	58.3	61.9	60.3
Mean	58.2	62.2	59.7	59.7	58.0	61.0	59.7
CV (%)	2	0.8	1.3	1.8	1.6	1.1	1.5
LSD 0.05	1.3	0.7	0.7	1.3	1.5	1.1	1.0
LSD 0.10	1.1	0.6	0.6	1.0	1.2	1.0	0.9

Table 4. Grain protein content at 12% grain moisture content of winter wheat varieties grown at six locations in North Dakota in 2022.

Variety	Casselton	Carrington	Langdon	Hettinger	Minot	Williston	Average
	------(%)-----						
AAC Vortex	13.6	13.7	13.0	13.2	14.3	14.3	13.7
AAC Wildfire	13.4	13.3	13.5	13.4	13.8	12.0	13.2
AC Emerson	13.3	14.5	13.4	13.4	14.4	13.1	13.7
AP Bigfoot	12.5	12.8	12.4	12.2	12.9	11.5	12.4
Draper	13.3	13.1	12.6	12.6	13.5	12.8	13.0
Jerry	12.5	13.7	12.8	13.1	13.7	10.8	12.8
Keldin	12.8	13.1	13.0	12.7	13.5	11.6	12.8
MS Iceman	14.4	15.2	14.9	14.3	15.4	12.8	14.5
MS Maverick	13.5	13.1	12.9	12.8	14.6	12.1	13.2
ND Noreen	12.9	13.9	13.0	13.2	13.7	13.0	13.3
Northern	13.4	13.4	13.3	13.3	13.6	12.1	13.2
Ray	13.7	13.5	13.1	13.6	13.3	11.8	13.2
SD Andes	12.5	12.9	12.3	12.5	12.7	12.1	12.5
SD Midland	12.7	13.0	12.6	12.4	12.5	11.7	12.5
SY Monument	12.4	12.8	12.8	12.5	12.6	11.1	12.4
SY Wolverine	13.4	13.3	13.2	13.0	13.9	12.5	13.2
WB4309	13.6	13.0	13.8	13.0	14.1	12.0	13.2
WB4510CLP	12.4	13.3	12.7	12.6	13.1	12.8	12.8
Winner	13.1	13.2	12.4	12.8	12.9	12.6	12.8
Mean	12.9	13.3	12.9	12.8	13.5	12.2	13.1
CV (%)	3.6	3.1	2.7	1.6	2.6	7.9	3.2
LSD 0.05	0.5	0.6	0.5	0.2	0.6	1.6	0.5
LSD 0.10	0.4	0.5	0.4	0.2	0.5	1.3	0.4

Table 5. Analytical milling and baking characteristics of selected varieties evaluated at three locations (Casselton, Dickinson and Minot), in 2021.

Variety	Kernel				Flour				Farinograph				Loaf		
	Test Weight ¹ (lb/bu)	1,000 Kernel Weight ² (gram)	Whole Wheat Protein		Flour Protein 14 MB (%)	Flour Ash 14 MB (%)	Milling Extraction ⁵ (%)	Wet Gluten (%)	Abs ⁶ (%)	Peak Time (min)	Stability ⁷ (min)	Mixing Tolerance Index (BU)	Loaf Volume ⁸ (cc)	Crumb Color (1-10) ⁹	
			12 MB ³ (%)	Falling Number ⁴ (seconds)											
AAC-Wildfire	59.4	30.4	15.0	421	14.1	0.6	73.2	38	92	61.1	6.6	14.0	32	1023	6
AC Emerson	60.3	25.6	15.5	427	14.4	0.5	74.4	35	96	58.8	8.1	14.5	26	1133	7
Draper	61.5	27.8	14.0	423	13.3	0.5	73.2	40	83	60.2	5.2	5.4	49	1062	7
Ideal	62.1	29.6	13.8	444	13.1	0.5	72.0	32	98	59.6	6.5	18.4	25	1025	7
Jerry	60.6	32.5	14.3	455	13.4	0.5	75.8	37	90	60.7	6.1	7.1	41	987	7
Keldin	61.3	34.4	14.0	425	13.2	0.6	71.8	33	95	60.1	6.5	10.6	30	995	7
MS Iceman	63.5	29.6	15.4	399	14.4	0.6	73.0	41	71	59.9	5.7	5.9	44	918	7
ND Noreen	63.2	34.0	14.4	415	13.4	0.5	72.0	38	87	60.1	5.8	7.5	43	1048	7
Northern	61.4	30.9	14.0	474	13.4	0.6	75.5	37	82	63.1	5.9	6.9	39	1075	7
Ray	60.0	32.8	14.2	458	13.5	0.5	71.2	31	97	60.4	5.0	11.9	23	910	7
SD Andes	62.3	32.4	14.0	460	13.3	0.6	72.7	36	86	60.3	6.1	6.9	43	1060	7
SY Monument	59.7	31.2	13.6	396	12.8	0.5	73.5	30	99	59.7	5.6	18.2	19	928	6
SY Wolf	61.8	31.2	14.0	414	13.2	0.5	72.1	33	88	60.7	7.1	7.7	33	998	6
SY Wolverine	61.5	31.5	14.5	389	13.5	0.6	72.3	36	81	60.9	7.4	10.2	27	1013	7
TCG-Boomlock	61.9	28.8	14.6	446	13.6	0.6	73.0	37	85	60.9	6.7	8.5	33	1028	6
WB4309	60.9	29.2	13.9	433	13.4	0.6	72.5	34	94	61.4	5.7	16.0	23	973	6
WB4462	60.2	34.1	14.4	445	13.5	0.5	71.9	36	87	59.4	5.7	6.9	46	925	7
Winner	61.5	32.8	14.0	454	13.0	0.5	70.0	36	79	59.9	6.3	9.5	31	1008	7
Mean	61.3	31.0	14.3	432	13.5	0.5	72.8	36	88	60.4	6.2	10.3	34	1006	6.7

¹Test weight - Expressed in pounds (lbs) per bushel. A high test weight is desirable. A 58 lb test weight is required for a grade of U.S. No. 1.

²1,000 KWT - Estimate of weight of 1,000 seeds based on a clean 10g sample. Expressed in grams and used to approximate seed size.

³Wheat Protein - Measured by NIR at a 12% moisture basis. A high protein is desirable for baking quality.

⁴Falling Number - Expressed in seconds at a 14% moisture basis. It is used as an indicator of sprouting based on elevated enzyme activity. A high falling number is desirable, preferably greater than 400 seconds.

⁵Flour Extraction - Percentage of milled flour recovered from cleaned and tempered wheat. A high flour extraction percentage is desirable.

⁶Farinograph Absorption - Measured by NIR at a 14% moisture basis. A measure of dough water absorption, expressed as percent. A high absorption is desirable.

⁷Farinograph Stability - A measure of dough strength. It is expressed in minutes above the 500 Brabender unit line during mixing. A high stability is desirable.

⁸Loaf Volume - The volume of the pup loaf of bread, expressed in cubic centimeters. A high volume is desirable.

⁹Scale 1-10, with 1 being low and 10 being superior.

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