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North Dakota Hard Red Winter Wheat

Variety Trial Results for 2023 and Selection Guide

Clair Keene, Francois Marais, Andrew Friskop, Zhaohui Liu, and Shaobin Zhong (NDSU Main Station); Leo Bortolon (North Central Research Extension Center, Minot); Glen Martin (Dickinson Research Extension Center); John Rickertsen (Hettinger Research Extension Center); Kristin Simons (Carrington Research Extension Center); Gautam Pradhan (Williston Research Extension Center); Bryan Hanson (Langdon Research Extension Center)

During the 2022-23 growing season, 150,000 acres of winter wheat were planted, and 130,000 acres were harvested. Winter wheat yield in North Dakota was estimated at 53 bushels per acre (bu/a) statewide, compared to last year's yield of 58 bu/a. Higher winter wheat yields ranging from 60-90 bu/a were reported from many areas across the state despite the dry fall of 2022. Deep snow cover that lasted winterlong across most growing regions contributed to spring moisture that benefitted the winter wheat crop and resulted in locally high yields.

Ideal continued to hold on to the top spot in the winter wheat variety survey, reported as occupying 16% of acres planted. The NDSU release ND Noreen increased in acres to occupy the No. 2 spot at 10% of acres. WestBred variety Keldin was third at 8%, and WB Matlock was fourth at 7%. Jerry fell to fifth place at 2% of acres planted. More than half of the acres surveyed did not report which varieties were planted.

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 pure live seeds per acre. The higher seeding rates of this recommended range should be used for late seeding or in 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 or following fallow, an application of phosphorus is recommended if soil phosphorus 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. 2023 North Dakota hard red winter wheat variety description and agronomic traits.

Variety	Agent or Origin ²	Year	Reaction to Disease ¹					Tan Spot	Days to Heading ³	Straw Strength ⁴	Height ⁵ (inches)	Winter ⁶ Hardiness
			Stripe Rust	Leaf Rust	Stem Rust	Scab						
AAC Goldrush	AAFC	2021	NA	6	4	NA	NA	2	3	26	3	
AAC Vortex	AAFC	2021	NA	NA	NA	4	8	2	2	25	2	
AAC Wildfire	AAFC	2015	1	4	8	4	6	3	3	26	2	
AC Emerson	Meridian	2011	1	6	1	3	5	1	2	26	3	
AP Bigfoot	Agripro	2020	NA	7	NA	7	4	-3	4	21	6	
Jerry	ND	2001	8	4	1	8	8	0	5	30	3	
Keldin	WB	2011	2	3	3	5	6	1	4	28	6	
MS Maverick	Meridian	2020	1	6	5	8	5	-1	4	23	5	
MS Sundown	Meridian	2022	NA	NA	NA	5	NA	-3	6	23	4	
ND Noreen	ND	2020	3	3	1	3	4	1	4	28	3	
Northern	MT	2015	1	8	1	8	6	2	4	24	4	
SD Andes	SD	2020	1	8	NA	5	3	0	2	25	2	
SD Midland	SD	2021	1	8	NA	6	4	0	4	26	3	
SY Monument	Agripro	2014	3	3	1	8	8	-2	4	23	4	
SY Wolverine	Agripro	2018	NA	7	NA	8	3	-4	5	21	5	
WB 4309	WB	2019	NA	8	NA	6	5	-2	6	22	5	
Winner	SD	2019	5	NA	NA	4	8	-2	5	23	4	

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.

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 five locations in North Dakota in 2023, with two or three-year averages (2021-23).

Variety	<u>Carrington</u>		<u>Langdon</u>		<u>Hettinger</u>		<u>Minot</u>		<u>Williston</u>		<u>Avg. N.D.</u>	
	2-Yr.		3-Yr.		3-Yr.		2-Yr.		2-Yr.		2-Yr./3-Yr.	
	2023	Avg.	2023	Avg.	2023	Avg.	2023	Avg.	2023	Avg.	2023	Avg.
(bu/a).....											
AAC Goldrush	61.4	--	65.5	--	54.5	--	41.1	--	37.0	--	51.9	--
AAC Vortex	56.3	70.1	61.4	--	55.3	--	51.9	57.9	38.1	36.0	52.6	--
AAC Wildfire	59.0	67.8	66.1	60.6	58.6	59.7	52.5	59.6	39.6	39.2	55.2	57.4
AC Emerson	49.6	64.3	51.0	54.4	46.4	53.6	42.7	49.1	31.4	26.6	44.2	49.6
AP Bigfoot	50.9	70.6	47.6	--	41.9	--	27.4	41.5	27.9	22.3	39.1	--
Jerry	56.3	70.0	62.7	62.7	48.5	54.9	52.5	60.3	29.8	26.4	50.0	54.9
Keldin	66.5	80.4	70.7	56.2	58.9	62.4	31.7	49.6	36.5	34.5	52.9	56.6
MS Maverick	51.1	71.1	57.9	--	45.2	--	34.6	42.2	32.1	25.2	44.2	--
MS Sundown	48.1	--	55.0	--	43.7	--	33.2		33.1	--	42.6	--
ND Noreen	57.2	71.6	62.0	65.0	55.5	59.0	56.6	58.4	36.5	36.1	53.6	58.0
Northern	65.0	75.4	68.8	57.7	58.0	61.4	52.7	59.8	33.7	31.4	55.6	57.1
SD Andes	65.6	77.6	65.9	--	58.7	62.7	53.8	64.9	33.5	33.4	55.5	--
SD Midland	66.0	78.7	68.5	--	58.9	--	41.4	56.2	35.6	31.3	54.1	--
SY Monument	58.4	71.2	59.7	52.0	44.6	54.9	37.5	50.4	33.1	29.6	46.7	51.6
SY Wolverine	39.6	56.9	48.4	45.8	41.5	51.5	27.9	42.4	25.6	22.4	36.6	43.8
WB4309	47.1	67.4	54.5	--	35.7	49.9	39.4	43.3	28.6	26.3	41.1	--
Winner	57.8	72.9	57.8	--	44.1	56.7	50.1	52.0	33.8	28.9	48.7	--
Mean	56.2	71.1	60.2	56.8	50.0	57.0	43.6	52.5	33.3	29.9	48.5	53.6
CV (%)	9.8	--	6.5	--	7.1	--	11.2	--	4.7	--	9.6	--
LSD 0.05	7.9	--	5.6	--	5.7	--	8.4	--	3.7	--	5.9	--
LSD 0.10	6.6	--	4.7	--	4.8	--	7.0	--	3.1	--	4.9	--

Table 3. Test weight of winter wheat varieties grown at five locations in North Dakota in 2023.

Variety	Carrington	Langdon	Hettinger	Minot	Williston	Average
(lb/bu).....					
AAC Goldrush	62.4	63.4	61.2	59.1	58.6	60.9
AAC Vortex	62.2	63.3	60.8	60.5	58.1	61.0
AAC Wildfire	62.5	63.8	61.0	60.6	58.7	61.3
AC Emerson	62.2	63.3	60.3	60.9	59.4	61.2
AP Bigfoot	61.8	63.6	61.4	59.7	59.3	61.2
Jerry	61.7	62.8	59.4	60.5	57.9	60.5
Keldin	62.6	64.0	60.5	57.6	60.1	61.0
MS Maverick	62.7	63.7	60.4	58.8	59.6	61.0
MS Sundown	61.7	63.0	60.8	60.3	58.5	60.9
ND Noreen	63.7	64.5	61.6	62.9	60.5	62.7
Northern	62.2	63.8	61.4	61.4	59.5	61.7
SD Andes	63.6	64.4	61.5	61.6	60.4	62.3
SD Midland	62.7	64.1	61.1	60.2	59.4	61.5
SY Monument	60.9	62.7	59.0	59.2	58.9	60.1
SY Wolverine	61.8	63.3	60.6	59.0	59.8	60.9
WB4309	61.1	63.4	57.2	59.3	58.5	59.9
Winner	62.2	63.4	61.1	61.5	59.4	61.5
Mean	62.2	63.5	60.5	60.3	59.2	61.1
CV (%)	0.4	0.4	1.6	1.4	0.2	--
LSD 0.05	0.4	0.4	1.4	1.4	0.4	--
LSD 0.10	0.3	0.3	1.1	1.2	0.3	--

Note: 58.0 lb/bu test weight is required for US No. 1 grade Hard Red Winter Wheat

Table 4. Grain protein content at 12% grain moisture content of winter wheat varieties grown at six locations in North Dakota in 2023.

Variety	Casselton	Carrington	Langdon	Hettinger	Minot	Williston	Average
(%).....						
AAC Goldrush	12.9	12.7	13.4	13.4	13.5	13.5	13.2
AAC Vortex	14.1	13.8	14.0	14.0	12.9	13.8	13.8
AAC Wildfire	13.3	12.4	12.4	13.2	13.3	12.4	12.8
AC Emerson	14.3	13.8	14.4	14.8	14.2	14.7	14.4
AP Bigfoot	12.5	13.2	13.5	13.5	13.6	12.9	13.2
Jerry	13	12.9	13.3	14.1	13.6	13.2	13.4
Keldin	12.9	12.4	12.9	13.0	13.4	12.1	12.8
MS Maverick	13.7	13.0	13.9	14.5	13.6	12.9	13.6
MS Sundown	12.7	13.4	13.2	13.5	13.0	12.8	13.1
ND Noreen	13.5	13.9	14.1	14.7	14.0	13.7	14.0
Northern	13.2	12.9	13.6	13.9	13.5	13.1	13.4
SD Andes	13	12.1	12.9	13.0	12.6	12.6	12.7
SD Midland	12.7	12.1	12.5	13.0	12.7	12.5	12.6
SY Monument	12.9	12.5	12.6	13.5	13	12.7	12.9
SY Wolverine	12.7	13.4	14.2	14.2	13.9	13.3	13.6
WB4309	13.5	13.2	14.2	14.5	13.6	12.9	13.7
Winner	12.8	12.9	13.2	13.5	13.3	12.4	13.0
Mean	13.2	13.0	13.3	13.8	13.3	13.0	13.3
CV (%)	3.8	3.3	1.9	2.9	3.7	2.1	--
LSD 0.05	0.7	0.6	0.4	0.6	0.9	0.6	--
LSD 0.10	0.5	0.5	0.3	0.5	0.7	0.5	--

Table 5. Analytical milling and baking characteristics of selected varieties evaluated at Casselton, North Dakota in 2022.

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 (%)	Gluten Index	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 Vortex	59.8	33.3	13.0	13.0	11.9	0.6	73.4	28	100	56.0	7.2	14.8	23	940	8
AAC-Wildfire	59.1	31.0	13.1	13.1	12.0	0.6	73.0	30	95	57.8	5.5	7.9	40	930	7
AC Emerson	59.7	27.9	13.4	406	12.0	0.5	71.7	28	100	54.6	7.6	17.4	22	950	8
AP Bigfoot	57.7	27.5	12.3	398	11.0	0.5	70.6	26	96	54.4	8.5	14.3	29	950	8
Draper	59.8	30.4	12.6	411	11.5	0.6	73.7	32	81	57.2	4.1	4.9	58	935	8
Jerry	59.4	34.0	11.7	418	10.7	0.5	72.0	26	99	57.1	4.7	7.7	37	950	8
Keldin	59.1	35.5	12.9	441	11.7	0.6	70.7	28	99	58.2	3.7	12.7	20	900	8
MS Iceman	60.1	27.8	14.5	429	13.1	0.5	70.0	35	83	58.1	5.7	8.3	41	975	9
MS Maverick	60.2	36.2	12.9	465	11.7	0.5	69.1	30	96	57.9	6.6	13.1	22	960	8
ND Noreen	61.1	35.6	11.6	418	10.6	0.5	71.5	29	82	55.1	4.0	6.2	51	940	8
Northern	58.9	32.3	12.0	474	11.2	0.6	73.2	27	96	59.4	4.9	6.1	50	930	7
Ray	59.0	36.8	12.4	472	11.2	0.6	71.4	24	100	58.3	2.7	7.4	35	955	9
SD Andes	61.2	33.8	12.3	427	11.2	0.6	74.3	30	85	56.2	5.1	5.6	50	915	8
SD Midland	60.8	40.3	11.8	428	11.0	0.6	72.8	28	98	56.9	5.2	8.2	45	940	9
SY Monument	56.8	29.2	12.4	414	11.1	0.5	71.4	25	99	56.9	3.2	10.7	26	925	7
SY Wolverine	58.2	29.2	13.3	413	12.0	0.6	70.2	30	95	57.4	7.0	16.7	12	935	7
WB4309	57.7	28.6	13.5	454	12.0	0.5	70.1	29	98	57.8	6.3	13.4	23	965	8
Winner	60.0	36.6	12.1	432	10.9	0.6	70.0	28	93	57.5	5.2	7.8	43	900	8
Mean	59.4	32.6	12.7	429	11.5	0.5	71.6	28	94	57.0	5.4	10.2	35	939	7.7

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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