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North Dakota
Hard Red Spring Wheat

Variety Trial Results for 2019 and Selection Guide

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Hard red spring (HRS) wheat was planted on 6.7 million acres in 2019, up slightly from 2018. The average yield of spring wheat was 50 bushels/acre (bu/a), similar to 2018.

SY Ingmar was the most popular HRS wheat variety in 2019, occupying 20.6% of the planted acreage, followed by SY Valda (12.5%), Bolles (5%), SY Soren (4.7%), Elgin-ND (4.2%), Barlow (3.7%), Faller (3.7%) and Glenn (2.9%). SY Ingmar, SY Soren and SY Valda were released by Syngenta/AgriPro. Bolles was released by the University of Minnesota. Barlow, Faller, Elgin-ND and Glenn are NDSU releases.

Successful wheat production depends on numerous factors, including selecting the right variety for a particular area. The information included in this publication is meant to aid in selecting that variety or group of varieties. Characteristics to consider in selecting a variety may include yield potential, protein content when grown with proper fertility, straw strength, plant height, response to problematic pests (diseases, insects, etc.) and maturity. Every growing season differs; therefore, when selecting a variety, we recommend using data that summarize several years and locations. Choose the variety that, on average, performs the best at multiple locations near your farm during several years.

Selecting varieties with good milling and baking quality also is important to maintain market recognition and avoid discounts. Hard red spring wheat from the northern Great Plains is known around the world for its excellent end-use quality.

Millers and bakers consider many factors in determining the quality and value of wheat they purchase. Several key parameters are: high test weight (for optimum milling yield and flour color), high falling number (greater than 300 seconds indicates minimal sprout damage), high protein content (the majority of HRS wheat export markets want at least 14% protein) and excellent protein quality (for superior bread-making quality as indicated by traditional strong gluten proteins, high baking absorption and large bread loaf volume).

Gluten strength, and milling and baking quality ratings are provided for individual varieties based on the results from the NDSU field plot variety trials in multiple locations in 2018. The wheat protein data often are higher than obtained in actual production fields but can be used to compare relative differences among varieties.

The agronomic data presented in this publication are from replicated research plots using experimental designs that enable the use of statistical analysis. These analyses enable the reader to determine, at a predetermined level of confidence, if the differences observed among varieties are reliable or if they might be due to error inherent in the experimental process.

The LSD (least significant difference) values beneath the columns in the tables are derived from these statistical analyses and apply only to the numbers in the column in which they appear. If the difference between two varieties exceeds the LSD value, it means that with 95% or 90% confidence (LSD probability 0.05 or 0.10), the higher-yielding variety has a significant yield advantage. When the difference between two varieties is less than the LSD value, no significant difference was found between those two varieties under those growing conditions.

NS is used to indicate no significant difference for that trait among any of the varieties at the 95% or 90% level of confidence. The CV stands for coefficient of variation and is expressed as a percentage. The CV is a measure of variability in the trial. Large CVs mean a large amount of variation that could not be attributed to differences in the varieties. Yield is reported at 13.5% moisture, while protein content is reported at 12% moisture content.

Presentation of data for the entries tested does not imply approval or endorsement by the authors or agencies conducting the test. North Dakota State University approves the reproduction of any table in the publication only if no portion is deleted, appropriate footnotes are given and the order of the data is not rearranged. Additional data from county sites are available from each Research Extension Center at *www.ag.ndsu.edu/varietytrials/spring-wheat*. Also consider using the online variety selection tool at *www.ag.ndsu.edu/varietyselectiontool/*, which allows you to generate tables of data from research locations nearest your farm and make head-to-head comparisons of varieties of interest.

List of Tables

Table 1. North Dakota hard red spring wheat variety descriptions, agronomic traits, 2019.

Variety	Agent or Origin[1]	Year Released	Height (inches)	Straw Strength[2]	Days to Head[3]	Stem Rust[5]	Leaf Rust	Stripe Rust	Tan Spot	Bact. Leaf Streak	Head Scab
Ambush	DynaGro	2016	29	5	58	1	4	3	NA	6	5
Barlow	ND	2009	30	6	58	1	6	4	6	4	4
Bolles	MN	2015	29	4	62	2	3	5	4	7	5
Boost	SD	2016	30	5	62	1	4	3	8	2	5
Commander	**DynaGro**	**2019**	**28**	**6**	**59**	**NA**	**4**	**NA**	**NA**	**4**	**5**
CP3504	Croplan	2015	27	3	61	1	1	6	8	4	6
CP3530	Croplan	2015	31	5	61	1	2	8	6	5	5
CP3616	Croplan	2016	29	4	60	1	5	5	4	6	6
CP3888	Croplan	2017	28	4	60	NA	1	NA	NA	6	6
CP3910	**Croplan**	**2019**	**27**	**5**	**58**	**NA**	**1**	**NA**	**NA**	**8**	**6**
CP3915	**Croplan**	**2019**	**28**	**4**	**59**	**NA**	**1**	**NA**	**NA**	**4**	**5**
CP3939	**Croplan**	**2019**	**29**	**4**	**59**	**NA**	**3**	**NA**	**NA**	**6**	**6**
Elgin-ND	ND	2012	31	5	59	1	6	5	6	6	4
Faller	ND	2007	30	5	61	1	7	8	7	5	4
Glenn	ND	2005	30	4	58	1	6	4	6	4	4
Lang-MN	MN	2017	30	5	61	1	2	1	7	3	4
Lanning	MT	2017	26	3	60	NA	NA	NA	NA	8	6
LCS Breakaway	Limagrain	2011	26	5	58	1	3	6	4	6	6
LCS Cannon	Limagrain	2018	27	4	57	NA	7	NA	NA	7	6
LCS Rebel	Limagrain	2017	30	5	58	1	7	4	8	4	5
LCS Trigger	Limagrain	2016	29	5	64	1	1	2	6	3	4
Linkert	MN	2013	26	2	60	1	3	1	4	6	5
MN-Washburn	**MN**	**2019**	**27**	**3**	**60**	**NA**	**1**	**NA**	**NA**	**5**	**5**
Mott[6]	ND	2009	32	3	60	1	6	6	6	5	6
MS Barracuda	Meridian	2018	27	3	57	NA	2	NA	NA	7	6
MS Camaro	Meridian	2016	26	5	59	1	1	2	8	7	6
MS Chevelle	Meridian	2014	28	5	59	1	4	3	6	7	6
ND VitPro	ND	2016	29	3	59	1	4	3	7	3	4
Shelly	MN	2016	27	5	61	2	6	5	3	7	5
Surpass	SD	2016	28	5	58	1	4	6	8	4	5
SY 611CL2	**Syngenta/AgriPro**	**2019**	**27**	**5**	**59**	**NA**	**NA**	**NA**	**NA**	**6**	**5**
SY Ingmar	Syngenta/AgriPro	2014	28	3	60	1	3	6	6	5	5
SY Longmire[6]	**Syngenta/AgriPro**	**2019**	**28**	**5**	**60**	**NA**	**7**	**NA**	**NA**	**6**	**7**
SY McCloud	**Syngenta/AgriPro**	**2019**	**28**	**4**	**58**	**NA**	**5**	**NA**	**NA**	**6**	**5**
SY Rockford	Syngenta/AgriPro	2017	30	3	61	NA	NA	NA	NA	8	6
SY Soren	Syngenta/AgriPro	2011	27	3	60	1	2	7	2	7	7
SY Valda	Syngenta/AgriPro	2015	27	4	60	1	2	7	6	6	5
TCG-Climax	21st Century Genetics	2017	29	2	64	1	6	3	8	5	5
TCG-Heartland	**21st Century Genetics**	**2019**	**27**	**5**	**58**	**NA**	**2**	**NA**	**NA**	**7**	**6**
TCG-Spitfire	21st Century Genetics	2015	29	4	62	1	5	4	8	4	6
TCG-Stalwart[6]	**21st Century Genetics**	**2019**	**28**	**4**	**59**	**NA**	**8**	**NA**	**NA**	**9**	**7**

[1]Refers to agent or developer: MN = University of Minnesota; MT = Montana State University; ND = North Dakota State University; SD = South Dakota State University. Bold varieties are those recently released, so data is limited and rating values may change.

[2]Straw Strength = 1 to 9 scale, with 1 the strongest and 9 the weakest. These values are based on recent data and may change as more data become available.

[3]Days to Head = the number of days from planting to head emergence from the boot, averaged based on data from several locations in 2019.

[4]Disease reaction scores from 1 to 9, with 1 = resistant and 9 = very susceptible, NA = not available.

[5]Fargo stem rust nursery inoculated with Puccinia graminis f. sp. Tritici races TPMK, TMLK, RTQQ, QFCQ and QTHJ.

[6]Solid stemmed or semisolid stem, imparting resistance to sawfly.

Table 2. Yield of hard red spring wheat varieties grown at four locations in eastern North Dakota, 2017-2019.

Variety	Carrington 2019	Carrington 3 Yr.	Casselton 2019	Casselton 3 Yr.	Langdon 2019	Langdon 3 Yr.	Steele Co. 2019	Steele Co. 2 Yr.	Avg. eastern N.D. 2019	Avg. eastern N.D. 2-3 Yr.
	--(bu/a)--									
Ambush	45.7	59.3	61.7	69.6	76.4	78.6	56.0	68.6	59.9	69.0
Barlow	45.4	56.3	59.8	69.5	75.5	78.3	51.4	63.2	58.0	66.8
Bolles	54.0	57.5	56.5	72.7	72.5	76.1	57.7	66.6	60.2	68.2
Boost	47.6	58.2	62.6	72.6	74.8	80.5	67.5	75.3	63.1	71.6
Commander	50.8	--	70.4	--	79.8	--	60.5	--	65.4	--
CP3504	55.1	63.7	66.1	77.7	82.4	83.6	63.6	74.4	66.8	74.9
CP3530	52.9	61.0	70.4	77.0	78.3	85.4	57.9	73.9	64.9	74.3
CP3616	50.3	59.1	68.6	76.2	76.8	77.9	47.7	62.3	60.9	68.9
CP3888	48.7	--	72.1	--	81.5	--	52.7	66.5	63.8	--
CP3910	44.2	--	59.0	--	75.9	--	50.7	--	57.5	--
CP3915	42.9	--	65.5	--	77.5	--	63.9	--	62.4	--
CP3939	44.2	--	71.1	--	76.0	--	49.5	--	60.2	--
Elgin-ND	49.6	56.6	69.7	73.8	80.7	83.6	51.5	64.4	62.9	69.6
Faller	51.4	61.9	68.1	77.7	83.7	87.8	60.6	74.6	66.0	75.5
Glenn	43.8	53.3	56.1	66.4	74.7	73.9	51.9	61.2	56.6	63.7
Lang-MN	46.9	58.9	67.2	72.8	77.0	77.9	56.0	66.4	61.8	69.0
LCS Breakaway	41.6	55.3	56.0	69.5	76.0	78.9	49.9	65.7	55.9	67.4
LCS Cannon	37.7	--	66.9	--	80.9	--	48.5	66.8	58.5	--
LCS Rebel	42.0	56.9	64.9	74.8	81.3	86.0	58.9	72.3	61.8	72.5
LCS Trigger	50.0	63.8	72.5	86.9	87.2	98.4	71.9	82.6	70.4	82.9
Linkert	50.1	56.9	62.6	69.8	69.3	69.4	51.1	62.4	58.3	64.6
MN Washburn	40.2	--	65.9	--	75.8	--	57.2	--	59.8	--
Mott	44.2	--	64.3	--	79.9	--	--	--	47.1	--
MS Barracuda	40.4	--	64.8	--	83.4	--	41.0	62.6	57.4	--
MS Camaro	43.3	52.7	63.5	68.6	82.2	75.2	40.2	57.5	57.3	63.5
MS Chevelle	51.3	63.0	67.2	76.4	84.9	88.5	51.0	67.1	63.6	73.7
ND VitPro	50.1	54.0	60.9	68.8	72.9	74.3	52.4	62.1	59.1	64.8
Shelly	41.1	60.5	70.6	78.9	82.1	83.9	49.5	67.3	60.8	72.6
Surpass	42.5	--	76.8	80.8	78.5	83.3	50.0	66.2	62.0	57.6
SY 611CL2	49.9	--	68.3	--	83.3	--	56.8	--	64.6	--
SY Ingmar	46.2	59.2	68.4	75.7	81.0	82.0	54.1	66.2	62.4	70.8
SY Longmire	47.8	--	67.7	--	78.7	--	55.4	--	62.4	--
SY McCloud	41.9	--	66.5	--	78.2	--	56.2	--	60.7	--
SY Rockford	53.7	--	65.7	--	81.0	--	25.3	51.7	56.4	--
SY Soren	50.4	58.6	64.8	72.4	77.9	77.9	47.9	61.3	60.2	67.6
SY Valda	54.0	64.3	69.1	78.5	80.2	88.4	61.6	75.4	66.2	76.6
TCG-Climax	43.5	57.8	58.6	67.3	69.2	74.5	54.0	67.9	56.3	66.9
TCG-Heartland	47.7	--	59.5	--	74.8	--	56.1	--	59.5	--
TCG-Spitfire	50.4	62.4	72.0	77.0	78.6	82.1	63.9	76.6	66.2	74.5
TCG-Stalwart	38.2	--	52.2	--	71.3	--	30.5	--	48.0	--
Mean	46.8	58.8	65.4	74.1	78.3	81.1	53.4	67.2	60.6	69.9
CV%	10.4	--	8.3	--	4.7	--	12.2	--	8.5	4.0
LSD 0.05	6.9	--	7.3	--	5.2	--	7.5	--	7.4	4.0
LSD 0.10	5.8	--	5.7	--	4.4	--	6.3	--	6.2	3.3

Table 3. Yield of hard red spring wheat varieties grown at five locations in western North Dakota, 2017-2019.

Variety	Dickinson 2019	Dickinson 3 Yr.	Hettinger 2019	Hettinger 3 Yr.	Mandan 2019	Mandan 3 Yr.	Minot 2019	Minot 3 Yr.	Williston 2019	Williston 3 Yr.	Avg. western N.D. 2019	Avg. western N.D. 3 Yr.
						--------(bu/a)--------						
Ambush	46.5	47.4	61.6	45.8	36.2	--	44.6	60.1	67.2	--	51.2	--
Barlow	45.2	47.8	66.3	48.8	34.4	32.2	46.2	58.9	59.6	46.7	50.3	46.9
Bolles	38.4	45.9	65.1	41.3	35.6	30.6	45.6	58.7	61.5	43.5	49.2	44.0
Boost	47.7	46.6	67.5	42.1	34.8	33.8	50.9	62.1	63.6	43.8	52.9	45.7
Commander	47.2	--	69.0	--	35.0	--	--	--	67.5	--	43.7	--
CP3504	53.9	53.0	70.0	46.9	43.7	--	49.7	62.2	69.4	--	57.3	--
CP3530	52.0	49.4	66.9	46.8	38.8	35.1	47.0	63.5	60.8	--	53.1	--
CP3616	50.6	50.8	62.8	46.1	36.8	--	45.3	58.3	64.5	--	52.0	--
CP3888	47.1	--	70.6	--	40.0	--	43.6	--	59.6	--	52.2	--
CP3910	51.0	--	68.4	--	33.6	--	8.5	--	67.5	--	45.8	--
CP3915	51.5	--	65.8	--	36.2	--	50.3	--	64.0	--	53.6	--
CP3939	51.8	--	65.0	--	34.0	--	44.9	--	58.6	--	50.9	--
Elgin-ND	47.3	47.9	68.2	50.1	38.7	35.0	50.6	61.4	71.2	53.1	55.2	49.5
Faller	51.2	52.6	71.8	50.5	42.1	--	58.0	69.9	64.5	47.8	57.5	--
Glenn	44.8	47.7	57.6	42.9	34.8	34.0	39.2	57.3	59.8	47.9	47.2	46.0
Lang-MN	51.2	49.4	68.7	47.8	40.0	37.5	50.6	58.4	62.8	43.3	54.7	47.3
Lanning	49.2	--	64.5	--	36.7	--	47.9	--	62.2	--	52.1	--
LCS Breakaway	41.0	41.1	67.5	44.1	34.1	--	42.5	51.3	61.9	46.8	49.4	--
LCS Cannon	47.3	--	63.5	--	37.1	--	43.1	--	60.8	--	50.4	--
LCS Rebel	48.9	47.5	63.7	46.8	36.8	--	48.3	56.5	68.3	48.4	53.2	--
LCS Trigger	47.1	52.4	70.0	54.9	41.7	38.0	54.9	67.1	68.1	50.1	56.4	52.5
Linkert	47.1	46.3	57.0	40.4	35.5	--	42.4	55.4	55.9	45.8	47.6	--
MN Washburn	48.6	--	64.7	--	35.4	--	47.3	--	58.3	--	50.9	--
Mott	42.7	44.2	62.8	43.6	40.0	34.4	49.2	56.0	63.5	--	51.6	35.6
MS Barracuda	36.8	--	66.9	--	34.7	--	51.8	--	61.4	--	50.3	--
MS Camaro	48.2	45.2	63.7	39.7	31.9	--	44.9	59.0	62.3	48.2	50.2	--
MS Chevelle	54.8	52.5	71.8	50.6	36.3	36.2	49.0	59.8	71.7	50.0	56.7	49.8
ND VitPro	--	--	61.5	43.8	36.9	33.4	39.1	50.5	60.5	48.4	48.4	44.3
Shelly	48.1	52.6	68.3	50.1	37.2	34.7	42.4	62.4	68.1	51.4	52.8	50.3
Surpass	45.8	48.8	67.4	44.4	41.9	36.9	39.0	52.7	69.9	50.8	52.8	46.7
SY 611CL2	49.8	--	68.7	46.8	40.7	--	47.1	--	69.3	--	55.1	--
SY Ingmar	46.8	48.5	73.8	--	33.0	36.3	37.0	55.7	67.2	45.6	51.6	37.2
SY Longmire	49.8	--	62.7	43.9	32.6	--	47.0	--	60.0	--	50.4	--
SY McCloud	46.2	--	69.0	--	32.5	--	41.0	--	65.7	--	50.9	--
SY Rockford	54.0	52.5	62.8	--	38.2	--	50.9	67.8	67.6	52.1	54.7	--
SY Soren	48.6	47.6	70.9	49.7	30.4	32.2	48.6	61.3	69.8	49.8	53.7	48.1
SY Valda	47.0	49.5	67.9	45.3	41.5	35.5	44.6	59.0	61.1	47.8	52.4	47.4
TCG-Climax	39.6	45.3	57.0	43.1	36.2	--	45.5	59.6	57.7	45.3	47.2	--
TCG-Heartland	43.9	--	65.5	--	30.9	--	49.5	--	61.3	61.3	50.2	--
TCG-Spitfire	52.6	51.3	69.4	48.6	38.5	37.0	49.8	66.5	68.9	53.3	55.8	51.3
TCG-Stalwart	48.2	--	59.8	--	26.6	--	48.2	--	66.0	66.0	49.8	--
Mean	47.6	48.6	66.0	46.1	36.1	34.5	47.0	59.7	64.3	49.5	51.7	46.4
CV %	8.1	--	7.1	--	7.6	--	13.7	--	7.0	--	8.5	5.1
LSD 0.05	5.4	--	6.6	--	3.8	--	10.4	--	7.3	--	5.5	3.1
LSD 0.10	4.5	--	5.5	--	3.2	--	8.7	--	6.1	--	4.6	2.6

Table 4. Protein at 12% moisture of hard red spring wheat varieties grown at nine locations in North Dakota, 2019.

Variety	Carrington	Casselton	Langdon	Steele Co.	Dickinson	Hettinger	Mandan	Minot	Williston	State Avg.
	--(%)--									
Ambush	15.4	15.8	14.9	15.6	17.5	15.4	12.4	16.3	14.9	15.3
Barlow	15.5	15.9	14.4	15.0	16.6	15.1	12.5	16.1	14.6	15.1
Bolles	17.4	17.5	15.3	16.0	18.7	15.8	12.8	17.9	16.7	16.5
Boost	15.4	14.8	14.2	14.6	16.4	14.6	12.3	15.9	15.0	14.8
Commander	14.7	15.2	13.7	14.7	16.6	14.7	12.9	15.3	15.2	14.8
CP3504	14.7	14.4	13.0	14.7	15.9	13.3	11.3	15.4	13.7	14.0
CP3530	15.0	15.1	14.2	15.9	15.7	14.5	12.3	15.6	14.5	14.8
CP3616	16.5	15.9	14.9	16.6	17.0	15.0	13.3	16.9	16.9	15.9
CP3888	15.5	15.5	14.0	15.4	16.4	14.5	12.3	16.6	15.5	15.1
CP3910	15.9	16.2	13.7	16.1	16.3	14.6	12.7	16.0	15.1	15.2
CP3915	14.5	15.3	14.3	15.1	17.0	15.2	12.2	15.1	15.9	15.0
CP3939	16.0	16.0	14.9	15.9	16.8	15.6	13.0	16.3	14.8	15.5
Elgin-ND	15.6	14.7	13.9	14.9	16.1	15.2	12.4	15.7	14.8	14.8
Faller	14.5	14.5	13.7	14.9	15.6	14.3	11.5	14.2	14.6	14.2
Glenn	15.8	15.6	15.0	15.6	16.9	15.4	12.3	16.1	14.5	15.2
Lang-MN	15.0	15.9	15.0	15.7	16.7	14.6	13.1	15.7	15.5	15.2
Lanning	--	--	--	--	17.5	16.0	13.0	16.6	15.5	--
LCS Breakaway	15.5	15.3	14.4	15.7	16.8	15.7	12.6	16.8	15.5	15.4
LCS Cannon	14.8	14.9	13.8	14.9	16.5	15.1	11.7	16.2	15.0	14.8
LCS Rebel	15.4	16.3	14.4	15.2	16.8	15.2	13.1	15.5	14.7	15.2
LCS Trigger	13.0	12.8	11.9	12.4	14.3	12.5	10.5	13.0	12.4	12.5
Linkert	16.4	15.4	15.1	16.1	17.1	16.7	13.8	17.6	15.8	16.0
MN Washburn	14.3	14.3	14.3	15.7	16.1	14.5	12.5	15.2	14.6	14.6
Mott	16.2	15.3	14.5	--	17.0	15.1	12.4	15.6	16.1	15.3
MS Barracuda	15.8	16.0	14.3	16.0	17.1	15.2	12.0	15.8	14.2	15.2
MS Camaro	15.3	15.5	14.4	15.7	17.0	15.1	13.5	16.1	16.5	15.4
MS Chevelle	14.0	14.6	12.6	14.7	15.7	13.7	11.6	14.4	13.7	13.9
ND VitPro	15.7	15.7	14.8	15.6	--	16.0	13.0	16.7	15.7	15.6
Shelly	14.2	14.8	13.5	14.9	16.0	14.3	11.9	15.8	13.8	14.4
Surpass	15.0	14.9	14.0	15.0	16.7	14.4	11.2	15.8	15.2	14.7
SY 611CL2	15.5	15.4	13.6	14.8	16.8	13.9	11.7	16.1	15.5	14.8
SY Ingmar	15.4	15.4	14.2	15.7	17.1	15.4	13.3	17.2	14.5	15.4
SY Longmire	15.7	14.9	14.0	14.6	16.7	14.4	12.8	16.4	15.6	15.0
SY McCloud	15.6	15.3	14.7	15.2	17.3	15.7	13.2	17.0	16.8	15.6
SY Rockford	15.2	15.4	13.9	16.4	16.2	14.2	12.3	15.8	14.7	14.9
SY Soren	16.1	15.7	14.4	15.8	17.7	15.3	13.0	16.1	16.2	15.6
SY Valda	14.7	15.1	13.0	14.4	16.0	13.9	11.8	15.0	14.3	14.2
TCG-Climax	16.6	16.5	15.9	15.8	17.6	15.6	13.1	16.6	17.0	16.1
TCG-Heartland	15.7	16.1	14.7	15.5	16.7	15.6	13.1	16.6	16.0	15.6
TCG-Spitfire	14.4	14.1	13.6	14.4	15.8	14.1	11.8	15.1	14.4	14.2
TCG-Stalwart	16.4	16.9	14.9	17.1	17.2	15.4	14.0	16.2	16.7	16.1
Mean	15.3	15.3	14.2	15.3	16.7	14.9	12.5	16.0	15.2	15.0
CV%	2.2	2.5	2.4	3.6	1.9	3.6	4.0	3.9	5.7	4.7
LSD 0.05	0.5	0.5	0.5	0.6	0.5	0.7	0.7	1.0	1.4	0.7
LSD 0.10	0.4	0.4	0.4	0.4	0.4	0.6	0.6	0.8	1.2	0.6

Table 5. Test weight of hard red spring wheat varieties grown at nine locations in North Dakota, 2019.

Variety	Carrington	Casselton	Langdon	Steele Co.	Dickinson	Hettinger	Mandan	Minot	Williston	State Avg.
	---(lb/bu)---									
Ambush	60.8	56.7	61.5	58.3	61.3	58.2	57.3	63.6	62.8	60.1
Barlow	60.3	56.7	62.3	55.3	61.1	58.8	57.0	63.9	62.6	59.8
Bolles	59.4	55.6	60.3	57.8	59.6	56.7	56.3	61.1	61.4	58.7
Boost	58.9	58.6	60.1	58.2	59.4	57.4	56.9	62.0	60.9	59.2
Commander	59.6	56.8	61.2	59.0	60.6	58.0	55.7	63.0	62.2	59.6
CP3504	58.5	56.5	59.5	56.4	59.3	56.3	56.4	61.3	60.6	58.3
CP3530	58.8	57.8	60.1	58.1	59.6	56.9	56.7	61.3	61.4	59.0
CP3616	59.6	55.4	60.3	55.4	59.6	56.7	55.4	61.3	61.6	58.4
CP3888	58.2	55.6	60.1	56.5	59.4	56.8	55.9	61.4	61.2	58.3
CP3910	58.8	53.4	60.9	56.0	61.5	59.0	55.9	63.6	62.5	59.1
CP3915	58.3	58.4	61.7	59.0	61.5	58.1	55.4	63.2	62.6	59.8
CP3939	59.9	55.3	61.5	56.8	60.6	56.7	54.8	61.5	62.7	58.9
Elgin-ND	59.0	56.6	60.7	56.5	59.5	56.9	56.4	62.2	61.7	58.8
Faller	60.1	56.5	60.4	58.2	59.4	56.9	56.1	61.0	60.7	58.8
Glenn	62.5	59.4	63.2	59.7	62.1	57.3	56.3	63.5	64.7	61.0
Lang-MN	60.8	57.4	61.4	59.1	60.9	58.1	56.8	62.7	61.8	59.9
Lanning	--	--	--	--	60.2	56.7	54.1	61.7	61.7	--
LCS Breakaway	60.7	57.4	62.1	58.0	61.6	58.6	56.5	63.4	63.1	60.2
LCS Cannon	60.0	57.7	61.8	54.0	61.6	59.2	56.8	63.7	62.6	59.7
LCS Rebel	60.4	58.1	61.7	58.3	61.0	58.0	56.5	63.2	63.0	60.0
LCS Trigger	58.7	57.3	60.5	59.4	59.6	57.9	57.5	62.4	62.1	59.5
Linkert	59.7	56.4	60.5	54.2	60.0	58.3	56.5	61.7	62.0	58.8
MN Washburn	57.7	58.6	60.7	57.5	59.4	57.2	54.5	62.1	61.7	58.8
Mott	59.5	57.1	60.7	--	60.3	57.2	56.8	61.3	61.9	59.1
MS Barracuda	59.5	54.7	61.3	54.7	60.1	57.7	55.8	62.2	61.9	58.7
MS Camaro	59.7	56.2	61.2	54.6	60.3	58.4	55.9	61.9	62.5	59.0
MS Chevelle	59.2	54.5	61.0	56.5	60.3	57.6	55.7	62.2	61.8	58.8
ND VitPro	61.2	59.0	63.0	59.1	--	57.3	54.4	62.8	64.0	60.2
Shelly	59.0	56.7	61.1	55.8	60.0	57.0	55.4	61.7	61.9	58.7
Surpass	58.9	56.6	60.5	58.3	60.0	57.0	56.4	61.2	61.1	58.9
SY 611CL2	60.4	56.8	62.3	57.6	61.0	59.0	57.4	64.2	63.3	60.2
SY Ingmar	59.9	57.8	61.5	59.0	61.4	58.8	56.2	63.4	62.6	60.1
SY Longmire	59.9	55.8	61.5	58.9	60.9	58.2	54.4	62.7	63.0	59.5
SY McCloud	61.1	58.0	61.8	58.4	61.1	58.2	56.8	63.1	63.2	60.2
SY Rockford	57.4	53.3	59.3	--	59.1	57.3	55.3	60.5	61.3	57.7
SY Soren	60.1	55.6	61.5	54.9	61.1	58.6	55.5	62.8	62.5	59.2
SY Valda	59.6	57.4	60.6	58.3	60.6	57.4	57.1	63.3	61.3	59.5
TCG-Climax	61.0	60.0	61.8	58.5	60.4	58.5	59.2	62.9	63.1	60.6
TCG-Heartland	60.8	57.4	61.9	59.5	60.9	58.1	54.9	63.5	63.5	60.1
TCG-Spitfire	57.9	56.8	60.2	57.2	59.5	56.5	55.1	62.7	61.8	58.6
TCG-Stalwart	55.7	51.7	59.5	50.6	59.1	56.0	51.1	60.8	60.8	56.1
Mean	59.6	56.9	61.2	57.3	60.5	57.7	56.2	62.4	62.1	59.3
CV%	1.4	1.5	0.8	2.9	0.6	1.2	1.7	0.6	0.5	1.5
LSD 0.05	1.1	1.1	0.7	1.9	0.5	1.0	1.3	0.6	0.5	0.9
LSD 0.10	0.9	0.9	0.6	1.6	0.5	0.8	1.1	0.5	0.4	0.7

Table 6. Quality data from 2018 eastern locations.

Variety	Test Weight[1]	Vitreous Kernels[2]	1,000 KWT[3]	Falling Number[4]	Wheat Protein[5]	Flour Extraction[6]	Farinograph Absorption[7]	Farinograph Stability[8]	Loaf Volume[9]
	(lb/bu)	(%)	(gram)	(seconds)	(%)	(%)	(%)	(minutes)	(cubic cm)
Ambush	64.5	97	38.2	414	14.9	67.2	64.4	10.3	1,069
Barlow	64.3	96	35.3	370	14.8	69.7	68.3	8.5	999
Bolles	62.8	97	36.8	419	16.1	65.6	67.4	20.1	1,101
Boost	62.4	97	36.1	424	15.0	66.9	67.3	7.0	1,001
CP3504	63.2	98	37.2	437	14.5	68.9	66.4	7.1	1,006
CP3530	63.3	98	37.5	417	14.4	67.0	66.4	6.9	1,014
CP3616	63.1	98	36.5	412	15.6	68.1	67.0	8.9	996
CP3888	63.3	96	35.4	414	14.6	69.1	65.6	7.4	1,011
Elgin-ND	62.8	95	34.7	414	14.9	67.4	67.5	9.0	1,019
Faller	63.3	97	38.6	410	14.4	68.9	64.8	9.8	1,014
Glenn	64.5	98	34.3	371	15.3	66.4	65.9	10.5	1,051
Lang-MN	64.4	98	32.5	416	14.5	69.1	65.9	8.9	964
LCS Breakaway	65.0	92	37.8	421	14.9	66.7	67.0	7.0	978
LCS Cannon	65.1	95	36.1	403	14.8	70.5	65.4	8.1	1,021
LCS Rebel	64.8	98	39.0	407	15.0	70.1	67.2	7.8	1,053
LCS Trigger	63.7	97	33.7	441	12.7	69.4	66.9	6.4	803
Linkert	63.3	87	37.4	458	15.1	65.5	65.2	14.2	1,033
MN Washburn	62.6	96	34.0	384	14.6	70.9	62.2	10.8	1,008
MS Barracuda	64.1	93	39.4	412	14.9	68.9	66.7	8.1	1,013
MS Camaro	63.8	95	33.0	401	15.6	67.1	66.7	6.6	1,004
MS Chevelle	64.0	96	35.8	380	13.9	68.8	65.4	8.7	1,038
ND VitPro	64.8	98	36.3	412	15.4	69.5	66.4	7.6	1,041
Shelly	63.7	98	34.4	428	13.7	70.2	62.4	10.1	935
Surpass	63.3	81	32.7	371	14.4	68.7	62.9	7.3	1,025
SY Ingmar	63.4	97	34.6	408	15.1	69.7	63.9	7.9	1,050
SY Soren	63.7	97	32.5	422	14.8	68.8	65.1	6.6	1,024
SY Valda	63.9	98	35.6	382	13.9	68.9	64.5	5.4	934
TCG-Climax	65.2	98	32.0	260	15.1	67.9	64.7	9.7	963
TCG-Spitfire	63.5	95	39.5	393	13.5	65.6	65.9	8.3	961

[1]Test 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.

[2]Vitreous kernels - Expressed as a percentage of seeds having a vitreous-colored endosperm. A high percentage is desirable. US No. 1 DNS requires greater than 75% vitreous kernels.

[3]1,000 KWT - Estimate of weight of 1,000 seeds based on a clean 10g sample. Expressed in grams and used to approximate seed size.

[4]Falling 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.

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

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

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

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

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

Table 7. Quality data from 2018 western locations.

Variety	Test Weight[1]	Vitreous Kernels[2]	1,000 KWT[3]	Falling Number[4]	Wheat Protein[5]	Flour Extraction[6]	Farinograph Absorption[7]	Farinograph Stability[8]	Loaf Volume[9]
	(lb/bu)	(%)	(gram)	(seconds)	(%)	(%)	(%)	(minutes)	(cubic cm)
Ambush	64.2	97	36.8	398	14.8	68.1	64.1	10.0	1,005
Barlow	64.3	98	33.8	414	14.8	71.2	67.9	9.0	1,025
Bolles	63.0	97	36.5	431	16.6	68.0	67.5	17.3	1,095
Boost	62.5	97	36.4	414	15.0	68.7	67.1	7.7	1,021
CP3504	62.6	96	35.4	454	13.9	70.0	64.9	7.1	948
CP3530	62.0	95	34.5	445	14.3	68.2	65.4	8.2	996
CP3616	63.4	97	37.4	404	15.4	68.0	67.2	9.2	1,053
CP3888	63.0	94	36.2	450	14.8	68.9	65.6	8.4	1,016
Elgin-ND	62.9	97	33.3	377	14.7	69.1	67.5	6.6	1,013
Faller	64.0	99	38.7	397	14.2	71.2	66.8	6.6	1,021
Glenn	65.7	99	33.7	382	15.3	68.6	66.4	11.2	1,029
Lang-MN	64.4	98	33.6	386	15.2	68.4	66.5	7.5	968
Lanning	62.7	93	37.5	404	15.0	67.4	65.5	6.7	1,059
LCS Breakaway	64.5	96	37.0	414	15.6	69.3	66.0	7.1	966
LCS Cannon	64.7	94	33.0	373	14.2	70.2	65.0	9.9	953
LCS Rebel	64.5	98	36.7	405	14.7	70.7	66.0	10.5	1,006
LCS Trigger	62.1	99	31.2	454	13.0	69.6	65.8	7.5	816
Linkert	63.4	97	39.5	452	15.8	68.2	66.3	14.6	1,084
MN Washburn	63.1	98	32.8	405	14.3	71.6	62.2	11.8	953
MS Barracuda	63.4	97	38.1	451	15.6	69.4	66.2	8.5	1,026
MS Camaro	63.9	96	34.8	383	15.2	66.4	66.1	6.4	963
MS Chevelle	63.4	97	33.2	371	13.7	69.1	65.1	11.8	1,000
ND VitPro	65.1	99	35.8	409	15.0	69.0	66.1	7.9	990
Shelly	64.0	98	36.0	444	13.4	69.6	61.9	12.6	894
Surpass	62.8	98	31.3	381	14.9	68.0	62.1	8.5	1,008
SY Ingmar	64.1	97	33.5	414	14.1	71.5	63.8	10.0	989
SY Rockford	61.9	97	35.8	409	14.3	68.8	66.4	8.4	1,011
SY Soren	64.1	97	33.0	422	15.3	68.4	65.5	9.2	1,084
SY Valda	63.2	99	35.5	398	13.8	68.0	64.5	6.9	976
TCG-Climax	63.6	97	32.4	267	16.5	68.3	65.8	8.2	1,028
TCG-Spitfire	62.4	95	38.6	419	14.1	66.7	67.5	8.4	1,035

[1]Test 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.

[2]Vitreous kernels - Expressed as a percentage of seeds having a vitreous-colored endosperm. A high percentage is desirable. US No. 1 DNS requires greater than 75% vitreous kernels.

[3]1,000 KWT - Estimate of weight of 1,000 seeds based on a clean 10g sample. Expressed in grams and used to approximate seed size.

[4]Falling 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.

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

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

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

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

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

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