

A574-20

North Dakota Hard Red Spring Wheat

Variety Trial Results for 2020 and Selection Guide

Joel Ransom, Andrew Green, Senay Simsek, Andrew Friskop, Matt Breiland, Tim Friesen, Zhaohui Liu and Shaobin Zhong (NDSU Main Station); John Rickertsen (Hettinger Research Extension Center); Eric Eriksmoen (North Central Research Extension Center, Minot); Bryan Hanson (Langdon Research Extension Center); Glenn Martin (Dickinson Research Extension Center); Gautam Pradhan (Williston Research Extension Center); Mike Ostlie (Carrington Research Extension Center)

Hard red spring (HRS) wheat was planted on 6 million acres in 2020, down from 6.6 million in 2019. The average yield of HRS wheat was 48 bushels/acre (bu/a), similar to 2019.

SY Ingmar was the most popular HRS wheat variety in 2020, occupying 19.2% of the planted acreage, followed by SY Valda (12.5%), WB9590 (6.1%), SY Soren (4.1%), Glenn (3.6%) and Faller (3.5%). SY Ingmar, SY Soren and SY Valda were released by Syngenta/AgriPro. WB9590 was released by Westbred/Monsanto. Glenn and Faller 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 2019. 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, 2020.

Table 2. Yield of hard red spring wheat varieties grown at six locations in eastern North Dakota, 2018-2020.

Table 3. Yield of hard red spring wheat varieties grown at four locations in western North Dakota, 2018-2020.

Table 4. Protein at 12% moisture of hard red spring wheat varieties grown at 10 locations in North Dakota, 2020.

Table 5. Test weight of hard red spring wheat varieties grown at 10 locations in North Dakota, 2020.

Table 6. Quality data from 2019 eastern North Dakota locations.

Table 7. Quality data from 2019 western North Dakota locations.

Table 1. North Dakota hard red spring wheat variety descriptions, agronomic traits, 2020.

| Variety | Agent or Origin ¹ | Year Released | Height (inches) | Straw Strength ² | Days to Head ³ | Reaction to Disease ⁴ | | | | | |
|--------------------------|------------------------------|---------------|-----------------|-----------------------------|---------------------------|----------------------------------|-----------|-------------|-----------|-------------------|-----------|
| | | | | | | Stem Rust ⁵ | Leaf Rust | Stripe Rust | Tan Spot | Bact. Leaf Streak | Head Scab |
| AP Murdock | Syngenta/AgriPro | 2019 | 26 | 4 | 53 | 1 | NA | NA | NA | 5 | 6 |
| Ambush | Dyna-Gro | 2016 | 27 | 5 | 53 | 1 | 4 | 3 | 4 | 6 | 5 |
| Ballistic | Dyna-Gro | 2018 | 28 | 3 | 54 | 1 | 5 | NA | NA | 5 | 3 |
| Barlow | ND | 2009 | 28 | 6 | 52 | 1 | 6 | 4 | 4 | 4 | 4 |
| Bolles | MN | 2015 | 28 | 4 | 56 | 1 | 3 | 5 | 4 | 6 | 5 |
| Boost | SD | 2016 | 29 | 5 | 56 | 1 | 4 | 3 | 8 | 2 | 5 |
| Commander | Dyna-Gro | 2019 | 27 | 3 | 53 | 1 | 4 | NA | 3 | 4 | 5 |
| CP3530 | Croplan | 2015 | 30 | 5 | 56 | 1 | 2 | 8 | 6 | 5 | 5 |
| CP3903 | Croplan | 2020 | 27 | 2 | 53 | 1 | 7 | NA | NA | 5 | 4 |
| CP3910 | Croplan | 2019 | 26 | 5 | 52 | 1 | 1 | NA | 8 | 8 | 6 |
| CP3915 | Croplan | 2019 | 27 | 4 | 54 | 1 | 1 | NA | 7 | 4 | 5 |
| Dagmar ⁶ | MT | 2019 | 27 | 6 | 53 | 1 | 7 | NA | NA | 7 | 7 |
| Driver | SD | 2019 | 28 | 3 | 55 | 1 | 1 | NA | NA | 7 | 3 |
| Elgin-ND | ND | 2012 | 30 | 5 | 53 | 1 | 6 | 5 | 6 | 6 | 4 |
| Faller | ND | 2007 | 28 | 5 | 56 | 1 | 7 | 8 | 7 | 5 | 4 |
| Glenn | ND | 2005 | 30 | 4 | 52 | 1 | 6 | 4 | 6 | 4 | 4 |
| Lang-MN | MN | 2017 | 28 | 5 | 55 | 1 | 2 | 1 | 4 | 3 | 3 |
| Lanning | MT | 2017 | 26 | 4 | 54 | 1 | 7 | NA | NA | 8 | 6 |
| LCS Buster | Limagrain | 2020 | 28 | 6 | 59 | NA | NA | NA | NA | 4 | 5 |
| LCS Cannon | Limagrain | 2018 | 26 | 4 | 51 | 1 | 7 | NA | 5 | 7 | 6 |
| LCS Rebel | Limagrain | 2017 | 29 | 6 | 52 | 1 | 7 | 4 | 3 | 4 | 5 |
| LCS Trigger | Limagrain | 2016 | 29 | 5 | 60 | 1 | 1 | 2 | 6 | 3 | 3 |
| Linkert | MN | 2013 | 25 | 2 | 54 | 1 | 3 | 1 | 4 | 6 | 5 |
| MN-Torgy | MN | 2020 | 27 | 3 | 54 | 1 | 4 | NA | NA | 3 | 3 |
| MN-Washburn | MN | 2019 | 26 | 3 | 56 | 1 | 1 | NA | 6 | 5 | 5 |
| MS Barracuda | Meridian Seeds | 2018 | 25 | 4 | 51 | 1 | 2 | NA | 7 | 7 | 6 |
| MS Chevelle | Meridian Seeds | 2014 | 26 | 5 | 53 | 1 | 4 | 3 | 6 | 7 | 6 |
| MS Rancho | Meridian Seeds | 2020 | 27 | 5 | 54 | 1 | 4 | NA | NA | 6 | 6 |
| ND Frohberg | ND | 2020 | 29 | 4 | 54 | 1 | 5 | NA | NA | 4 | 5 |
| ND VitPro | ND | 2016 | 28 | 3 | 53 | 1 | 4 | 3 | 7 | 4 | 4 |
| Shelly | MN | 2016 | 26 | 4 | 56 | 1 | 6 | 5 | 3 | 7 | 5 |
| SY 611CL2 | Syngenta/AgriPro | 2019 | 25 | 5 | 54 | 1 | 6 | NA | 4 | 6 | 5 |
| SY Ingmar | Syngenta/AgriPro | 2014 | 27 | 3 | 54 | 1 | 3 | 6 | 6 | 4 | 5 |
| SY Longmire ⁶ | Syngenta/AgriPro | 2019 | 27 | 4 | 54 | 1 | 7 | NA | 2 | 6 | 7 |
| SY McCloud | Syngenta/AgriPro | 2019 | 27 | 4 | 54 | 1 | 5 | NA | 7 | 8 | 5 |
| SY Rockford | Syngenta/AgriPro | 2017 | 27 | 4 | 55 | 1 | 6 | NA | 2 | 8 | 6 |
| SY Soren | Syngenta/AgriPro | 2011 | 25 | 3 | 54 | 1 | 2 | 7 | 2 | 7 | 7 |
| SY Valda | Syngenta/AgriPro | 2015 | 26 | 4 | 54 | 1 | 2 | 7 | 6 | 6 | 5 |
| TCG-Heartland | 21st Century Genetics | 2019 | 26 | 3 | 52 | 1 | 2 | NA | 5 | 7 | 6 |
| TCG-Spitfire | 21st Century Genetics | 2015 | 27 | 3 | 57 | 1 | 5 | 4 | 8 | 4 | 6 |
| TCG-Wildcat | 21st Century Genetics | 2020 | 27 | 3 | 55 | 1 | 5 | NA | NA | 5 | NA |
| Velocity | Dyna-Gro | 2019 | 27 | 3 | 54 | 1 | 2 | NA | NA | 6 | 5 |

¹Refers 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 are limited and rating values may change.

²Straw 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.

³Days to Head = the number of days from planting to head emergence from the boot, averaged based on data from several locations in 2020.

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

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

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

Table 2. Yield of hard red spring wheat varieties grown at six locations in eastern North Dakota, 2018-2020.

| Variety | <u>Carrington</u> | | <u>Casselton</u> | | <u>Grand Forks</u> | <u>Gwinner</u> | <u>Langdon</u> | | <u>Steele Co.</u> | | <u>Average</u> | |
|---------------|-------------------|-------|------------------|-------|--------------------|----------------|----------------|-------|-------------------|-------|----------------|-------|
| | 2020 | 3 Yr. | 2020 | 3 Yr. | 2020 | 2020 | 2020 | 3 Yr. | 2020 | 3 Yr. | 2020 | 3 Yr. |
| | ------(bu/a)----- | | | | | | | | | | | |
| AP Murdock | 46.5 | -- | 87.7 | -- | 65.7 | 80.4 | 87.4 | -- | 81.1 | -- | 74.8 | |
| Ambush | 44.5 | 54.3 | 69.0 | 63.7 | 55.7 | 66.8 | 68.1 | 77.5 | 68.4 | 68.5 | 62.1 | 66.0 |
| Ballistic | 47.7 | -- | 89.1 | -- | 66.3 | 65.2 | 73.1 | -- | 68.6 | -- | 68.3 | -- |
| Barlow | 38.8 | 50.2 | 71.6 | 62.8 | 48.0 | 57.6 | 67.7 | 76.1 | 68.1 | 64.8 | 58.6 | 63.5 |
| Bolles | 33.2 | 48.6 | 67.4 | 62.5 | 50.6 | 53.0 | 67.9 | 74.0 | 71.5 | 68.2 | 57.3 | 63.3 |
| Boost | 47.1 | 53.7 | 74.6 | 68.0 | 57.4 | 54.9 | 71.0 | 77.8 | 69.5 | 73.3 | 62.4 | 68.2 |
| Commander | 29.8 | -- | 80.3 | -- | 60.9 | 70.2 | 74.1 | -- | 78.3 | -- | 65.6 | -- |
| CP3530 | 44.9 | 56.6 | 86.6 | 73.5 | 57.6 | 77.3 | 83.1 | 86.8 | 79.2 | 75.7 | 71.4 | 73.2 |
| CP3903 | 41.7 | -- | 74.3 | -- | 57.5 | 71.9 | 76.9 | -- | 73.9 | -- | 66.0 | -- |
| CP3910 | 41.3 | -- | 72.0 | -- | 53.4 | 63.6 | 70.1 | -- | 67.4 | -- | 61.3 | -- |
| CP3915 | 53.0 | -- | 78.8 | -- | 61.3 | 72.0 | 80.0 | -- | 77.7 | -- | 70.5 | -- |
| Dagmar | 45.9 | -- | 74.8 | -- | 57.5 | 64.0 | 66.0 | -- | 69.4 | -- | 62.9 | -- |
| Driver | 49.4 | -- | 79.9 | -- | 60.8 | 70.0 | 72.7 | -- | 74.6 | -- | 67.9 | -- |
| Elgin-ND | 48.3 | 53.5 | 78.9 | 69.7 | 55.0 | 65.5 | 66.1 | 78.5 | 62.6 | 63.8 | 62.7 | 66.4 |
| Faller | 53.6 | 60.3 | 82.2 | 73.6 | 63.7 | 81.2 | 80.6 | 87.3 | 78.0 | 75.7 | 73.2 | 74.2 |
| Glenn | 35.5 | 46.3 | 69.6 | 60.2 | 48.0 | 57.5 | 73.6 | 74.8 | 70.4 | 64.2 | 59.1 | 61.4 |
| Lang-MN | 51.7 | 56.6 | 78.7 | 68.1 | 57.7 | 55.2 | 72.3 | 76.1 | 68.9 | 67.2 | 64.1 | 67.0 |
| Lanning | 36.6 | -- | 75.1 | -- | 53.2 | 63.1 | 57.1 | -- | 63.6 | -- | 58.1 | -- |
| LCS Buster | 44.5 | -- | 85.2 | -- | 61.2 | 68.0 | 73.4 | -- | 81.5 | -- | 69.0 | -- |
| LCS Cannon | 37.9 | 49.6 | 88.3 | 71.1 | 53.0 | 68.2 | 73.3 | 81.4 | 75.4 | -- | 66.0 | -- |
| LCS Rebel | 43.7 | 52.4 | 70.9 | 65.9 | 63.3 | 65.7 | 75.5 | 83.1 | 76.6 | 73.7 | 66.0 | 68.8 |
| LCS Trigger | 48.9 | 58.9 | 82.6 | 76.1 | 76.0 | 66.8 | 80.6 | 92.5 | 76.5 | 80.6 | 71.9 | 77.0 |
| Linkert | 43.8 | 52.5 | 72.1 | 64.5 | 48.6 | 64.2 | 68.5 | 70.9 | 69.3 | 64.7 | 61.1 | 63.1 |
| MN-Torgy | 56.3 | -- | 81.0 | -- | 60.7 | 68.8 | 70.4 | -- | 79.8 | -- | 69.5 | -- |
| MN-Washburn | 42.0 | 48.0 | 75.9 | -- | 54.2 | 82.2 | 77.8 | 79.6 | 73.0 | -- | 67.5 | -- |
| MS Barracuda | 35.3 | 47.6 | 83.0 | 70.4 | 54.2 | 70.2 | 65.6 | 80.7 | 61.8 | 62.3 | 61.7 | 65.2 |
| MS Chevelle | 34.2 | 54.2 | 78.3 | 69.8 | 57.6 | 73.0 | 74.6 | 84.6 | 62.5 | 65.6 | 63.4 | 68.5 |
| MS Ranchero | 50.5 | -- | 78.2 | -- | 60.4 | 52.2 | 61.8 | -- | 51.8 | -- | 59.2 | -- |
| ND Frohberg | 47.4 | 57.3 | 73.9 | -- | 53.1 | 65.2 | 73.4 | 80.8 | 75.9 | -- | 64.8 | -- |
| ND VitPro | 27.3 | 44.3 | 72.5 | 63.4 | 54.0 | 54.5 | 76.2 | 75.8 | 67.6 | 63.9 | 58.7 | 61.9 |
| Shelly | 53.3 | 56.2 | 90.4 | 75.3 | 60.8 | 74.0 | 57.7 | 76.0 | 67.7 | 67.4 | 67.3 | 68.7 |
| SY 611CL2 | 29.5 | 46.8 | 81.4 | -- | 54.9 | 70.3 | 77.7 | 81.6 | 74.7 | -- | 64.8 | -- |
| SY Ingmar | 35.2 | 51.9 | 73.3 | 68.9 | 60.1 | 65.6 | 77.1 | 83.1 | 77.2 | 69.9 | 64.7 | 68.4 |
| SY Longmire | 44.4 | 52.5 | 75.9 | -- | 55.6 | 72.6 | 78.1 | -- | 70.7 | -- | 66.2 | -- |
| SY McCloud | 36.6 | 47.0 | 76.7 | -- | 48.0 | 72.7 | 75.9 | 79.0 | 73.5 | -- | 63.9 | -- |
| SY Rockford | 40.4 | 53.1 | 86.1 | -- | 49.7 | 60.0 | 54.8 | -- | 54.8 | 52.7 | 57.6 | -- |
| SY Soren | 36.6 | 50.8 | 77.4 | 67.3 | 49.6 | 66.4 | 70.6 | 76.2 | 75.7 | 66.1 | 62.7 | 65.1 |
| SY Valda | 49.0 | 58.3 | 83.6 | 72.9 | 54.7 | 76.1 | 78.8 | 86.5 | 78.0 | 76.3 | 70.0 | 73.5 |
| TCG-Heartland | 37.3 | -- | 78.4 | -- | 50.0 | 64.6 | 66.5 | -- | 71.8 | -- | 61.4 | -- |
| TCG-Spitfire | 47.7 | 56.2 | 74.0 | 69.4 | 63.5 | 81.4 | 79.9 | 83.4 | 83.2 | 78.8 | 71.6 | 71.9 |
| TCG-Wildcat | 41.6 | -- | 75.0 | -- | 60.4 | 66.3 | 73.6 | -- | 84.8 | -- | 67.0 | -- |
| Velocity | 40.9 | -- | 70.5 | -- | 52.4 | 67.5 | 70.1 | -- | 66.8 | -- | 61.4 | -- |
| Mean | 42.3 | 52.5 | 78.2 | 68.4 | 56.8 | 66.9 | 71.2 | -- | 71.9 | 68.7 | 64.9 | 67.8 |
| CV% | 13.9 | -- | 6.6 | -- | 11.6 | 11.0 | 8.1 | -- | 10.1 | -- | -- | -- |
| LSD 0.05 | 8.2 | -- | 8.4 | -- | 6.7 | 12.0 | 8.1 | -- | 11.8 | -- | 8.9 | 4.6 |
| LSD 0.10 | 6.9 | -- | 7.0 | -- | 5.6 | 9.7 | 6.8 | -- | 9.9 | -- | 7.5 | 3.8 |

Table 3. Yield of hard red spring wheat varieties grown at four locations in western North Dakota, 2018-2020.

| Variety | <u>Dickinson</u> | | <u>Mandan</u> | | <u>Minot</u> | | <u>Williston</u> | | <u>Average</u> | |
|---------------|-------------------|-------|---------------|-------|--------------|-------|------------------|-------|----------------|-------|
| | 2020 | 3 Yr. | 2020 | 3 Yr. | 2020 | 3 Yr. | 2020 | 3 Yr. | 2020 | 3 Yr. |
| | ------(bu/a)----- | | | | | | | | | |
| AP Murdock | 42.0 | -- | 44.7 | -- | 59.7 | -- | 28.0 | -- | 43.6 | -- |
| Ambush | 40.8 | 49.6 | 42.9 | 43.2 | 59.9 | 64.1 | 28.7 | -- | 43.1 | -- |
| Ballistic | 48.5 | -- | 52.6 | -- | 65.3 | -- | 31.8 | -- | 49.6 | -- |
| Barlow | 43.5 | 49.6 | 43.0 | 41.2 | 52.1 | 60.2 | 25.9 | 46.0 | 41.1 | 49.3 |
| Bolles | 38.6 | 47.3 | 40.7 | 41.6 | 59.1 | 62.2 | 28.0 | 44.2 | 41.6 | 48.8 |
| Boost | 42.3 | 49.2 | 44.5 | 43.3 | 58.6 | 65.2 | 28.5 | 43.6 | 43.5 | 50.3 |
| Commander | 40.7 | -- | 44.5 | -- | 66.7 | -- | 29.5 | -- | 45.4 | -- |
| CP3530 | 44.4 | 53.2 | 45.9 | 44.3 | 67.8 | 69.0 | 31.2 | -- | 47.3 | -- |
| CP3903 | 42.2 | -- | 42.0 | -- | 60.6 | -- | 30.1 | -- | 43.7 | -- |
| CP3910 | 40.7 | -- | 45.3 | -- | 70.1 | -- | 27.5 | -- | 45.9 | -- |
| CP3915 | 44.5 | -- | 47.9 | -- | 55.6 | -- | 30.4 | -- | 44.6 | -- |
| Dagmar | 44.8 | -- | 40.5 | -- | 51.6 | -- | 28.6 | -- | 41.4 | -- |
| Driver | 45.4 | -- | 50.7 | -- | 65.0 | -- | 28.7 | -- | 47.5 | -- |
| Elgin-ND | 43.8 | 50.4 | 51.6 | 46.4 | 60.9 | 64.8 | 30.2 | 53.6 | 46.6 | 53.8 |
| Faller | 46.8 | 56.7 | 48.3 | 45.3 | 63.8 | 74.5 | 36.5 | 51.6 | 48.9 | 57.0 |
| Glenn | 37.3 | 48.5 | 42.0 | 44.3 | 55.8 | 59.1 | 29.2 | 47.9 | 41.1 | 50.0 |
| Lang-MN | 42.6 | 51.7 | 48.8 | 46.7 | 58.2 | 62.1 | 29.8 | 44.1 | 44.9 | 51.2 |
| Lanning | 44.4 | 54.3 | 47.4 | 43.5 | 56.4 | 66.2 | 30.6 | 51.9 | 44.7 | 54.0 |
| LCS Buster | 52.2 | -- | 54.0 | -- | 75.9 | -- | 32.6 | -- | 53.7 | -- |
| LCS Cannon | 44.4 | 49.4 | 41.5 | 42.9 | 56.3 | 61.3 | 26.7 | 46.1 | 42.2 | 49.9 |
| LCS Rebel | 44.4 | 51.3 | 46.8 | 45.2 | 60.2 | 61.0 | 34.1 | 50.6 | 46.4 | 52.0 |
| LCS Trigger | 51.6 | 58.2 | 50.2 | 45.1 | 73.0 | 75.1 | 34.3 | 54.4 | 52.3 | 58.2 |
| Linkert | 40.1 | 48.7 | 45.1 | 42.2 | 56.5 | 61.1 | 28.4 | 46.1 | 42.5 | 49.5 |
| MN-Torgy | 45.4 | -- | 48.2 | -- | 61.3 | -- | 32.1 | -- | 46.8 | -- |
| MN-Washburn | 40.1 | 51.2 | 40.4 | 42.7 | 54.6 | 60.8 | 29.0 | -- | 41.0 | -- |
| MS Barracuda | 36.4 | 41.4 | 43.6 | 42.8 | 59.6 | 68.7 | 27.9 | 44.6 | 41.9 | 49.4 |
| MS Chevelle | 46.9 | 56.3 | 41.7 | 42.6 | 69.0 | 67.7 | 28.7 | 49.7 | 46.6 | 54.1 |
| MS Rancho | 47.5 | -- | 49.1 | -- | 59.6 | -- | 31.6 | -- | 47.0 | -- |
| ND Frohberg | 41.2 | 48.4 | 45.2 | -- | 59.9 | 60.5 | 28.7 | -- | 43.8 | -- |
| ND VitPro | 38.9 | 47.7 | 46.1 | 43.4 | 52.3 | 56.2 | 28.2 | 48.5 | 41.4 | 49.0 |
| Shelly | 45.9 | 54.8 | 48.7 | 45.9 | 64.3 | 68.1 | 32.1 | 52.6 | 47.8 | 55.4 |
| SY 611CL2 | 44.2 | -- | 44.3 | 43.4 | 68.7 | 68.9 | 36.8 | -- | 48.5 | -- |
| SY Ingmar | 43.3 | 50.7 | 39.9 | 42.8 | 55.9 | 58.4 | 29.9 | 43.9 | 42.3 | 49.0 |
| SY Longmire | 43.0 | 51.4 | 45.1 | 43.4 | 63.5 | 63.8 | 32.9 | -- | 46.1 | -- |
| SY McCloud | 39.9 | 48.9 | 41.5 | 39.9 | 53.3 | 61.7 | 26.5 | -- | 40.3 | -- |
| SY Rockford | 47.5 | 55.4 | 49.6 | 44.6 | 64.6 | 72.5 | 31.4 | 52.2 | 48.3 | 56.2 |
| SY Soren | 40.5 | 50.3 | 39.4 | 39.3 | 61.7 | 65.0 | 28.5 | 46.3 | 42.5 | 50.2 |
| SY Valda | 46.6 | 52.2 | 51.5 | 46.3 | 52.1 | 61.8 | 31.0 | 51.2 | 45.3 | 52.9 |
| TCG-Heartland | 41.0 | -- | 42.1 | -- | 55.9 | -- | 34.5 | -- | 43.4 | -- |
| TCG-Spitfire | 47.7 | 55.5 | 48.7 | 45.5 | 68.9 | 68.1 | 33.1 | 54.5 | 49.6 | 55.9 |
| TCG-Wildcat | 47.3 | -- | 38.9 | -- | 65.7 | -- | 32.8 | -- | 46.2 | -- |
| Velocity | 40.4 | -- | 38.2 | -- | 55.0 | -- | 28.7 | -- | 40.6 | -- |
| Mean | 43.3 | 51.2 | 44.8 | 43.6 | 59.9 | 64.6 | 30.0 | 48.7 | 45.0 | 52.2 |
| CV% | 7.6 | -- | 14.0 | -- | 10.3 | -- | 9.6 | -- | -- | -- |
| LSD 0.05 | 4.6 | -- | 8.8 | -- | 10 | -- | 4.7 | -- | 4.3 | 3.7 |
| LSD 0.10 | 3.8 | -- | 7.4 | -- | 8.4 | -- | 3.9 | -- | 3.6 | 3.1 |

Table 4. Protein at 12% moisture of hard red spring wheat varieties grown at 10 locations in North Dakota, 2020.

| Variety | Carrington | Casselton | Grand Forks | Gwinner | Langdon | Steele Co. | Dickinson | Mandan | Minot | Williston | Avg. |
|---------------|----------------|-----------|-------------|---------|---------|------------|-----------|--------|-------|-----------|------|
| | ------(%)----- | | | | | | | | | | |
| Ambush | 17.8 | 15.0 | 16.0 | 16.0 | 15.6 | 15.8 | 16.7 | 14.3 | 14.9 | 20.1 | 16.2 |
| AP Murdock | 16.3 | 14.4 | 15.1 | 14.4 | 14.0 | 14.7 | 15.8 | 14.3 | 14.0 | 18.4 | 15.1 |
| Ballistic | 17.0 | 14.1 | 15.2 | 15.1 | 15.1 | 15.1 | 16.1 | 13.9 | 13.9 | 18.7 | 15.4 |
| Barlow | 17.4 | 14.8 | 15.6 | 15.4 | 15.6 | 15.5 | 15.7 | 14.8 | 14.4 | 17.5 | 15.7 |
| Bolles | 19.4 | 16.4 | 17.6 | 17.0 | 16.6 | 16.8 | 18.5 | 17.2 | 16.7 | 17.9 | 17.4 |
| Boost | 16.9 | 14.8 | 16.1 | 15.1 | 14.8 | 15.8 | 17.0 | 15.1 | 14.9 | 18.2 | 15.9 |
| Commander | 19.3 | 14.7 | 15.0 | 15.1 | 14.7 | 14.8 | 16.7 | 14.7 | 14.4 | 18.0 | 15.7 |
| CP3530 | 17.5 | 15.5 | 16.1 | 14.9 | 15.3 | 16.0 | 15.7 | 14.7 | 14.0 | 15.6 | 15.5 |
| CP3903 | 16.5 | 14.9 | 16.0 | 15.0 | 14.9 | 15.7 | 16.3 | 15.0 | 15.3 | 18.4 | 15.8 |
| CP3910 | 16.6 | 14.0 | 15.8 | 15.1 | 15.1 | 15.4 | 16.2 | 15.1 | 14.7 | 18.3 | 15.6 |
| CP3915 | 16.2 | 14.9 | 15.7 | 15.2 | 14.9 | 15.1 | 16.4 | 14.4 | 13.7 | 17.8 | 15.4 |
| Dagmar | 16.2 | 15.0 | 16.0 | 15.7 | 16.2 | 16.0 | 16.3 | 15.3 | 15.1 | 17.9 | 16.0 |
| Driver | 16.3 | 14.6 | 15.3 | 15.1 | 14.5 | 15.0 | 15.7 | 13.9 | 13.8 | 17.4 | 15.2 |
| Elgin-ND | 16.4 | 14.3 | 15.1 | 14.7 | 14.7 | 15.2 | 15.7 | 14.2 | 14.7 | 18.1 | 15.3 |
| Faller | 16.1 | 13.4 | 14.6 | 14.3 | 14.1 | 14.6 | 16.0 | 13.8 | 13.6 | 18.5 | 14.9 |
| Glenn | 18.1 | 15.4 | 16.0 | 15.3 | 15.2 | 15.6 | 16.6 | 15.0 | 15.2 | 18.0 | 16.0 |
| Lang-MN | 16.3 | 15.7 | 16.5 | 16.6 | 15.6 | 16.4 | 16.1 | 14.9 | 14.0 | 17.2 | 15.9 |
| Lanning | 18.8 | 15.1 | 16.6 | 16.5 | 16.6 | 16.2 | 16.7 | 14.9 | 14.3 | 18.6 | 16.4 |
| LCS Buster | 16.6 | 12.8 | 13.1 | 13.0 | 12.8 | 13.0 | 13.9 | 12.2 | 12.2 | 19.2 | 13.9 |
| LCS Cannon | 17.9 | 14.3 | 15.1 | 15.0 | 14.8 | 14.8 | 15.3 | 14.8 | 13.9 | 18.3 | 15.4 |
| LCS Rebel | 16.9 | 15.0 | 16.1 | 14.8 | 15.4 | 15.7 | 16.7 | 15.6 | 14.0 | 15.4 | 15.6 |
| LCS Trigger | 15.8 | 13.1 | 13.2 | 13.3 | 12.6 | 13.5 | 14.4 | 12.1 | 12.2 | 18.3 | 13.8 |
| Linkert | 17.8 | 15.1 | 15.8 | 15.6 | 15.8 | 15.4 | 17.5 | 15.0 | 15.9 | 15.3 | 15.9 |
| MN-Torgy | 16.3 | 15.4 | 15.9 | 16.0 | 15.5 | 15.5 | 15.8 | 14.1 | 13.7 | 17.2 | 15.5 |
| MN-Washburn | 17.2 | 14.3 | 16.4 | 15.2 | 14.4 | 16.0 | 15.5 | 13.7 | 13.6 | 17.4 | 15.4 |
| MS Barracuda | 17.8 | 15.4 | 16.3 | 15.4 | 15.8 | 16.2 | 17.0 | 16.3 | 15.0 | 17.3 | 16.2 |
| MS Chevelle | 17.5 | 13.4 | 14.8 | 14.3 | 14.3 | 14.7 | 14.6 | 13.7 | 12.7 | 16.2 | 14.6 |
| MS Rancho | 15.7 | 14.5 | 15.0 | 15.9 | 15.4 | 15.3 | 15.2 | 14.3 | 12.9 | 18.5 | 15.3 |
| ND Frohberg | 17.1 | 14.3 | 15.8 | 14.8 | 14.7 | 15.1 | 16.8 | 15.2 | 15.4 | 18.3 | 15.7 |
| ND VitPro | 19.4 | 14.8 | 16.2 | 15.6 | 15.1 | 15.8 | 17.0 | 15.7 | 15.1 | 16.6 | 16.1 |
| Shelly | 16.7 | 14.0 | 14.8 | 14.2 | 16.1 | 15.1 | 15.3 | 14.1 | 13.7 | 17.9 | 15.2 |
| SY 611CL2 | 19.3 | 14.5 | 15.4 | 15.3 | 14.9 | 15.3 | 16.4 | 15.0 | 14.5 | 18.1 | 15.9 |
| SY Ingmar | 18.2 | 15.0 | 15.9 | 15.3 | 15.2 | 15.2 | 16.7 | 15.6 | 15.5 | 17.6 | 16.0 |
| SY Longmire | 17.8 | 14.8 | 15.9 | 15.3 | 15.2 | 15.3 | 16.0 | 15.4 | 14.9 | 17.2 | 15.8 |
| SY McCloud | 18.4 | 15.5 | 15.9 | 15.0 | 15.1 | 15.0 | 17.5 | 15.8 | 14.9 | 18.2 | 16.1 |
| SY Rockford | 17.8 | 14.5 | 16.1 | 15.9 | 15.8 | 15.8 | 16.1 | 15.2 | 13.4 | 17.3 | 15.8 |
| SY Soren | 18.6 | 14.8 | 15.8 | 15.5 | 15.1 | 14.9 | 16.9 | 15.0 | 15.4 | 18.2 | 16.0 |
| SY Valda | 16.3 | 14.2 | 15.4 | 14.7 | 14.2 | 15.3 | 15.0 | 14.1 | 13.5 | 19.1 | 15.2 |
| TCG-Heartland | 18.5 | 15.1 | 15.9 | 15.4 | 15.7 | 15.5 | 17.1 | 15.3 | 15.0 | 18.4 | 16.2 |
| TCG-Spitfire | 16.7 | 13.7 | 15.0 | 14.8 | 14.0 | 14.2 | 14.7 | 13.2 | 14.0 | 17.8 | 14.8 |
| TCG-Wildcat | 17.5 | 14.8 | 16.0 | 14.9 | 15.2 | 15.0 | 16.2 | 15.6 | 14.7 | 15.6 | 15.6 |
| Velocity | 17.7 | 15.7 | 16.7 | 16.0 | 16.1 | 16.5 | 17.0 | 14.8 | 15.4 | 17.3 | 16.3 |
| Mean | 17.4 | 14.7 | 15.6 | 15.2 | 15.1 | 15.3 | 16.2 | 14.7 | 14.4 | 17.7 | 15.6 |
| CV% | 5.1 | -- | 1.5 | 2.4 | 3.0 | 1.8 | 3.6 | 3.3 | 5.5 | 2.3 | -- |
| LSD 0.05 | 1.3 | -- | 0.3 | 0.6 | 0.6 | 0.3 | 0.8 | 0.7 | 1.3 | 0.6 | 0.5 |
| LSD 0.10 | 1.0 | -- | 0.3 | 0.5 | 0.5 | 0.3 | 0.7 | 0.6 | 1.0 | 0.5 | 0.4 |

Table 5. Test weight of hard red spring wheat varieties grown at 10 locations in North Dakota, 2020.

| Variety | Carrington | Casselton | Grand Forks | Gwinner | Langdon | Steele Co. | Dickinson | Mandan | Minot | Williston | Avg. |
|---------------|--------------------|-----------|-------------|---------|---------|------------|-----------|--------|-------|-----------|------|
| | ------(lb/bu)----- | | | | | | | | | | |
| Ambush | 62.6 | 60.0 | 58.6 | 58.2 | 59.6 | 58.0 | 61.3 | 61.5 | 61.8 | 59.8 | 60.2 |
| AP Murdock | 61.5 | 57.0 | 57.9 | 58.0 | 59.7 | 57.8 | 60.5 | 61.2 | 59.5 | 59.3 | 59.2 |
| Ballistic | 61.8 | 59.1 | 58.2 | 57.7 | 56.7 | 56.7 | 61.0 | 61.7 | 59.6 | 58.9 | 59.1 |
| Barlow | 62.4 | 59.6 | 58.9 | 59.0 | 59.3 | 58.8 | 62.2 | 62.1 | 61.4 | 60.0 | 60.4 |
| Bolles | 60.4 | 58.0 | 57.8 | 57.2 | 58.8 | 57.2 | 60.4 | 60.2 | 59.9 | 58.4 | 58.8 |
| Boost | 62.2 | 58.7 | 58.7 | 58.1 | 59.7 | 58.2 | 60.7 | 60.7 | 60.1 | 58.2 | 59.5 |
| Commander | 59.5 | 59.5 | 58.1 | 58.6 | 59.2 | 57.6 | 61.1 | 61.0 | 60.5 | 60.1 | 59.5 |
| CP3530 | 61.3 | 56.9 | 58.4 | 58.7 | 60.1 | 58.8 | 61.0 | 62.2 | 60.3 | 59.4 | 59.7 |
| CP3903 | 62.2 | 60.0 | 59.6 | 59.4 | 62.1 | 59.6 | 61.8 | 62.2 | 59.7 | 60.2 | 60.7 |
| CP3910 | 63.4 | 59.4 | 58.3 | 58.2 | 58.6 | 56.9 | 62.2 | 63.1 | 61.0 | 60.4 | 60.1 |
| CP3915 | 63.4 | 60.3 | 58.8 | 59.4 | 61.1 | 60.4 | 62.0 | 62.4 | 60.6 | 60.1 | 60.8 |
| Dagmar | 61.8 | 58.5 | 57.8 | 57.7 | 58.9 | 57.7 | 61.0 | 60.8 | 58.3 | 59.0 | 59.2 |
| Driver | 63.9 | 58.7 | 59.7 | 59.1 | 60.0 | 59.7 | 62.6 | 62.5 | 61.8 | 60.6 | 60.9 |
| Elgin-ND | 62.2 | 57.7 | 58.3 | 58.1 | 59.1 | 55.8 | 61.0 | 61.8 | 59.4 | 58.6 | 59.2 |
| Faller | 61.9 | 58.3 | 57.9 | 57.8 | 59.7 | 57.7 | 60.8 | 61.5 | 59.6 | 58.4 | 59.4 |
| Glenn | 61.8 | 61.1 | 59.2 | 59.9 | 62.5 | 59.6 | 62.6 | 62.4 | 61.0 | 60.9 | 61.1 |
| Lang-MN | 62.9 | 58.0 | 58.3 | 57.9 | 60.7 | 58.4 | 61.6 | 62.0 | 61.3 | 59.0 | 60.0 |
| Lanning | 60.0 | 56.1 | 56.6 | 55.8 | 55.1 | 55.6 | 60.4 | 61.1 | 59.2 | 59.1 | 57.9 |
| LCS Buster | 61.1 | 54.7 | 57.3 | 55.6 | 57.0 | 57.3 | 60.8 | 61.6 | 59.4 | 58.3 | 58.3 |
| LCS Cannon | 63.4 | 59.7 | 58.9 | 58.9 | 59.8 | 58.7 | 62.7 | 62.9 | 61.6 | 61.3 | 60.8 |
| LCS Rebel | 62.8 | 60.5 | 59.1 | 60.5 | 61.5 | 59.1 | 61.9 | 61.8 | 62.1 | 60.0 | 60.9 |
| LCS Trigger | 62.1 | 56.2 | 58.9 | 59.2 | 60.2 | 58.8 | 61.7 | 62.4 | 61.0 | 59.6 | 60.0 |
| Linkert | 61.2 | 59.3 | 58.5 | 58.0 | 59.8 | 58.7 | 60.9 | 62.1 | 60.5 | 59.3 | 59.8 |
| MN-Torgy | 63.2 | 58.7 | 59.3 | 58.1 | 59.1 | 58.9 | 61.5 | 62.4 | 60.8 | 60.0 | 60.2 |
| MN-Washburn | 61.7 | 58.6 | 58.6 | 58.7 | 60.0 | 59.3 | 61.2 | 61.6 | 60.1 | 59.2 | 59.9 |
| MS Barracuda | 61.3 | 59.1 | 57.4 | 57.6 | 57.9 | 55.0 | 60.9 | 60.6 | 60.2 | 59.4 | 58.9 |
| MS Chevelle | 60.8 | 58.7 | 57.0 | 57.3 | 58.1 | 55.8 | 61.7 | 61.5 | 60.5 | 59.5 | 59.1 |
| MS Ranchero | 61.3 | 56.4 | 56.1 | 54.6 | 54.6 | 53.7 | 60.3 | 60.4 | 58.9 | 58.7 | 57.5 |
| ND Frohberg | 62.6 | 58.5 | 58.5 | 59.1 | 61.0 | 58.8 | 61.4 | 61.6 | 61.5 | 59.3 | 60.2 |
| ND VitPro | 59.9 | 60.6 | 60.1 | 60.1 | 62.2 | 59.1 | 61.8 | 62.4 | 60.8 | 60.4 | 60.7 |
| Shelly | 63.0 | 59.2 | 58.7 | 57.2 | 55.5 | 56.5 | 61.8 | 60.1 | 59.9 | 60.2 | 59.2 |
| SY 611CL2 | 61.5 | 58.7 | 58.9 | 58.5 | 60.4 | 58.1 | 61.9 | 63.2 | 61.6 | 60.5 | 60.3 |
| SY Ingmar | 61.1 | 60.5 | 59.5 | 59.1 | 60.6 | 59.1 | 62.1 | 61.8 | 61.2 | 60.6 | 60.6 |
| SY Longmire | 62.5 | 58.3 | 58.5 | 58.7 | 59.4 | 58.1 | 61.5 | 62.3 | 60.5 | 60.0 | 60.0 |
| SY McCloud | 62.0 | 59.7 | 58.3 | 59.4 | 61.2 | 59.3 | 61.7 | 62.3 | 60.7 | 61.3 | 60.6 |
| SY Rockford | 60.7 | 56.1 | 53.6 | 53.7 | 54.9 | 51.8 | 59.8 | 60.1 | 59.2 | 58.7 | 56.9 |
| SY Soren | 61.5 | 58.1 | 57.9 | 57.6 | 59.5 | 58.1 | 61.3 | 61.9 | 60.5 | 60.1 | 59.6 |
| SY Valda | 63.1 | 60.1 | 58.2 | 58.9 | 59.9 | 58.6 | 61.8 | 61.8 | 60.3 | 59.8 | 60.3 |
| TCG-Heartland | 62.5 | 60.7 | 58.3 | 59.5 | 59.8 | 58.6 | 61.7 | 62.6 | 61.1 | 60.1 | 60.5 |
| TCG-Spitfire | 61.2 | 58.3 | 57.8 | 57.7 | 60.1 | 58.5 | 61.5 | 61.8 | 60.8 | 59.4 | 59.7 |
| TCG-Wildcat | 61.8 | 59.9 | 59.5 | 59.4 | 60.5 | 59.7 | 62.0 | 61.9 | 61.6 | 60.0 | 60.6 |
| Velocity | 62.2 | 58.5 | 58.6 | 58.9 | 60.3 | 59.0 | 61.7 | 61.3 | 61.2 | 59.7 | 60.1 |
| Mean | 61.9 | 58.7 | 58.3 | 58.2 | 59.1 | 57.9 | 61.4 | 61.6 | 60.3 | 59.5 | 59.8 |
| CV% | 1.3 | 2.0 | 2.1 | 1.0 | 1.8 | 2.1 | 0.7 | 1.5 | 1.2 | 0.6 | -- |
| LSD 0.05 | 1.1 | 1.9 | 1.4 | 0.9 | 1.5 | 2.0 | 0.6 | 1.3 | 1.2 | 0.5 | 2.5 |
| LSD 0.10 | 0.9 | 1.6 | 1.2 | 0.8 | 1.2 | 1.7 | 0.5 | 1.1 | 1.0 | 0.5 | 2.1 |

Table 6. Quality data from 2019 eastern North Dakota 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 | 62.5 | 75 | 36.3 | 390 | 14.4 | 67.4 | 61.2 | 12.5 | 958 |
| Barlow | 62.4 | 70 | 34.6 | 339 | 14.4 | 69.7 | 65.8 | 10.1 | 946 |
| Bolles | 61.4 | 70 | 36.4 | 392 | 15.2 | 66.1 | 63.0 | 22.3 | 948 |
| Boost | 60.9 | 74 | 35.5 | 389 | 14.1 | 67.8 | 64.0 | 8.1 | 885 |
| Commander | 61.5 | 64 | 34.9 | 389 | 13.7 | 69.0 | 61.9 | 8.2 | 901 |
| CP 3530 | 60.8 | 45 | 34.8 | 418 | 13.7 | 69.1 | 62.1 | 8.7 | 976 |
| CP 3910 | 61.4 | 65 | 32.2 | 368 | 14.0 | 68.9 | 58.3 | 12.5 | 998 |
| CP 3915 | 61.8 | 79 | 31.0 | 397 | 14.1 | 71.4 | 62.5 | 10.5 | 968 |
| Elgin-ND | 60.9 | 62 | 35.0 | 354 | 14.0 | 68.0 | 64.1 | 8.8 | 941 |
| Faller | 61.8 | 56 | 39.7 | 398 | 13.4 | 68.8 | 64.1 | 7.7 | 913 |
| Glenn | 64.0 | 91 | 34.5 | 354 | 14.6 | 66.6 | 63.5 | 13.0 | 1,008 |
| Lang-MN | 62.6 | 91 | 32.5 | 433 | 14.3 | 68.5 | 63.4 | 9.8 | 934 |
| LCS Cannon | 61.6 | 30 | 32.1 | 366 | 13.7 | 69.9 | 61.7 | 11.1 | 995 |
| LCS Rebel | 62.6 | 74 | 35.2 | 369 | 14.5 | 70.4 | 63.2 | 10.8 | 1,013 |
| LCS Trigger | 60.9 | 74 | 34.4 | 433 | 12.5 | 69.6 | 63.1 | 6.6 | 796 |
| Linkert | 61.5 | 67 | 37.4 | 408 | 14.5 | 66.6 | 62.5 | 15.3 | 1,005 |
| MN-Torgy | 61.6 | 62 | 34.1 | 343 | 14.6 | 68.2 | 61.9 | 11.3 | 915 |
| MN-Washburn | 61.1 | 86 | 34.5 | 384 | 13.8 | 71.1 | 61.1 | 11.0 | 955 |
| MS Barracuda | 61.3 | 75 | 36.7 | 364 | 14.6 | 68.4 | 63.6 | 9.3 | 986 |
| MS Chevelle | 61.5 | 55 | 34.2 | 340 | 12.9 | 67.7 | 62.2 | 10.0 | 950 |
| ND Frohberg | 62.2 | 67 | 38.2 | 333 | 13.7 | 67.7 | 64.4 | 11.6 | 963 |
| ND VitPro | 63.1 | 91 | 34.3 | 385 | 14.3 | 68.5 | 64.3 | 9.7 | 953 |
| Shelly | 61.2 | 31 | 33.9 | 393 | 13.0 | 70.3 | 59.9 | 12.1 | 919 |
| SY 611 CL2 | 62.5 | 38 | 35.0 | 403 | 13.9 | 67.0 | 66.9 | 6.8 | 886 |
| SY Ingmar | 61.4 | 65 | 31.6 | 386 | 13.8 | 68.3 | 61.6 | 10.6 | 970 |
| SY Longmire | 62.0 | 63 | 34.9 | 386 | 13.9 | 68.0 | 63.1 | 7.7 | 954 |
| SY McCloud | 62.5 | 57 | 37.8 | 305 | 14.1 | 67.7 | 64.7 | 8.5 | 959 |
| SY Rockford | 60.6 | 57 | 36.2 | 390 | 13.7 | 67.7 | 62.5 | 10.4 | 954 |
| SY Soren | 62.0 | 45 | 32.7 | 397 | 14.4 | 67.7 | 62.5 | 8.2 | 994 |
| SY Valda | 61.5 | 77 | 35.2 | 376 | 12.9 | 69.1 | 60.9 | 7.3 | 905 |
| TCG-Heartland | 62.7 | 65 | 35.8 | 407 | 14.2 | 69.3 | 61.9 | 13.5 | 944 |
| TCG-Spitfire | 60.9 | 50 | 36.1 | 305 | 13.4 | 68.0 | 63.0 | 8.4 | 976 |
| TCG-Stalwart | 59.2 | 81 | 35.0 | 380 | 14.6 | 68.4 | 62.8 | 9.4 | 979 |

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.

²Vitreous 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.

³1,000 KWT - Estimate of weight of 1,000 seeds based on a clean 10g sample. Expressed in grams and used to approximate seed size.

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.

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

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

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

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

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

Table 7. Quality data from 2019 western North Dakota 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 | 61.8 | 42 | 38.3 | 393 | 16.4 | 66.0 | 62.7 | 10.7 | 975 |
| Barlow | 61.7 | 59 | 35.9 | 370 | 16.0 | 67.8 | 66.3 | 16.1 | 1,003 |
| Bolles | 60.2 | 53 | 37.1 | 446 | 17.8 | 64.4 | 65.4 | 30.7 | 990 |
| Boost | 60.3 | 55 | 37.4 | 424 | 15.7 | 66.8 | 65.3 | 8.5 | 988 |
| Commander | 61.3 | 40 | 38.4 | 401 | 15.9 | 67.0 | 64.1 | 7.5 | 905 |
| CP 3530 | 60.8 | 30 | 37.7 | 380 | 15.1 | 69.0 | 65.4 | 10.9 | 965 |
| CP 3910 | 62.6 | 81 | 34.8 | 363 | 16.2 | 69.4 | 61.9 | 13.5 | 1,015 |
| CP 3915 | 62.5 | 88 | 34.3 | 422 | 16.3 | 70.7 | 64.5 | 15.0 | 960 |
| Elgin-ND | 60.7 | 50 | 34.1 | 391 | 15.7 | 66.9 | 65.5 | 9.6 | 975 |
| Faller | 60.5 | 36 | 38.1 | 400 | 14.6 | 68.3 | 63.2 | 12.2 | 955 |
| Glenn | 63.3 | 92 | 35.6 | 352 | 16.4 | 65.8 | 65.8 | 14.0 | 988 |
| Lang-MN | 61.5 | 81 | 36.0 | 395 | 16.4 | 67.3 | 66.1 | 9.5 | 918 |
| Lanning | 61.2 | 81 | 39.4 | 372 | 16.3 | 65.4 | 64.6 | 10.4 | 903 |
| LCS Cannon | 62.7 | 51 | 36.6 | 338 | 15.7 | 69.6 | 64.0 | 12.7 | 985 |
| LCS Rebel | 62.0 | 60 | 38.3 | 384 | 15.7 | 68.5 | 64.2 | 12.7 | 930 |
| LCS Trigger | 61.1 | 59 | 33.4 | 439 | 13.1 | 68.4 | 63.5 | 10.2 | 728 |
| Linkert | 61.1 | 59 | 39.6 | 430 | 16.9 | 65.1 | 65.7 | 20.2 | 1,000 |
| MN-Torgy | 61.6 | 46 | 35.7 | 449 | 15.8 | 66.3 | 63.5 | 19.0 | 858 |
| MN-Washburn | 61.0 | 94 | 33.0 | 431 | 15.0 | 69.4 | 61.8 | 18.0 | 883 |
| MS Barracuda | 61.4 | 56 | 41.7 | 447 | 16.7 | 67.4 | 65.7 | 12.2 | 1,013 |
| MS Chevelle | 61.1 | 45 | 34.5 | 367 | 14.6 | 67.8 | 64.0 | 11.2 | 970 |
| ND Frohberg | 61.8 | 56 | 39.0 | 426 | 16.0 | 65.7 | 68.6 | 13.3 | 980 |
| ND VitPro | 62.9 | 92 | 35.9 | 409 | 16.5 | 66.6 | 65.6 | 9.7 | 998 |
| Shelly | 61.4 | 35 | 37.8 | 470 | 15.2 | 70.0 | 61.6 | 25.7 | 878 |
| SY 611 CL2 | 63.0 | 78 | 37.2 | 417 | 16.0 | 65.4 | 69.3 | 8.2 | 890 |
| SY Ingmar | 61.9 | 55 | 34.8 | 412 | 16.4 | 66.6 | 64.9 | 12.2 | 1,063 |
| SY Longmire | 61.9 | 47 | 36.8 | 447 | 16.0 | 67.8 | 65.4 | 12.3 | 993 |
| SY McCloud | 62.4 | 46 | 40.8 | 340 | 16.4 | 66.3 | 67.3 | 10.9 | 940 |
| SY Rockford | 60.0 | 41 | 36.9 | 452 | 15.3 | 66.3 | 66.4 | 11.4 | 905 |
| SY Soren | 61.7 | 32 | 34.0 | 413 | 16.6 | 67.1 | 64.8 | 10.3 | 1,038 |
| SY Valda | 60.9 | 67 | 37.3 | 380 | 15.1 | 67.2 | 62.8 | 9.6 | 933 |
| TCG-Heartland | 62.5 | 49 | 39.6 | 421 | 16.3 | 68.1 | 64.9 | 17.3 | 918 |
| TCG-Spitfire | 60.9 | 53 | 36.0 | 366 | 14.8 | 67.3 | 65.0 | 14.6 | 935 |
| TCG-Stalwart | 60.4 | 54 | 38.1 | 426 | 16.5 | 68.4 | 64.5 | 15.5 | 973 |

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.

²Vitreous 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.

³1,000 KWT - Estimate of weight of 1,000 seeds based on a clean 10g sample. Expressed in grams and used to approximate seed size.

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.

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

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

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

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

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

NDSU does not endorse commercial products or companies even though reference may be made to tradenames, trademarks or service names.

For more information on this and other topics, see www.ag.ndsu.edu

NDSU encourages you to use and share this content, but please do so under the conditions of our Creative Commons license. You may copy, distribute, transmit and adapt this work as long as you give full attribution, don't use the work for commercial purposes and share your resulting work similarly. For more information, visit www.ag.ndsu.edu/agcomm/creative-commons.

County commissions, North Dakota State University and U.S. Department of Agriculture cooperating. NDSU does not discriminate in its programs and activities on the basis of age, color, gender expression/identity, genetic information, marital status, national origin, participation in lawful off-campus activity, physical or mental disability, pregnancy, public assistance status, race, religion, sex, sexual orientation, spousal relationship to current employee, or veteran status, as applicable. Direct inquiries to Vice Provost for Title IX/ADA Coordinator, Old Main 201, NDSU Main Campus, 701-231-7708, ndsu.eoaa.ndsu.edu. This publication will be made available in alternative formats for people with disabilities upon request, 701-231-7881.