**UNITED STATES DEPARTMENT OF AGRICULTURE**

**AGRICULTURAL RESEARCH SERVICE**

**In cooperation with**

**STATE AGRICULTURAL EXPERIMENT STATIONS**

**Report on Hard Red Spring Wheat Varieties Grown in Cooperative Plot and**

**Nursery Experiments in the Spring Wheat Region in 2023**

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This is a joint progress report of cooperative investigations underway in the State Agricultural Experiment Stations and the Agricultural Research Service of the U.S. Department of Agriculture. It contains preliminary data which have not been sufficiently confirmed to justify general release, and interpretations may be modified after additional experimentation. Confirmed results will be published through established channels. This report is primarily a tool for use by cooperators and their official staffs, and for those persons having direct and special interest in the development of agricultural research programs.

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**2023 HARD RED SPRING WHEAT UNIFORM REGIONAL NURSERY REPORT**

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**COOPERATING AGENCIES, STATIONS, AND PERSONNEL FOR THE 2023 HRSWURN**

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**Entering Lines with Protected or Patented Genes into the Hard Red Spring Wheat Uniform Regional Nursery**

Transgenic wheat lines may be considered for the nursery program ONLY if they have been granted permanent non-regulated status. Non-regulated status is granted only after the originator files a formal petition to de-regulate a line with APHIS. However, ultimately the decision whether to include or exclude such germplasm will reside with individual location cooperators.

**PREVIOUS HRSWURN ENTRIES RELEASED AS NEW CULTIVARS**

Previously, the HRSWURN Annual Report included the names of released cultivars that were tested as entries. The last year that this information was included was 2008. The released variety name, experimental name, PI number, brief description, and years entered in the HRSWURN or URSN are included below. Released varieties are listed in order of year released.

**Walworth** (SD3348, PI 630938, PVP#200200108) Released in 2002 by South Dakota State University. Good adaptation to the spring wheat region with high yield. **HRSWURN 1998-2000**

**Briggs** (SD3367, PI 632970) Released in 2002 by the South Dakota Agricultural Experiment Station. It has high and stable yield potential, above average test weight and protein content. It has good disease resistance to leaf rust and stem rust, and an intermediate resistance to FHB. **HRSWURN 2000-2001, URSN 1998**

**Oklee** (MN95002-A, PI 634553) Released in 2003 in cooperation between the University of Minnesota Agricultural Experiment Station and USDA-ARS. It is a semidwarf hard red spring wheat with high yield, high protein content, early maturity and moderate resistance to FHB. **HRSWURN 1998-1999**

**Dapps** (ND724, PI 633862) Released in 2003 by the North Dakota Agricultural Experiment Station. It has a good yield potential with high end-use quality and is resistant to seed shattering. **HRSWURN 1999-2000**

**Granger** (SD3546, PI 636134) Released in 2004 by the South Dakota Agricultural Experiment Station for its superior yield potential, moderate resistance to FHB, large seed, and excellent end-use quality. **HRSWURN 2001-2003**

**Steele-ND** (ND741, PI 634981) Released in 2004 by the North Dakota Agricultural Experiment Station. It has high yield and end-use quality with good FHB resistance from a source not originating from Sumai-3. **HRSWURN 2001-2004**

**Ulen** (MN97803-A, PI 639921) Released in 2005 in cooperation between the University of Minnesota Agricultural Experiment Station and USDA-ARS. It is a semidwarf hard red spring wheat with good yield, good protein content, and has early maturity. **HRSWURN 2000-2001**

**Glenn** (ND747, PI 639273) Released in 2005 by the North Dakota Agricultural Experiment Station. A semidwarf variety with high grain yield and volume, excellent end-use quality and high level of resistance to FHB. It also has resistance to seed shattering. **HRSWURN 2003-2004**

**Ada** (MN95229-A, PI 642856) Released in 2006 in cooperation between University of Minnesota Agricultural Experiment Station and USDA-ARS. It is a semidwarf hard red spring wheat with high yield, high protein concentration, good leaf rust resistance, and straw strength. **HRSWURN 1999-2000**

**Traverse** (SD3687, PI 642780) Released in 2006 by the South Dakota Agricultural Experiment Station. It has high yield potential with good FHB resistance. **HRSWURN 2004-2005**

**Howard** (ND800, PI 642367) Released in 2006 by the North Dakota Agricultural Experiment Station due to its high yield and end-use quality. A semidwarf variety with a good level of resistance to FHB derived from tetraploid *Triticum dicoccoides*. **HRSWURN 2003-2004**

**RB07** (MN99436-6, PI 652930) Released in 2007 by the University of Minnesota Agricultural Experiment Station. It’s a hard red spring wheat with consistent and high yields, early maturity, good end-use quality and moderately resistant to FHB. **HRSWURN 2003-2004**

**Cromwell** (MN00261-4, PI 653527) Released in 2007 by Thunder Seed, license required for seed production. Hard red spring wheat with moderately strong straw, good test weight, and good end-use quality. Moderately resistant to FHB. **HRSWURN 2004-2005, URSN 2006**

**Faller** (ND805, PI 648350) Released in 2007 by the North Dakota Agricultural Experiment Station. It is a semidwarf that combines very high yield potential and good end-use quality with resistance to FHB and leaf diseases.

**Tom** (MN01311-A-1, PI 656383) Released in 2008 by the University of Minnesota Agricultural Experiment Station due to its high yield, moderate resistance to FHB (type 2 resistance), and adult plant resistance to Ug99 race of stem rust. **HRSWURN 2004-2005, URSN 2006**

**ND901CL** (ND901, PI 655233) Released in 2008 by the North Dakota Agricultural Experiment Station. A semidwarf variety with resistance to imadazolinone herbicides, namely Clearfield. It is adapted to rainfed environments and has high yield potential and good end-use quality.

**Sabin** (MN03358-4, PI 659083) Released in 2009 by the University of Minesota Agricultural Experiment Station due to its high yield, moderate resistance to FHB due to the Fhb1 locus, and has the Lr34 gene for adult plant resistance to leaf rust. It heads relatively later than other cultivars in the region. **HRSWURN 2006-2007, URSN 2008**

**Brick** (SD3851, PI 657697) Released in 2009 by the South Dakota Agricultural Experiment Station due to its high resistance to FHB and high yield potential. It has early maturity and is moderately resistant to leaf rust. **HRSWURN 2005-2006, URSN 2007**

**Mott** (NDSW0449, PI 658542) Released in 2009 by the North Dakota Agricultural Experiment Station due to its wheat stem sawfly resistance. **HRSWURN 2006-2008**

**Barlow** (ND809, PI 658018) Released in 2009 by the North Dakota Agricultural Experiment Station. A semidwarf variety adapted to rainfed regions and has high yield potential, excellent end-use quality, and resistance to many diseases, including medium resistance to FHB.

**Select** (SD3948, PI 659554) Released in 2010 by the South Dakota Agricultural Experiment Station due to its high resistance to FHB with high yield potential. It is also moderately resistant to leaf rust and has an early heading date. **HRSWURN 2007-2008, URSN 2009**

**Rollag** (MN05214-3, PI 665250) Released in 2011 by the University of Minnesota Agricultural Experiment Station due to its good resistance to FHB and has the Fhb1 locus. This semidwarf variety also has a competitive yield, very good straw strength, and acceptable end-use quality. **HRSWURN 2009-2010, URSN check 2019-2023**

**Prosper** (ND808, PI 662387) Released in 2011 cooperation between the North Dakota Agricultural Experiment Station and the Minnesota Agricultural Experiment Station. A semidwarf variety with good adaptation to the U.S. North Central Plains due to its high yield potential and good milling and baking qualities. It is resistant to stem rust and moderately resistant to FHB. And has resistance to leaf rust due to Lr21. **HRSWURN check 2019-2023**

**Norden** (MN03196, PI 667104) Released in 2012 by the Minnesota Agricultural Experiment Station. A semidwarf wheat with good yield, very good straw strength, resistant to preharvest sprouting, and resistance to lodging. It has the Fhb1 locus and is moderately resistant to FHB. It has the Lr34 gene for leaf rust resistance. **HRSWURN 2007-2008**

**LCS Breakaway** (MN02072-7, PI 667103) Licensed by Limagrain Cereal Seeds LLC for its good yield and high protein. It has good disease resistance and stiff straw. **HRSWURN 2005-2006**

**Forefront** (SD3997, PI 664483) Released in 2012 by the South Dakota Agricultural Experiment Station due to its competitive high yield and protein content. It has resistance to FHB and leaf rust, along with an early heading date. **HRSWURN 2009-2010, URSN 2009**

**Advance** (SD4023, PI 664482) Released in 2012 by South Dakota Agricultural Experiment Station due to its competitive yield potential, grain volume weight and short height. It has the slow rusting gene Lr34 and is resistant to leaf rust. **HRSWURN 2010**

**Velva** (ND811, PI 665417) Released in 2012 by the North Dakota Agricultural Experiment Station. It has high yield potential, good end-use quality, and good disease resistance, including FHB and stem rust. It is resistant to leaf rust due to Lr21.

**Linkert** (MN06028, PI 672164) Released in 2013 by the University of Minnesota Agricultural Experiment Station for its very good straw strength, good yield potential, high protein concentration, strong gluten and good bread baking qualities. Resistant to preharvest sprouting. It is moderately susceptible to FHB but has field resistance to the Ug99 race of stem rust. **HRSWURN 2009-2010, HRSWURN check 2019-2023**

**Prevail** (SD4178, PI 672486) Released in 2013 by the South Dakota Agricultural Experiment Station due to its competitive high yield potential and desirable plant height for the region. **HRSWURN 2013**

**Elgin-ND** (ND818, PI 668099) Released in 2013 by the North Dakota Agricultural Experiment Station. It has high yield potential, high protein, end-use quality, and great disease resistance, including FHB, stem rust, tan spot, and bacterial leaf blight. It has Lr21, conferring leaf rust resistance.

**Focus** (SD4362, PI 675337) Released in 2014 by the South Dakota Agricultural Experiment Station due to its yield potential, high grain volume weight, and early maturity. A goal is to replace Brick due to its susceptibility to leaf rust. It has the slow rusting gene Lr34, and Fhb1 locus providing good resistance to FHB. **HRSWURN 2014**

**Bolles** (MN08165-8, PI 678430) Released in 2015 by University of Minnesota Agricultural Experiment Station because of its high protein concentration, strong gluten and end-use quality. It is a hard red spring wheat with good yield potential and good resistance to FHB. **Tri-State nursery 2011-2012**

**Boost** (SD4299, PI 678681) Released in 2015 by the South Dakota Agricultural Experiment Station. Has good yield potential, good protein content along with disease resistance to FHB and bacterial leaf streak. **HRSWURN 2013-2014, HRSWURN check 2019-2023**

**Surpass** (SD4383, PI 678682) Released in 2015 by the South Dakota Agricultural Experiment Station. Has good potential and good protein content. Resistant to bacterial leaf streak and FHB. **HRSWURN 2014-2015**

**WB9208** (MN07098-6, PI 678443)Released in 2016 by Monsanto Technology LLC for its good yield potential. **HRSWURN 2010**

**Shelly** (MN11325-7, PI 681618) Released in 2016 by the University of Minnesota Agricultural Experiment Station. A semidwarf hard red spring wheat with high yield potential, good end-use quality, and protein concentration. Moderate resistance to FHB. **HRSWURN 2014-2015**

**Lanning** (MT1316, PI 676978) Released in 2016 Montana Agricultural Experiment Station due to its high yield potential in dryland conditions and superior end-use quality. It is an awned, semidwarf hard red spring wheat. It is hollow stemmed, making it susceptible to wheat stem sawfly. **HRSWURN 2015-2016, URSN 2015-2016 and 2019**

**Lang-MN** (MN10261-1, PI 687038) Released in 2017 by the University of Minnesota Agricultural Experiment Station. It has high yield and grain protein, good end-use quality, and disease resistance, especially to FHB. **HRSWURN 2013-2014, URSN 2016**

**ND VitPro** (ND825, PI 682660) Released in 2017 by the North Dakota Agricultural Experiment Station. It has improved straw strength, end-use quality, and good disease resistance, including FHB and stem rust. It has high vitreous kernel percentage and high grain protein. **HRSWURN 2016, URSN 2016**

**MN-Washburn** (MN10201-4-A, PI 694049) Released in 2019 by the University of Minnesota Agricultural Experiment Station due to its high yield, good lodging resistance, and good end-use qualities. It also has good disease resistance to barley yellow dwarf virus, leaf rust, stripe rust, and the Ug99 race group of stem rust. **HRSWURN 2014-2015**

**Dagmar** (MT1621, PI 690450) Released in 2019 by Montana Agricultural Experiment Station for its adaptation to drought and wheat stem sawfly regions. It has a longer green leaf stage after heading, good grain protein, and good gluten strength. It has intermediate stem-solidness providing protection against wheat stem sawfly. **HRSWURN 2018-2019, URSN 2018-2019**

**MN-Torgy** (MN14105-7, PI 698205) Released in 2020 by the University of Minnesota Agricultural Experiment Station. Has a balance of high grain yield and grain protein content and is moderately resistant to important diseases including FHB and bacterial leaf streak. **HRSWURN 2017-2018**

**Driver** (SD4625, PI 698121) Released in 2020 by the South Dakota Agricultural Experiment Station due to its competitive grain yield potential, grain volume weight, protein content, protein yield, and resistance to lodging. It also has good resistance to FHB and bacterial leaf streak. **HRSWURN 2017-2018**

**ND Frohberg** (NDHRS16-13-97, PI 698310) Released in 2020 by the North Dakota Agricultural Experiment Station. It has improved straw strength, yield potential, and end-use quality. It has high resistance to stem rust, moderate resistance to leaf rust, bacterial leaf streak, and FHB. **HRSWURN 2018-2019, URSN 2018**

**MT Sidney** (MT1716, PI 699957) Released in 2021 by the Montana Agricultural Experiment Station. It is a high yielding, early-heading, awned, and semidwarf hard red spring wheat variety. Has moderate resistance to FHB. Hollow-stem makes it susceptible to wheat stem sawfly. **HRSWURN 2020-2021, URSN 2019-2021**

**Ascend-SD** (SD4873, PI 700966) Released in 2021 by South Dakota Agricultural Experiment Station due to its competitive high yield potential, grain protein content, and good resistance to bacterial leaf streak. It has the Fhb1 locus, providing good resistance to FHB. **HRSWURN 2020-2021**

**MN-Rothsay** (MN15005-4, PI 702731) Released in January 2022 by the University of Minnesota. MN-Rothsay has high grain yield and strong straw. **HRSWURN 2018-2019**

**Brawn-SD** (SD4843) Released in 2022 by the South Dakota Agricultural Experiment Station. It has high yields with good test weight. It also has good resistance to FHB and bacterial leaf streak. **HRSWURN 2021-2022**

**ND Heron** (NDHRS16-14-126, PI 699926) Released in 2022 by the North Dakota Agricultural Experiment Station. It has competitive yield potential with good protein, test weight, and resistance to FHB and bacterial blight. It has excellent end-use qualities. **HRSWURN 2019-2021, URSN 2019-2020**

**MT Dutton** (MT1809) Released in 2023 by the Montana Agricultural Experiment Station. It has high yield in rainfed conditions, good protein content, and moderate aluminum tolerance. It is also moderately resistant to FHB and has resistance to foliar disease. **HRSWURN 2021-2022, URSN 2020**

**MT Carlson** (MT1939) Released in 2023 by the Montana Agricultural Experiment Station due to its high yield potential, aluminum tolerance, and increased wheat stem sawfly resistance. **HRSWURN 2021-2022**

**ND Thresher** (NDHRS13-0273-0036, PI 703392) Released in 2023 by the North Dakota Agricultural Experiment Station. It has a shorter plant height but good straw strength, and while it matures later, it dries down well for easy threshing. It has high yield potential with good end-use qualities. It has good resistance to FHB and bacterial leaf streak. **HRSWURN 2020-2021**

**U.S. SPRING WHEAT PRODUCTION, 2023**

***SPRING WHEAT (OTHER THAN DURUM)*: Growers produced an estimated 505 million bushels of spring wheat. This production estimate is 4.7 percent higher than year 2022 production. Yield averaged 46 bushels per acre, a decrease of 0.2 bushels per acre from year 2022. Acres harvested totaled ~11 million acres, which is approximately 5.2 percent higher than the acreage harvested in 2022.**

**Spring Wheat Production Statistics, 2021-2023\***

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Acres Harvested (x1000) | | |  | Production (x1000 Bushels) | | |  | Yield (Bushels/Acre) | | |
|  | 2021 | 2022 | 2023 |  | 2021 | 2022 | 2023 |  | 2021 | 2022 | 2023 |
| Minnesota | 1,160 | 1,210 | 1,260 |  | 55,680 | 73,810 | 78,120 |  | 48 | 61 | 62 |
| Montana | 2,180 | 2,440 | 2,670 |  | 37,060 | 61,000 | 80,100 |  | 17 | 25 | 30 |
| North Dakota | 5,210 | 5,260 | 5,520 |  | 174,535 | 263,00 | 267,720 |  | 33.5 | 50 | 48.5 |
| South Dakota | 580 | 700 | 650 |  | 16,820 | 33,600 | 27,950 |  | 29 | 48 | 43 |
| USA | 10,155 | 10,440 | 10,985 |  | 330,850 | 482,190 | 504,900 |  | 32.6 | 46.2 | 46 |

\* Source: National Agricultural Statistics Service: (https://quickstats.nass.usda.gov) as of 1-3-24.

**2023 ENVIRONMENTAL NOTES BY STATIONS**

Environmental notes from each agronomic station were previously included in the HRSWURN, with 1981 being the last year to report location environment notes. This information provided valuable context to explain high or low yields. Environmental notes are reported here and can be found in each location table.

**South Dakota**

Brookings- Trial plots were abandoned due to drought stress. Mist-irrigated FHB plot results seem reasonable.

Groton- Trial conditions were not out of the ordinary - very little disease pressure.

Selby- Excellent trial- no disease pressure.

**North Dakota**

Langdon- Foot of snow on April 21 and after that, hardly any significant rainfall in May and temperatures were much above normal. June was slightly below normal with most of the rainfall coming in two events. July was below average temperature but the 3rd driest on record. August rainfall was less than 0.45 at any one time with lots of smokey skies. Rainfall from May-August was about 50% of normal. Hardly any diseases. Farmers in the region experienced the same thing.

Carrington- Previous crop was soybean.

Hettinger- Previous crop was cover crop mix. Excellent growing conditions with plentiful growing season rainfall. Precipitation throughout the season: April (0.22 in), May (5.53 in), June (5.33 in), July (1.17 in), and August (3.67 in).

Williston- Hail storm on August 1, 2023. The WREC Farm had hail damage rated at 40%, data was not used in cross location means due to the severity of damage. Previous crop was flax. Soil type is Williams-Bowbells loam. Rainfall: 7.8 inches (4/26 - 8/16).

**Montana**

Bozeman- The previous high yield under dryland conditions in Bozeman was 2010. Frequent rain provided sufficient moisture throughout the entire spring wheat growing season in Bozeman. The yield of breeding lines in dryland was similar to those grown under irrigated conditions this year.

**2023 NURSERY DESCRIPTION AND SUMMARY**

The Hard Red Spring Wheat Uniform Regional Nursery (HRSWURN) was planted for the 93rd year in 2023. The nursery contained 25 entries submitted by five different scientific or industry breeding programs, and six check varieties (Table 1). Trials were conducted as randomized complete blocks with three replicates except where noted. The HRSWURN was planted at 14 locations in 4 different states in the USA (MN, ND, SD, MT). All fourteen locations provided data included in this report (Figure 1, Table 2). Brookings only provided FHB data due to drought stress. Williston data was not included in across location means or yield ranking due to severe hail damage. Data summaries for each of the reporting locations are presented in individual tables. Overall means across locations for a set of core traits are summarized in Table 17, and yield rankings for individual locations are found in Table 18. Entries were also evaluated for various diseases at different locations; these can be found in individual location data summaries. Leaf rust and stem rust resistance were evaluated in St. Paul, MN. These results are presented in Tables 19-20. Entries were evaluated for Fusarium head blight at St. Paul and Crookston, MN, and Prosper, ND; these results are provided in Tables 21, 22 and 23, respectively. Molecular marker genotyping for select agronomic, quality and disease resistance traits was also performed; this information is presented in Table 24. The highest average yielding location was Bozeman, MT, with 121.7 Bu/Ac, while the lowest yielding location was Williston, ND, with 27.8 Bu/Ac, due to hail damage.

A digital copy of the 2023 HRSWURN and older annual reports can be found on the GrainGenes website: https://wheat.pw.usda.gov/GG3/

New to the 2023 HRSWURN annual report is the addition of field results from the African stem rust nursery planted in Njoro, Kenya and Debre Zeit, Ethiopia. Seedling resistance to foreign races, including Ug99, were screened for in the USDA-ARS Cereal Disease Lab (CDL) in St. Paul, Minnesota. The timeline of field planting in the United States is about six months ahead of field planting in Africa. Due to this offset of the field season, the entire HRSWURN is screened a year later in triplicate per entry after this report is published (2022 HRSWURN results received this year in 2023). To overcome this challenge, wheat breeders send at least 50 entries of their elite breeding material with the intention to capture some of the future URN entries in single rows. Thus, the African stem rust data is incomplete for the 2023 entries but is complete for the 2022 entries. The 2023 HRSWURN entries will be grown, and results will be received in 2024. A more complete copy of the previous year’s URN entries in the African stem rust nursery can be found on GrainGenes.

Wheat stem rust was found in nine states throughout the US in 2023. There was low incidence and severity of wheat stem rust. The dominant wheat stem rust race was QFCSC. Wheat leaf rust was found in 23 states across the US in 2023. In the Great Plains, there was low infection and spread of leaf rust due to prolonged drought conditions. This information is provided by the CDL, updated status of rust surveys in the US can be accessed at their website:

https://www.ars.usda.gov/midwest-area/stpaul/cereal-disease-lab/docs/cereal-rust-bulletins/cereal-rust-bulletins/

**Figure 1. Hard Red Spring Wheat Uniform Regional Performance Nursery Locations, 2023**

Diagram

Description automatically generated