



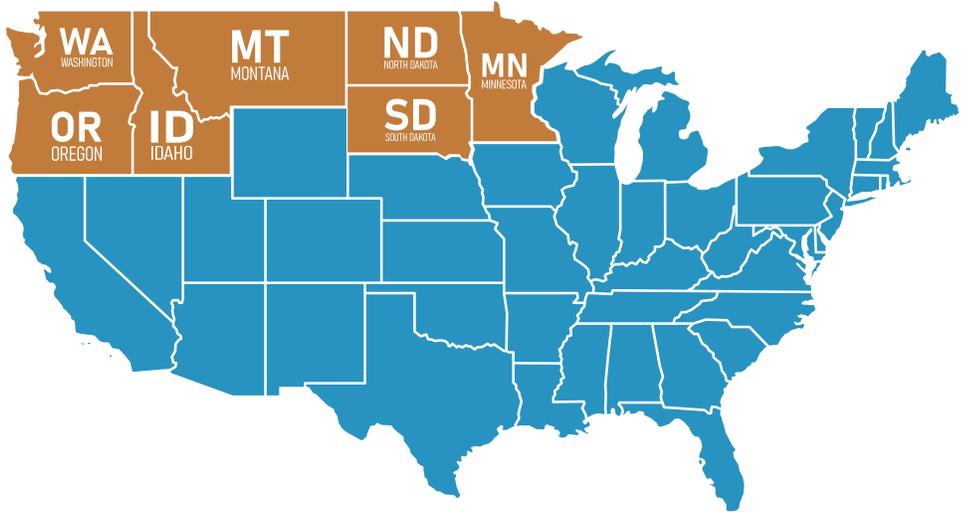
2023

U.S. HARD RED  
SPRING WHEAT

*REGIONAL QUALITY REPORT*

# U.S. HARD RED SPRING *Wheat*

# U.S. HARD RED SPRING *Wheat*



## ● ● ● TABLE OF CONTENTS ● ● ●

Grading and Kernel Characteristics.....	5-9
Milling Characteristics .....	10-11
Physical Dough Characteristics .....	12-14
Baking Characteristics.....	15
Summary Information.....	16
Laboratory Analysis .....	17
Methods, Terms and Symbols.....	18-19
Varietal Information.....	20-23

## THE ARISTOCRAT OF WHEAT

Hard Red Spring, a specialty wheat grown primarily in the Northern Plains of the United States - stands out as the aristocrat of wheat when it comes to baking bread. The high protein content and superior gluten quality of hard red spring wheat make it ideal for use in some of the world's finest baked goods. Yeast breads, hard rolls, specialty products such as hearth breads, whole grain breads, bagels and pizza crusts look and taste their best when bake with top-quality spring wheat flour. Even frozen dough products are better with spring wheat because they can be stored longer than those made with lower protein wheats.

Flour mills in the United states and around the world also use hard red spring wheat extensively as a blending wheat to increase the gluten strength in a batch of flour. Adding hard red spring to lower protein wheat improves dough handling and mixing characteristics as well as water absorption. The resulting flour can be used to make an assortment of bread products, as well as Chinese-type noodles.



**MINNESOTA | MONTANA**  
**NORTH DAKOTA | SOUTH DAKOTA**  
**IDAHO | OREGON | WASHINGTON**

## OVERVIEW

**THE 2023 U.S. HARD RED SPRING** is a high grading crop with good protein levels, strong dough properties, and improved bake parameters compared to last year. Heat did stress the crop early, and many areas were marginal for growing season precipitation, but relatively cool temperatures during the latter half of the growing season benefited kernel fill. Total production is 5% higher than last year at 468 million bushels (12.7 MMT) due to average to above-average yields, and higher planted area. Protein content is similar to a year ago, but levels are variable across the region due to difference in precipitation. A challenge for some buyers this year is below normal vitreous kernel levels, due to sporadic areas of low protein, and periodic rains and heavy dews during the harvest period. Other kernel qualities are very positive however, including low moisture, no DON, and little to no damage. Laboratory evaluation of the crop is showing an improvement over recent years, including stronger dough properties and higher loaf volumes.

**THE CROP AVERAGES** a No. 1 Northern Spring. Nearly 90% of the survey samples graded a No. 1, which is exceptionally high. Crop average test weight is 61.2 lbs/bu (80.4 kg/hl), slightly lower than 2022 and the 5-yr average, still three-fourths of the crop is greater than 60 lbs/bu (78.9 kg/hl). Average damaged kernel levels are very low at 0.1%, as disease pressures were minimal to non-existent. Overall vitreous kernel levels average 57%, notably lower than last year and the 5-year average. Distributions show only 38% of the crop samples exceed 75%, or the DNS subclass, while 14% of the crop falls below 25 percent.

Crop average **PROTEIN** is 14.1% (12% moisture basis), similar to last year, but one-half percentage point lower than the 5-year average. Distribution of protein shows 63% of the survey samples exceeding 14% protein and just 14% falling below 13% protein. However, the percent of the crop below 12% protein is nearly double from a year ago in pockets of the region which received well above normal precipitation.

**THOUSAND KERNEL WEIGHTS** (TKW) are very high at 34.5 grams for a crop average, well above 2022 and the 5-yr average. Cooler temperatures and more consistent rainfall in latter half of growing season benefited kernel development. In addition, disease pressures from Fusarium headlight were minimal to non-existent in all areas. Crop average falling number values are similar to a year ago at 389 seconds, but some parts of the region are showing lower year-to-year values due to rains during the harvest period. Still, 90% of the crop exceeds 350 seconds.

**MILLING** analysis, based on a Buhler Lab Mill, averages 69.9% extraction, higher than 2022 and the 5-year average. The higher extraction value is due in part to adjustments in flour yield calculation methods. Flour ash is 0.47%, lower than last year and the 5-year average. Flour viscosity is 618 B.U., lower than last year and the 5-year average, with wetter conditions during harvest impacting portions of the crop.

**PHYSICAL DOUGH** tests are revealing a crop with stronger characteristics as measured by the Farinograph, Extensigraph and Alveograph. The crop average stability on the Farinograph is 15.2 minutes, up nearly 3 minutes from last year and the 5-year average. Farinograph absorption is 62.9%, similar to recent crops. The extensigraph is showing much stronger dough properties with a similar to slightly less extensible crop compared to last year. Alveograph values for the crop average a W value of 411 and a 0.81 P/L ratio, up from 0.66 on a 5-year average.

**BAKING** evaluations are showing improved loaf volumes compared to last year and similar to the 5-year average. The crop averages 969 cubic centimeters, with some parts of the region reaching up to 1050. Dough handling properties scored slightly lower than a year ago, but bread scores rated similar.

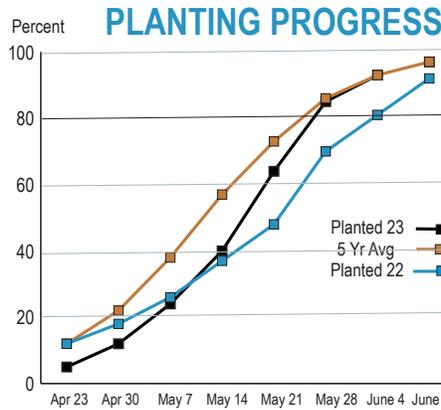
### 2023 PRODUCTION DATA

	2023	2022	2018-22 AVERAGE
<b>MILLION BUSHELS</b>			
Minnesota	78	74	75
Montana	80	61	84
North Dakota	268	263	265
South Dakota	28	34	30
ID/OR/WA	14	14	22
<b>U.S. Total</b>	468	446	476
<b>MILLION METRIC TON</b>			
Minnesota	2.12	2.01	2.04
Montana	2.18	1.66	2.29
North Dakota	7.29	7.16	7.21
South Dakota	0.76	0.91	0.83
ID/OR/WA	0.38	0.38	0.60
<b>U.S. Total</b>	12.7	12.1	13.0

*Source: USDA 2023 Small Grains Summary*

## SEASONAL CONDITIONS - 2023

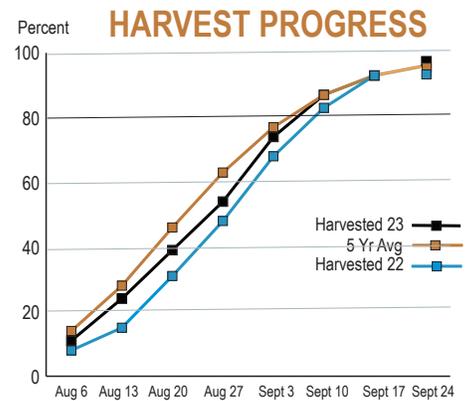
**PLANTING** began later than normal in many parts of the region, due to a cold spring, and slow warm up of soil temperatures. Parts of the region also had late season snow, which created overly wet soil conditions into early May. More favorable planting conditions allowed planting to accelerate in the latter half of May, with most parts of the region completed by early June, near normal.



**CROP EMERGENCE** was favorable in most areas, as adequate soil moisture, and a warm up in temperatures in late May and early June promoted crop development. The growing season brought some early stress to crops in the eastern half of the region due to abnormally hot June temperatures and limited moisture. Across the region, growing season rainfall was quite variable, with eastern areas and parts of Montana and South Dakota the most deficient relative to normal. In contrast, southwestern parts of the region received frequent and well above normal precipitation. Crop development was near normal in most

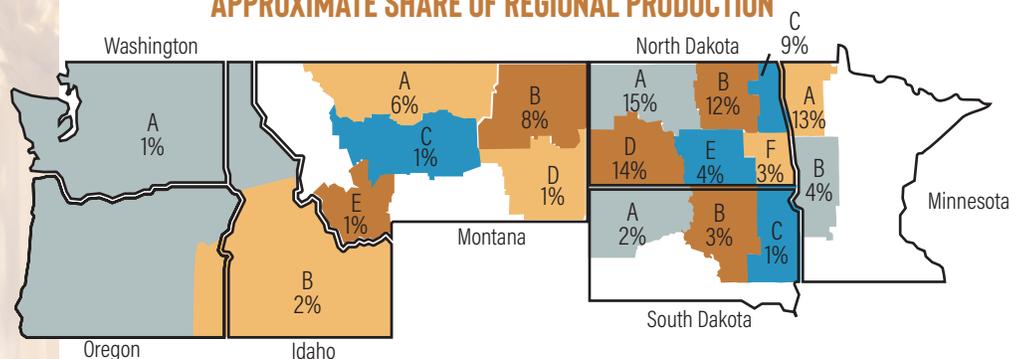
areas, and cooler July temperatures benefited crops across the entire region, limiting crop stress during the critical kernel fill period. Disease pressures were minimal to non-existent.

**HARVEST** began in early August, slightly later than normal, and progress through August was somewhat slower than normal due to sporadic rainfall, and cool, cloudy conditions. These conditions impacted vitreous kernel levels in a greater than normal share of the region. The regional harvest pace accelerated in late August and early September, and harvest was completed by late September in most areas.



**PRODUCTION** of the U.S. HRS crop, at 468 million bushels (12.7 MMT), is up 5% from last year on higher planted area and above-average yields.

### APPROXIMATE SHARE OF REGIONAL PRODUCTION



## THE ARISTOCRAT OF WHEAT

**WHEAT GRADES** as defined by the Federal Grain Inspection Service (FGIS) of the USDA Grain Inspection, Packers and Stockyards Administration (GIPSA), reflect the general quality and condition of a representative sample. U.S. grades are based on test weight and include limits on damaged kernels, foreign material, shrunken and broken kernels, and wheat of contrasting classes. Each determination is made on the basis of the grain when free from dockage and shrunken and broken kernels.

**SUBCLASS** is as separate marketing factor based on the number of kernels that are dark, hard and vitreous. For hard red spring wheat, the subclasses are:

- **Dark Northern Spring (DNS)** – at least 75 percent or more dark, hard, vitreous kernels;
- **Northern Spring (NS)** – between 25 and 74 percent dark, hard, vitreous kernels;
- **Red Spring (RS)** – less than 25 percent dark, hard, vitreous kernels.

**OTHER BASIC CRITERIA** not included as grading factors but important in the U.S. wheat marketing system.

**PROTEIN** is probably the most important factor in determining the value of hard red spring wheat since it relates to many processing properties. In the U.S. market HRS prices are usually quoted for 14.0 percent protein (on a 12.0 percent moisture basis). Price premiums or discounts may be specified for halves, fifths and tenths of a percentage point above and below 14.0 percent.

**MOISTURE** content is an indicator of grain storability. Wheat with lower moisture content is generally more stable during storage and more profitable to a miller. U.S. HRS ranges from 12 to 13 percent.

**DOCKAGE** is any material easily removed from a wheat sample during cleaning using standard mechanical means. All U.S. grade and non-grade factors are determined only after dockage is removed.

**FALLING NUMBER** indicates the soundness of wheat or its alpha-amylase activity. Falling numbers above 300 seconds are most desired for baking products.

### 2023 PRODUCTION DATA

GRADING FACTORS	U.S. GRADES				
	1	2	3	4	5
<b>HARD RED SPRING - MINIMUM TEST WEIGHTS</b>					
Pounds per bushel	58.0	57.0	55.0	53.0	50.0
Kilograms per hectoliter	76.4	75.1	72.5	69.9	66.0
<b>MAXIMUM PERCENT LIMITS OF:</b>					
Damaged kernels					
<i>Heat (part of total)</i>	0.2	0.2	0.5	1.0	3.0
<i>Total</i>	2.0	4.0	7.0	10.0	15.0
Foreign material	0.4	0.7	1.3	3.0	5.0
Shrunken/broken kernels	3.0	5.0	8.0	12.0	20.0
Total	3.0	5.0	8.0	12.0	20.0
Wheat of other class <sup>2</sup>					
<i>Contracting classes</i>	1.0	2.0	3.0	10.0	20.0
<i>Total<sup>1</sup></i>	3.0	5.0	10.0	10.0	10.0
Stones	0.1	0.1	0.1	0.1	0.1
<b>MAXIMUM COUNT LIMITS OF:</b>					
Other material					
<i>Animal filth</i>	1	1	1	1	1
<i>Castor beans</i>	1	1	1	1	1
<i>Crotalaria seeds</i>	2	2	2	2	2
<i>Glass</i>	0	0	0	0	0
<i>Stones</i>	3	3	3	3	3
<i>Unknown foreign material</i>	3	3	3	3	3
<i>Total<sup>1</sup></i>	4	4	4	4	4
<i>Insect-damaged kernels</i>	31	31	31	31	31

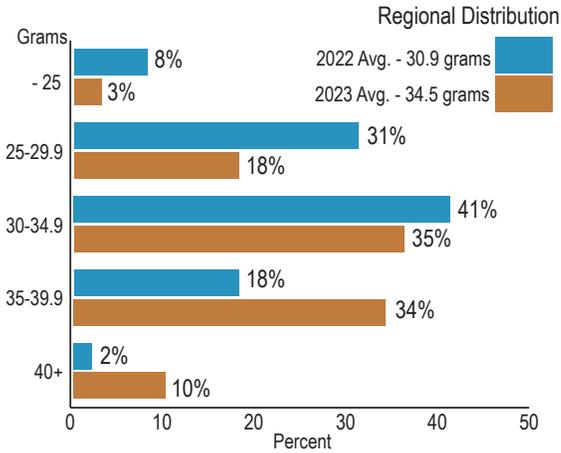
- U.S. sample grade is wheat that:
- Does not meet the requirements for U.S. Nos. 1, 2, 3, 4 or 5; or
  - Has a musty, sour or commercially objectionable foreign odor (except smut or garlic odor); or
  - Is heating or of distinctly low quality.
    - Includes damaged kernels (total), foreign material and shrunken and broken kernels.
    - Unclassed wheat of any grade may contain not more than 10.0 percent of wheat of other classes.
    - Includes contrasting classes.
    - Includes any combination of animal filth, castor beans, crotalaria seeds, glass, stones or unknown foreign substance.

2023 WHEAT GRADING DATA							
STATE AND CROP REPORTING AREA	TEST WEIGHT		KERNEL FACTORS				
	LBS/BU	KG/HL	DAMAGE %	SHRUNKEN BROKEN %	TOTAL DEFECTS %	U.S. GRADE SUBCLASS	VITREOUS KERNELS %
<b>MINNESOTA</b>							
Area A	62.1	81.7	0.3	0.2	0.5	1 NS	46
Area B	62.1	81.7	0.3	0.2	0.5	1 NS	54
State Avg. 2023	62.1	81.7	0.3	0.2	0.5	1 NS	48
State Avg. 2022	62.9	82.7	0.1	0.4	0.5	1 NS	59
<b>MONTANA</b>							
Area A	59.2	77.9	0.0	1.7	1.7	1 DNS	88
Area B	60.1	79.1	0.0	1.3	1.3	1 NS	73
Area C	58.6	77.1	0.0	1.6	1.6	1 DNS	92
Area D	57.3	75.5	0.0	1.7	1.7	2 NS	61
Area E	60.7	79.8	0.0	0.4	0.4	1 NS	42
State Avg. 2023	59.6	78.5	0.0	1.4	1.4	1 DNS	78
State Avg. 2022	60.4	79.4	0.1	2.1	2.2	1 DNS	93
<b>NORTH DAKOTA</b>							
Area A	61.2	80.5	0.0	0.5	0.5	1 NS	59
Area B	61.8	81.3	0.2	0.3	0.5	1 NS	59
Area C	61.8	81.3	0.0	0.2	0.2	1 NS	41
Area D	60.8	80.0	0.2	0.8	1.0	1 NS	47
Area E	61.1	80.4	0.0	0.3	0.3	1 NS	59
Area F	61.8	81.3	0.0	0.4	0.4	1 NS	64
State Avg. 2023	61.4	80.7	0.1	0.5	0.6	1 NS	54
State Avg. 2022	62.4	82.0	0.1	0.7	0.8	1 NS	73
<b>SOUTH DAKOTA</b>							
Area A	61.0	80.2	0.3	0.8	1.1	1 NS	53
Area B	59.7	78.6	0.4	0.8	1.2	1 NS	27
Area C	61.8	81.3	0.0	0.6	0.6	1 NS	73
State Avg. 2023	60.4	79.5	0.3	0.8	1.1	1 NS	42
State Avg. 2022	61.7	81.2	0.1	0.8	0.9	1 NS	68
<b>IDAHO · OREGON · WASHINGTON</b>							
Area A	61.8	81.3	0.2	0.7	0.9	1 DNS	81
Area B	62.1	81.7	0.9	0.5	1.4	1 NS	69
State Avg. 2023	61.9	81.4	0.5	0.6	1.1	1 DNS	76
State Avg. 2022	61.9	81.4	0.0	0.7	0.7	1 DNS	80
<b>REGION AVERAGE</b>							
Avg. 2023	61.2	80.4	0.1	0.6	0.7	1 NS	57
Avg. 2022	62.1	81.7	0.1	0.8	0.9	1 NS	73
Five-Year Avg	61.7	81.1	0.3	0.8	1.1	1 NS	74

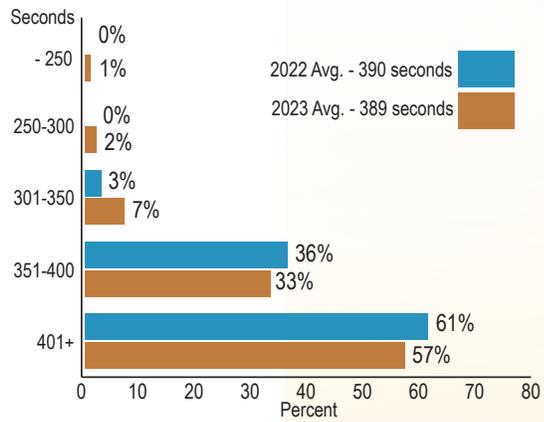


2023 OTHER KERNEL QUALITY DATA									
STATE AND CROP REPORTING AREA	DOCKAGE %	MOISTURE %	1000 KERNEL WEIGHT G	KERNEL DIST. MED/LGE %	PROTEIN 12%/0% MOISTURE BASIS	DON (PPM)	WHEAT ASH%	FALLING NUMBER (SEC)	ZELNY SED (CC)
<b>MINNESOTA</b>									
Area A	0.4	13.0	38.3	24/75	14.3/16.3	0.0	1.47	367	62
Area B	0.2	12.5	37.7	27/72	14.4/16.4	0.0	1.49	398	62
State Avg. 2023	0.4	12.9	38.2	25/74	14.3/16.3	0.0	1.47	373	62
State Avg. 2022	0.4	12.9	33.5	38/59	13.7/15.6	0.0	1.47	395	62
<b>MONTANA</b>									
Area A	0.7	10.5	30.6	74/19	15.0/17.0	0.0	1.48	401	69
Area B	0.6	11.1	31.2	65/30	14.1/16.0	0.0	1.48	366	67
Area C	0.9	10.8	29.3	76/19	13.8/15.7	0.0	1.42	310	67
Area D	1.2	11.1	27.9	76/16	14.1/16.0	0.0	1.48	390	68
Area E	1.1	12.6	35.5	36/63	13.7/15.6	0.1	1.47	371	70
State Avg. 2023	0.7	10.9	31.0	68/27	14.4/16.4	0.0	1.48	377	68
State Avg. 2022	0.8	10.0	26.7	72/20	14.6/16.6	0.0	1.62	386	61
<b>NORTH DAKOTA</b>									
Area A	0.7	12.7	34.0	48/50	13.9/15.8	0.0	1.40	396	69
Area B	0.5	12.9	34.5	40/59	13.8/15.7	0.0	1.42	392	69
Area C	0.5	13.0	38.2	32/67	14.2/16.1	0.0	1.46	410	68
Area D	1.1	12.1	32.8	49/48	13.6/15.5	0.0	1.50	392	68
Area E	0.9	12.8	33.9	39/60	14.0/15.9	0.0	1.53	398	66
Area F	0.3	13.0	35.2	37/62	14.3/16.3	0.0	1.56	391	67
State Avg. 2023	0.7	12.7	34.6	42/56	13.9/15.8	0.0	1.45	396	68
State Avg. 2022	0.6	12.3	31.3	50/48	14.1/16.1	0.1	1.56	388	63
<b>SOUTH DAKOTA</b>									
Area A	0.9	11.5	31.6	60/38	14.2/16.1	0.0	1.59	409	66
Area B	0.5	12.5	32.4	42/54	15.3/17.4	0.0	1.75	386	66
Area C	0.5	12.4	33.4	43/55	14.5/16.5	0.0	1.59	385	62
State Avg. 2023	0.6	12.2	32.3	48/49	14.9/16.9	0.0	1.68	393	65
State Avg. 2022	0.7	12.2	29.1	64/33	14.6/16.6	0.2	1.66	388	52
<b>IDAHO - OREGON - WASHINGTON</b>									
Area A	0.5	9.4	37.2	44/54	14.4/16.4	0.1	1.58	399	66
Area B	0.2	10.1	33.9	52/46	14.6/16.6	0.0	1.57	367	70
State Avg. 2023	0.4	9.7	35.9	47/51	14.5/16.5	0.0	1.58	386	68
State Avg. 2022	0.3	8.8	30.5	57/39	14.4/16.3	0.0	1.63	415	59
<b>REGION AVERAGE</b>									
Avg. 2023	0.6	12.3	34.5	44/53	14.1/16.0	0.0	1.48	389	67
Avg. 2022	0.6	11.9	30.9	52/45	14.2/16.1	0.1	1.56	390	62
Five-Year Avg	0.6	12.1	31.3	52/45	14.6/16.6	0.3	1.55	383	65

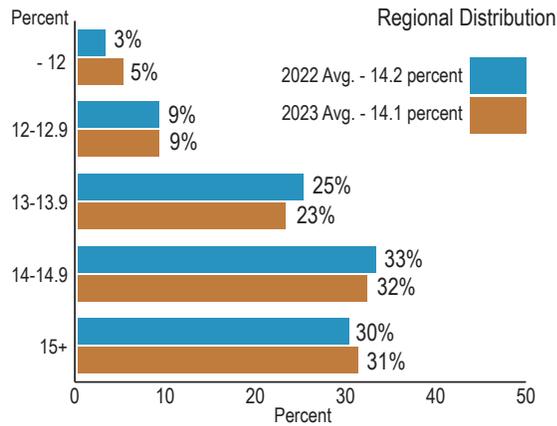
## 1000 KERNEL WEIGHT



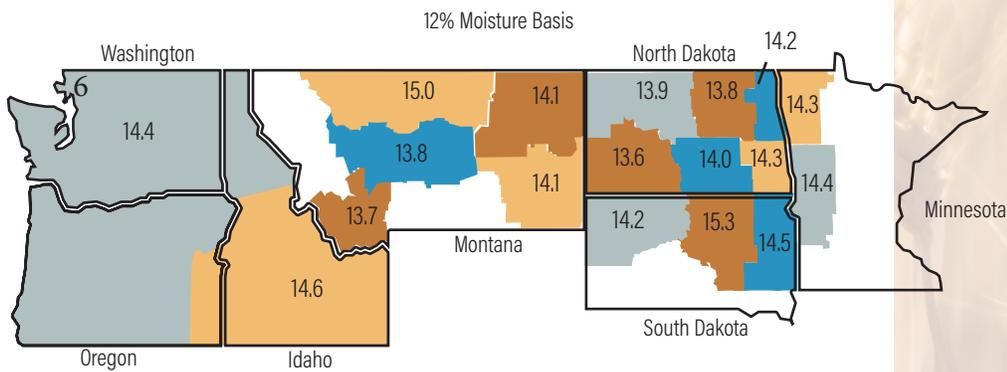
## FALLING NUMBER - Regional Distribution



## PROTEIN - 12% MOISTURE



## 2023 AVERAGE WHEAT PROTEIN% BY AREA



**2023 FLOUR QUALITY DATA**

STATE AND CROP REPORTING AREA	FLOUR EXTRACTION %	FLOUR ASH %	FLOUR PROTEIN (14% MOISTURE) %	STARCH DAMAGE %	SRC: GPI	WATER/50% SUCROSE %	5% LACTIC ACID/5% NA <sub>2</sub> CO <sub>3</sub> %	WET GLUTEN %	GLUTEN INDEX	FALLING NUMBER	AMYLOGRAPH VISCOSITY 65 G FL B.U.
<b>MINNESOTA</b>											
Area A	68.6	0.49	13.1	6.2	0.70	70/114	148/98	34.4	95	372	529
Area B	69.2	0.48	12.8	6.0	0.69	69/113	143/95	31.1	96	370	545
State Avg. 2023	68.7	0.49	13.0	6.2	0.70	70/114	147/97	33.7	95	372	532
State Avg. 2022	66.8	0.44	12.2	5.1	0.68	69/115	144/96	29.3	99	396	715
<b>MONTANA</b>											
Area A	69.6	0.48	13.4	6.0	0.68	71/123	153/101	36.8	88	405	817
Area B	68.9	0.48	12.8	6.5	0.66	71/122	150/104	33.5	90	387	668
Area C	69.3	0.48	12.6	6.2	0.65	71/123	148/106	34.6	85	322	330
Area D	69.4	0.48	12.9	5.9	0.69	70/122	155/102	34.8	91	400	779
Area E	69.2	0.49	12.5	6.6	0.65	74/122	148/107	34.3	90	399	544
State Avg. 2023	69.2	0.48	13.0	6.3	0.67	71/122	151/103	34.9	89	392	705
State Avg. 2022	66.4	0.52	13.5	5.4	0.67	72/119	146/99	36.2	92	400	850
<b>NORTH DAKOTA</b>											
Area A	69.9	0.43	12.6	6.1	0.73	68/115	153/96	32.0	96	379	627
Area B	70.4	0.43	12.6	6.3	0.72	69/117	154/96	31.9	94	386	653
Area C	71.3	0.47	12.7	6.7	0.68	72/115	147/101	33.8	95	392	572
Area D	70.1	0.48	12.6	6.2	0.69	71/118	152/103	32.3	94	389	613
Area E	70.8	0.48	12.7	6.4	0.69	68/113	145/96	32.3	95	389	630
Area F	71.4	0.52	12.8	7.0	0.67	70/115	143/100	32.5	95	378	572
State Avg. 2023	70.4	0.46	12.6	6.3	0.70	70/116	151/99	32.4	95	386	619
State Avg. 2022	67.2	0.49	12.7	5.8	0.67	72/118	146/100	33.0	96	388	711
<b>SOUTH DAKOTA</b>											
Area A	70.3	0.50	12.6	5.9	0.72	68/112	144/88	34.4	92	388	746
Area B	69.8	0.54	13.7	6.0	0.68	69/117	143/94	35.9	94	392	480
Area C	71.2	0.51	13.1	6.7	0.66	71/114	139/97	35.0	89	379	545
State Avg. 2023	70.2	0.52	13.3	6.1	0.69	69/115	143/93	35.3	93	389	570
State Avg. 2022	67.7	0.55	13.1	5.9	0.62	68/115	129/93	35.4	88	389	667
<b>IDAHO • OREGON • WASHINGTON</b>											
Area A	70.4	0.51	13.3	6.3	0.64	72/125	145/103	36.8	81	447	687
Area B	68.4	0.49	13.2	6.6	0.65	74/128	153/108	34.3	94	431	647
State Avg. 2023	69.6	0.50	13.3	6.4	0.64	73/126	148/105	35.8	86	441	671
State Avg. 2022	64.7	0.54	13.0	5.5	0.61	74/127	144/108	34.9	90	445	782
<b>REGION AVERAGE</b>											
Avg. 2023	69.9	0.47	12.8	6.3	0.69	70/117	150/99	33.3	93	386	618
Avg. 2022	67.0	0.49	12.7	5.6	0.67	71/117	144/99	33.1	95	393	730
Five-Year Avg	67.8	0.51	13.5	6.9	0.66	73/121	148/104	34.8	92	386	631

## TERMS DEFINED

**FLOUR** is evaluated for several factors to determine overall milling efficiency grad, soundness and functional properties.

**EXTRACTION**, or the proportion of the wheat kernel that can be milled into flour, is important to mill profitability. For purposes of this survey, test milling was conducted with a Buhler Laboratory mill. Results are suitable for comparison between crop years, however yields are lower than those obtained in commercial mills.

Another measure of milling efficiency and of flour grade is the ash content, or mineral residue, remaining after incineration of a sample.

**STARCH DAMAGE** measures physical damage to a proportion of the starch granules of flour. The level directly affects water absorption and dough mixing properties.

**WET GLUTEN** provides a quantitative measure of the gluten forming proteins in the flour that are primarily responsible for its dough mixing and baking properties.

**FALLING NUMBER** measures enzyme activity in flour. A fast time indicates high activity, revealing too much sugar and too little starch. Since starch provides bread's supporting structure, too much activity results in sticky dough and poor texture in finished products.

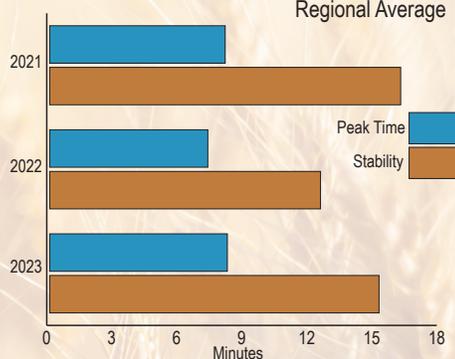


Physical characteristics of dough are evaluated to reveal useful information about variations in flour types, processing requirements and expected end-product quality.

A farinograph traces a curve during the dough mixing process to record variations in gluten development and the breakdown of gluten proteins over time. Water absorption indicates the amount of water that can be added to the flour until the dough reaches a definite consistency. Peak time indicates the number of minutes required to achieve this level of dough consistency and mixing tolerance indicates the stability of the dough. Both peak time and stability are related to dough strength.

### FARINOGRAPH RESULTS

Regional Average



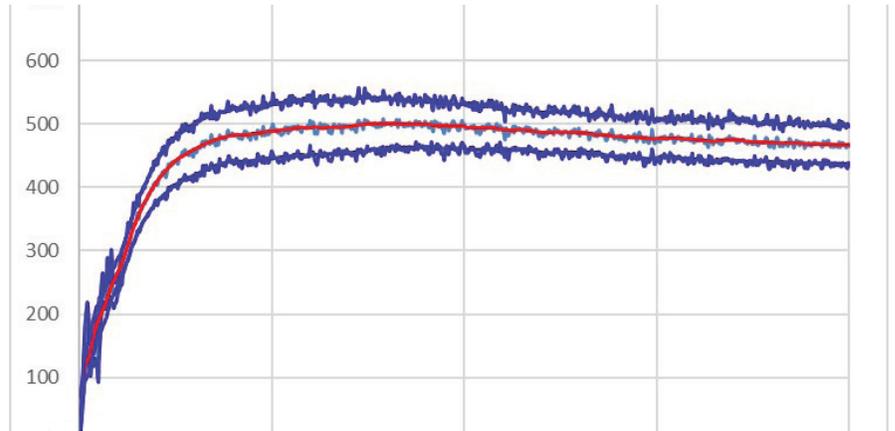
### 2023 PHYSICAL DOUGH QUALITY DATA - FARINOGRAPH

STATE AND CROP REPORTING AREA	ABSORPTION %	PEAK TIME MIN	STABILITY MIN	MTI B.U.	QUALITY NUMBER MM
<b>MINNESOTA</b>					
Area A	62.9	7.2	15.4	20	168
Area B	62.7	8.4	15.1	18	174
State Avg. 2023	62.9	7.4	15.3	19	169
State Avg. 2022	61.6	6.9	15.2	20	165
<b>MONTANA</b>					
Area A	63.7	8.5	14.3	15	187
Area B	63.6	7.8	11.8	22	148
Area C	62.1	7.0	10.1	29	74
Area D	61.7	8.1	14.4	18	168
Area E	64.5	8.6	13.9	18	175
State Avg. 2023	63.6	8.1	12.8	19	161
State Avg. 2022	63.8	8.5	12.1	19	171
<b>NORTH DAKOTA</b>					
Area A	61.8	9.6	19.0	21	203
Area B	61.7	8.6	19.2	18	201
Area C	63.5	7.7	15.0	21	167
Area D	63.4	7.5	12.6	26	141
Area E	63.4	8.4	13.1	25	158
Area F	62.4	7.3	15.8	14	185
State Avg. 2023	62.5	8.4	16.5	21	179
State Avg. 2022	63.3	7.1	12.1	21	152
<b>SOUTH DAKOTA</b>					
Area A	61.4	7.9	12.5	23	153
Area B	64.1	7.9	10.2	23	144
Area C	63.7	6.8	8.6	30	122
State Avg. 2023	63.2	7.7	10.7	24	143
State Avg. 2022	62.0	7.2	9.4	28	135
<b>IDAHO · OREGON · WASHINGTON</b>					
Area A	64.8	9.3	11.5	24	162
Area B	65.2	9.3	14.8	18	192
State Avg. 2023	65.0	9.3	12.8	22	174
State Avg. 2022	64.6	9.0	15.4	20	207
<b>REGION AVERAGE</b>					
Avg. 2023	62.9	8.2	15.2	21	172
Avg. 2022	63.0	7.3	12.5	21	157
Five-Year Avg	62.9	7.7	12.4	22	162

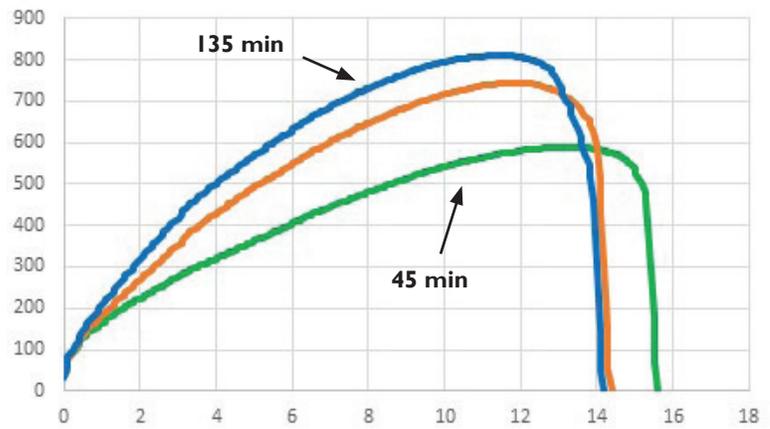
### 2023 PHYSICAL DOUGH QUALITY

2023 PHYSICAL DOUGH QUALITY										
EXTENSIGRAPH						ALVEOGRAPH				
STATE AND CROP REPORTING AREA	EXTENSIBILITY 45 MIN CM	RESISTANCE 45 MIN B.U.	AREA SQ CM	EXTENSIBILITY 135 MIN CM	RESISTANCE 135 MIN B.U.	AREA SQ CM	P MM	L MM	P/L RATIO	W JOULES X 10 <sup>4</sup>
<b>MINNESOTA</b>										
Area A	16.1	669	133	12.9	1279	197	105	120	0.88	466
Area B	16.1	664	131	12.6	1140	103	100	116	0.86	416
State Avg. 2023	16.1	668	133	12.8	1251	178	104	119	0.87	456
State Avg. 2022	15.7	586	116	14.8	761	149	98	124	0.78	427
<b>MONTANA</b>										
Area A	16.0	525	112	15.0	1030	192	91	123	0.74	390
Area B	16.6	551	118	15.0	830	164	92	115	0.80	372
Area C	19.0	464	116	13.9	668	120	75	141	0.53	330
Area D	17.8	559	128	16.5	874	190	82	143	0.57	402
Area E	18.2	442	107	16.1	784	166	104	113	0.92	387
State Avg. 2023	16.6	532	115	15.0	897	173	91	120	0.76	378
State Avg. 2022	16.1	514	106	13.5	856	151	96	127	0.75	409
<b>NORTH DAKOTA</b>										
Area A	18.1	673	154	15.1	1088	213	95	125	0.76	429
Area B	16.7	681	139	13.9	1126	203	93	121	0.77	410
Area C	18.2	597	140	15.1	950	185	100	117	0.85	427
Area D	14.9	636	117	12.8	1075	178	106	107	0.99	412
Area E	17.4	526	120	12.7	936	155	89	117	0.76	367
Area F	16.1	604	125	12.6	1168	188	100	104	0.96	391
State Avg. 2023	16.9	642	136	14.0	1068	193	98	117	0.83	414
State Avg. 2022	16.5	549	115	14.5	828	154	97	130	0.74	419
<b>SOUTH DAKOTA</b>										
Area A	16.1	553	117	12.8	1012	166	78	137	0.57	359
Area B	16.6	524	113	13.0	950	171	80	133	0.60	349
Area C	18.5	399	102	15.8	619	128	79	134	0.59	327
State Avg. 2023	16.7	514	113	13.4	919	163	79	134	0.59	349
State Avg. 2022	16.6	420	95	15.0	619	121	80	131	0.61	326
<b>IDAHO • OREGON • WASHINGTON</b>										
Area A	16.7	499	112	13.7	925	166	86	132	0.65	378
Area B	15.6	481	99	12.2	941	156	95	128	0.74	420
State Avg. 2023	16.3	492	107	13.1	931	162	90	130	0.69	395
State Avg. 2022	16.4	547	120	12.5	816	136	104	119	0.88	424
<b>REGION AVERAGE</b>										
Avg. 2023	16.7	615	130	13.9	1056	185	96	119	0.81	411
Avg. 2022	16.3	541	113	14.4	804	150	96	129	0.74	412
Five-Year Avg	16.7	544	117	14.2	857	153	87	131	0.66	378

### 2023 AVERAGE FARINOGRAPH



### 2023 AVERAGE EXTENSIGRAPH



The extensigraph measures dough strength by stretching a piece of dough on a hook until it breaks. The apparatus traces a curve that measures extensibility, resistance to extension and the area beneath the curve, or energy value.

BAKING DATA							
STATE AND CROP REPORTING AREA	BAKING ABSORPTION %	DOUGH HANDLING PROPERTIES	LOAF VOLUME CC	GRAIN AND TEXTURE	CRUMB COLOR	CRUST COLOR	SYMMETRY
<b>MINNESOTA</b>							
Area A	64.9	9.0	965	75	8.0	10.0	9.0
Area B	64.6	8.0	935	70	8.5	10.0	7.0
State Avg. 2023	64.9	8.8	959	74	8.1	10.0	8.6
State Avg. 2022	66.8	9.0	912	78	8.0	10.0	7.8
<b>MONTANA</b>							
Area A	65.4	9.0	1015	8.0	8.0	10.0	9.0
Area B	66.2	9.0	1015	8.0	8.5	10.0	10.0
Area C	65.6	9.0	945	8.0	9.0	10.0	8.0
Area D	64.5	8.0	1015	8.0	7.5	10.0	8.0
Area E	65.8	10.0	1005	8.0	8.0	10.0	9.0
State Avg. 2023	65.8	9.0	1011	8.0	8.3	10.0	9.4
State Avg. 2022	72.4	9.0	933	7.6	7.7	10.0	8.4
<b>NORTH DAKOTA</b>							
Area A	64.4	9.0	975	75	8.0	10.0	9.0
Area B	63.4	8.0	955	8.0	8.0	10.0	8.0
Area C	65.4	9.0	940	8.0	8.0	10.0	8.0
Area D	65.6	8.0	935	8.0	7.5	10.0	7.0
Area E	64.9	8.0	950	8.0	8.0	9.0	7.0
Area F	64.7	9.0	990	7.0	8.0	10.0	9.0
State Avg. 2023	64.6	8.5	955	7.8	7.9	9.9	8.0
State Avg. 2022	71.5	8.9	940	7.9	8.1	10.0	8.8
<b>SOUTH DAKOTA</b>							
Area A	63.5	10.0	955	8.0	7.5	9.0	8.0
Area B	64.8	9.0	975	8.5	8.0	9.0	7.0
Area C	65.8	10.0	990	7.5	8.0	10.0	9.0
State Avg. 2023	64.6	9.5	971	8.2	7.9	9.2	7.6
State Avg. 2022	68.3	8.6	886	7.6	7.9	10.0	7.9
<b>IDAHO - OREGON - WASHINGTON</b>							
Area A	67.4	9.0	1030	8.5	8.5	10.0	9.0
Area B	68.3	10.0	1055	8.0	8.5	10.0	9.0
State Avg. 2023	67.7	9.4	1040	8.3	8.5	10.0	9.0
State Avg. 2022	71.4	8.0	947	7.7	8.2	10.0	8.4
<b>REGION AVERAGE</b>							
Avg. 2023	64.9	8.7	969	7.8	8.0	9.9	8.4
Avg. 2022	70.6	8.9	931	7.8	8.0	10.0	8.5
Five-Year Avg	68.3	8.8	967	7.7	7.8	9.9	8.7

Dough handling, grain and texture, crumb color, crust color and symmetry all have a scale of 1-10. The highest rating is 10.

RECENT QUALITY TRENDS							
CROP YEAR	2023	2022	2021	2020	2019	2018	FIVE-YEAR AVERAGE
<b>WHEAT GRADING</b>							
Test Weight (lbs/bu)	61.2	62.1	61.5	61.8	60.7	62.2	61.7
Test Weight (kg/hl)	80.4	81.7	80.8	81.3	79.8	81.8	81.1
Vitreous Kernels (%)	57	73	81	72	55	86	74
1000 Kernel Weight (gm)	34.5	30.9	30.6	32.0	31.9	31.2	31.3
Protein: 12%/0% moisture	14.1/16.0	14.2/16.1	15.4/17.4	14.3/16.2	14.5/16.4	14.5/16.5	14.6/16.6
Ash: 14% moisture (%)	1.48	1.56	1.52	1.57	1.54	1.57	1.55
Falling Number (sec)	389	390	398	389	337	399	383
<b>FLOUR DATA</b>							
Extractions (%)	69.9	67.0	67.4	67.7	68.7	68.1	67.8
Ash: 14% moisture (%)	0.47	0.49	0.50	0.52	0.53	0.52	0.51
Protein: 14% moisture (%)	12.8	12.7	14.3	13.3	13.5	13.6	13.5
Wet Gluten (%)	33.3	33.1	37.1	33.1	34.1	36.4	34.8
Falling Number (sec)	386	393	409	407	352	421	396
<b>Amylograph Peak Viscosity</b>							
65g FL (B.U.)	618	730	705	632	441	649	631
<b>PHYSICAL DOUGH PROPERTIES</b>							
<b>*Farinograph:</b>							
<i>Absorption (%)</i>	62.9	63.0	62.8	61.6	62.6	64.2	62.9
<i>Peak Time (min)</i>	8.2	7.3	8.1	7.9	7.3	7.7	7.7
<i>Stability (min)</i>	15.2	12.5	16.2	11.8	10.0	11.4	12.4
<b>Extensigraph:</b>							
<i>Extensibility-45 min (cm)</i>	16.7	16.3	16.8	16.2	17.9	16.1	16.7
<i>Resistance-45 min (B.U.)</i>	615	541	615	498	497	570	544
<i>Area-45 min (sq cm)</i>	130	113	130	105	117	120	117
<b>Alveograph:</b>							
<i>P (mm)</i>	96	96	85	81	83	88	87
<i>L (mm)</i>	119	129	140	134	135	119	131
<i>W (joules x10<sup>4</sup>)</i>	411	412	415	359	360	345	378
<b>BAKING DATA</b>							
Absorption (%)	64.9	70.6	67.2	67.0	67.2	69.5	68.3
Dough Handling Properties	8.7	8.9	8.7	8.9	8.4	9.0	8.8
Loaf Volume (CC)	969	931	918	977	1019	988	967
Grain and Texture	7.8	7.8	7.8	7.8	7.7	7.6	7.7
Crumb Color	8.0	8.0	8.0	7.7	7.6	7.7	7.8
Crust Color	9.9	10.0	9.8	9.9	9.8	10.0	9.9
Symmetry	8.4	8.5	8.0	8.7	9.1	9.3	8.7

\*Dough handling, grain and texture, crumb color, crust color, symmetry all have a scale of 1-10. The highest rating is 10.

## 2023 SURVEY BACKGROUND

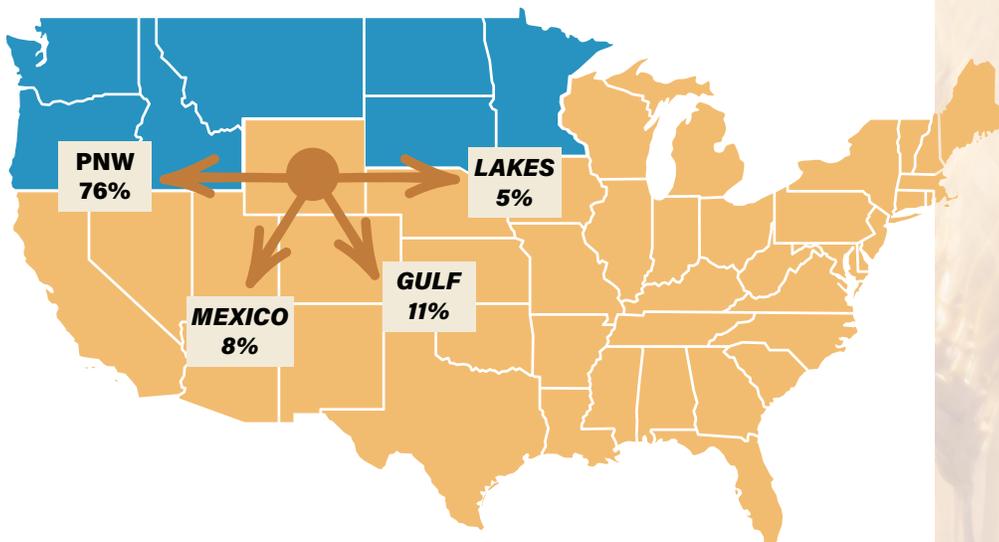
All quality data contained in this report are the result of testing and analysis conducted under the supervision of Dr. Shahidul Islam, Wheat Quality Specialist, and by his team members, Kelly McMonagle, Amber Walter, Heymant Kaur and Yun Zhao with the Hard Red Spring Wheat Quality Laboratory at North Dakota State University, Fargo, North Dakota, USA.

**COLLECTION** - The North Dakota, South Dakota, Montana and Minnesota state offices of the National Agricultural Statistics Service, and the NDSU Extension Service obtained samples during harvest directly from growers either in the fields or farm bins and local elevators. PNW samples were obtained from the Wheat Marketing Center. These samples reflect the condition of the grain at

the point of origin. Sample collection is based on county production histories. A total of 755 samples were collected. Minnesota (115), Montana (151), North Dakota (365), South Dakota (89) and PNW (35).

**ANALYSIS** - Approximately 60 percent of the total wheat samples collected were analyzed for grade and other physical kernel characteristics, to generate distribution data. Distribution averages may differ from data averages in the various tables, because the latter are derived from all samples. All samples collected are represented in the composite for each crop reporting area. All state and regional averages have been adjusted to reflect current year production.

### AVERAGE SHARE OF U.S. HRS EXPORTS BY PORT (2019-2022)



## METHODS, TERMS, SYMBOLS

### WHEAT

**SAMPLE COLLECTION** – Each sample contained approximately 2 to 3 pounds of wheat, stored in sealed, moisture-proof plastic bags.

**MOISTURE** – Official USDA procedure using Dickey-John Moisture Meter.

**GRADE** – Official United States Standards for Grain, as determined by a licensed grain inspector. North Dakota Grain Inspection Service, Fargo, ND, provided grades for composite wheat samples representing each crop reporting area.

**VITREOUS KERNELS** – Approximate percentage of kernels having vitreous endosperm.

**DOCKAGE** – Official USDA procedure. All matter other than wheat which can be removed readily from a test portion of the original sample by use of an approved device (Carter Dockage Tester). Dockage may also include underdeveloped, shriveled and small pieces of wheat kernels removed in properly separating the material other than wheat and which cannot be recovered by properly rescreening or recleaning.

**TEST WEIGHT** – American Association of Cereal Chemists International (AACCI) Method 55-10. Measured as pounds per bushel (lb/bu), kilograms per hectoliter (kg/hl) = (lbs/bu X 1.292) + 1.419. \*Approved Methods of the AACCI Approved Methods (11th Edition), St. Paul, MN.

**THOUSAND KERNEL WEIGHT** – Based on 10 gram sample of cleaned wheat (free of foreign material and broken kernels) counted by electronic seed counter.

**KERNEL SIZE DISTRIBUTION** – Percentages of the size of kernels (large, medium, small) were determined using a wheat sizer equipped with the following sieve openings:

- top sieve—Tyler #7 with 2.92 mm opening;
- middle sieve—Tyler #9 with 2.24 mm opening; and
- bottom sieve—Tyler #12 with 1.65 mm opening.

**PROTEIN** – AACCI (NIR) Method: 39.10.01 expressed on dry basis and 12 percent moisture basis.

**ASH** – AACCI Method 08.01, expressed on a 14 percent moisture basis.

**DON** – Analysis was done on ground wheat using a gas chromatograph with an electron capture detector as described in J. Assoc. Official Anal. Chem 79,472 (1996).

**FALLING NUMBER** – AACCI Method 56.81.04; units of seconds (14 percent moisture basis).

**SEDIMENTATION** – AACCI Method 56.61.01, expressed in centimeters.

### FLOUR

**EXTRACTION** – Samples are cleaned and tempered according to AACCI 26-01.02. The milling laboratory is controlled at 68 percent relative humidity and 72°F to 74°F. Milling is performed on a Buhler laboratory mill (Type MLU-202). Straight grade flour (of all six flour streams) is blended and reported as “flour extraction.” The blended flour is rebolted through an 84 SS sieve. All mill settings are optimized to achieve maximum laboratory mill flour extraction with standardized ash content.

**ASH** – AACCI Method 08.01, expressed on a 14 percent moisture basis.

**PROTEIN** – AACCI Method 39.10.01 (NIR Method), expressed on a 14 percent moisture basis.

**WET GLUTEN** – AACCI Method 38.12.02, expressed on a 14 percent moisture basis determined with the glutomatic instrument.

**GLUTEN INDEX** – AACCI Method 38.12.02, determined with the glutomatic instrument as an indication of gluten strength.

**FLOUR FALLING NUMBER** – AACCI Method 56.81.03, units of seconds. Determination is performed on 70 g of Buhler milled flour (14 percent moisture basis).

**AMYLOGRAM** – (65 g) AACCI Method 22.10.01, modified as follows: 65 g of flour (14 percent moisture basis) are slurried in 450 ml distilled water, paddle stirrers are used with the Brabender Amylograph. Peak viscosity reported in Brabender units (B.U.), on a 14 percent moisture basis.

**STARCH DAMAGE** – AACCI Method 76.31.01. Spectrophotometric method (megazyme).

**SOLVENT RETENTION CAPACITY (SRC)** – AACCI 56-11.02, expressed on a 14 percent moisture basis. SRC is used to predict commercial baking performance. Flour is shaken with excess of four types of solvent, to determine the amount of solvent held by the flour. The four solvents used relate to the functionality to flour components as follows:

- **WATER** – Water absorption
- **SUCROSE** – Non-starch polysaccharides
- **LACTIC ACID** – Glutenins
- **SODIUM CARBONATE** – Damaged Starch

# U.S. HARD RED SPRING *Wheat*

| MINNESOTA | MONTANA | NORTH DAKOTA | SOUTH DAKOTA | IDAHO | OREGON | WASHINGTON |

**GLUTEN PERFORMANCE INDEX (GPI)** – is a ratio of the solvents and used as an overall performance of flour glutenins especially in relation to bread wheat flour.

## PHYSICAL DOUGH PROPERTIES

**FARINOGRAM** – AACC I Method 54-21.02; constant flour weight method, small (50 g) mixing bowl. (Flour weight 14 percent moisture basis).

**ABSORPTION** – Amount of water required to center curve peak on the 500 Brabender unit line, expressed on 14 percent moisture basis.

**PEAK TIME** – The interval, to the nearest 0.5 min, from the first addition of water to the maximum consistency immediately prior to the first indication of weakening. Also known as dough development time.

**STABILITY** – The time interval, to the nearest 0.5 min, between the point where the top of the curve that first intersects the 500-BU line and the point where the top of the curve departs the 500-BU line.

**MIXING TOLERANCE INDEX** – The difference, in Brabender units, from the top of the curve at the peak to the top of the curve measured five minutes after the peak.

**QUALITY NUMBER** – AACC I Method 115. The length, expressed in mm, along the time axis, between the point of water addition and the point where the height in the center of the curve decreased by 30 BU compared to the height of the center of the curve at development time. Stronger flours have a higher quality number.

**EXTENSIGRAM** – AACC I Method 54-10.01; modified as follows: (a) 100 grams of flour (14 percent moisture basis), 2.0 percent sodium chloride (U.S.P.) and water (equal to farinograph absorption minus 2 percent) are mixed to optimum development in a National pin dough mixer; (b) doughs are scaled to 150 grams, rounded, moulded, placed in extensigram holders, and rested for 45 minutes and 135 minutes, respectively, at 30°C and 78 percent relative humidity. The dough is then stretched as described in the procedure referenced above. For conversion purposes, 500 grams equals 400 B.U.

**EXTENSIBILITY** – Total length of the curve at the base line in centimeters.

**RESISTANCE** – Maximum curve height, reported in Brabender units (B.U.).

**AREA** – The area under the curve is measured and reported in square centimeters.

**ALVEOGRAPH** – AACC I Method 54.30.02. Alveolab is used to measure dough extensibility and resistance to extension.

**“P”** – Maximal overpressure; related to dough’s resistance to deformation.

**“L”** – Dough extensibility.

**“W”** – The “work” associated with dough deformation.

## BAKING

**PROCEDURE** – AACC I Method 10-09.01, modified as follows: (a) fungal amylase (SKB 15) replacing malt dry powder, (b) Instant dry yeast (1.5 percent) in lieu of compressed yeast, (c) 5 to 10 ppm ammonium phosphate, where added oxidants are required, (d) 2 percent shortening added. Doughs are mechanically punched using 6-inch rolls, and mechanically moulded using a National Laboratory Test moulder. Baking is accomplished in “Shogren-type” pans.

**BAKING ABSORPTION** – Water required for optimum dough baking performance, expressed as a percent of flour weight on a 14 percent moisture basis.

**DOUGH CHARACTER** – Handling conversion assessed at panning on a scale of 1 to 10 with higher scores preferred.

**LOAF VOLUME** – Rapeseed displacement measurement made 30 minutes after bread is removed from the oven.

**CRUMB GRAIN AND TEXTURE** – Visual comparison to standard using a constant illumination source. Scale of 1 to 10, the higher scores preferred.

**CRUMB COLOR** – Visual comparison with a standard using a constant illumination source on a scale of 1 to 10, the higher scores preferred.

**CRUST COLOR** – Visual comparison with a standard using a constant illumination source on a scale of 1 to 10, the higher scores preferred.

**SYMMETRY** – Visual comparison with a standard using a constant illumination source on a scale of 1 to 10, the higher scores preferred.

VARIETAL INFORMATION											
2023 MAJOR VARIETIES PRODUCED - AGRONOMIC FACTORS											
VARIETY	AGRONOMIC DESCRIPTION			REACTION TO DISEASE <sup>3</sup>				AVERAGE YIELD			
	AGENT OR ORIGIN	YEAR RELEASED	STRAW STRENGTH <sup>2</sup>	LEAF RUST	BACTERIAL LEAF STREAK	HEAD (SCAB)	EASTERN, ND <sup>4</sup>		WESTERN ND <sup>5</sup>		
							BU/ACRE	MT/HECT	BU/ACRE	MT/HECT	
AP Murdock	Syngenta/AgriPro	2019	4	5	6	6	75.4	5.07	575	3.87	
AP Smith	Syngenta/AgriPro	2023	2	3	5	4	68.2	4.59	574	3.86	
Faller	NDSU	2007	5	7	5	4	73.5	4.94	60.9	4.09	
Glenn	NDSU	2005	4	6	5	4	60.3	4.05	52.4	3.52	
Lanning	MSU	2017	4	7	8	6	63.3	4.26	57.8	3.89	
MN Rothsay	U of MN	2023	3	6	6	4	70.2	4.72	61.1	4.11	
MN Torgy	U of MN	2020	3	3	4	3	74.6	5.02	61.0	4.10	
ND Heron	NDSU	2023	6	7	7	3	63.8	4.29	53.7	3.61	
ND Thresher	NDSU	2023	na	na	4	5	65.2	4.38	54.5	3.66	
Shelly	U of MN	2016	4	6	8	5	70.4	4.73	58.9	3.96	
SY Ingmar	Syngenta/AgriPro	2014	3	3	6	5	64.8	4.36	52.4	3.52	
SY Valda	Syngenta/AgriPro	2015	4	2	6	5	73.9	4.97	57.1	3.84	
WB 9590	Westbred	2017	3	3	8	6	71.5	4.81	56.1	3.77	

1. NDSU - North Dakota State University (Public), U of MN - University of Minnesota (Public), MSU - Montana State University (Public), Syngenta/AgriPro - (Private), and Westbred (Private).
2. Straw Strength: 1 to 9 scale, with 1 the strongest and 9 the weakest.
3. Disease reaction scores from 1 - 9, with 1 = resistant and 9 = very susceptible.
4. Means were obtained using mixed model analysis to account for unbalanced and occasional missing data. Data source was 2018-2021 North Dakota statewide variety trials. East locations: Carrington, Casselton, Langdon, Prosper, Thompson, Sargent, and Steel county.
5. West locations: Dickinson, Hettinger, Mandan, Minot and Williston.

QUALITY INFORMATION								
2023 MAJOR VARIETIES PRODUCED - QUALITY & END-USE FACTORS								
VARIETY	TEST WEIGHT LB/BU	TEST WEIGHT KG/HL	WHEAT PROTEIN %	VITREOUS KERNELS %	FARINOGRAM STABILITY (MIN)	ABSORPTION %	LOAF VOLUME CC	MILL & BAKE QUALITY RATING <sup>7</sup>
AP Murdock	60.4	79.5	14.0	66	11.9	63.1	944	★★★
AP Smith	60.6	79.7	15.0	76	11.2	63.4	986	★★★
Faller	60.7	79.8	14.4	72	10.5	64.9	980	★★★
Glenn	62.9	82.7	15.6	81	11.7	65.1	1041	★★★★★
Lanning	59.6	78.4	15.7	78	9.4	63.5	947	★★★
MN Rothsay	60.9	80.1	14.8	73	11.9	61.9	939	★★★
MN Torgy	61.5	80.9	15.1	72	9.9	63.0	916	★★★
ND Heron	62.5	82.2	15.6	72	8.6	72.4	972	★★★
ND Thresher	60.1	79.1	15.1	72	11.3	65.7	1014	★★★★★
Shelly	61.5	80.9	14.5	76	11.0	61.9	909	★★
SY Ingmar	61.1	80.4	15.5	79	10.5	62.9	1018	★★★★★
SY Valda	61.0	80.2	14.7	79	8.4	63.8	949	★★★
WB 9590	61.3	80.6	15.4	76	11.7	64.1	955	★★★

6. Source: NDSU Plant Science Department, Hard Red Spring Wheat Quality Laboratory, 2019-2022 drill strip trials across ND locations.
7. Mill and bake quality rating based on protein content, milling performance, flour attributes, dough characteristics and baking performance. Five stars = superior, four stars = excellent, three stars = good, two stars = average, one star = poor.

## NORTH DAKOTA

**WB 9590** advanced to first position in both North Dakota and Minnesota, with an 8.7 and 23.7 percent share of the acres, respectively. In North Dakota, it's share of acres held steady with 2022 levels, while in Minnesota it increased from 19.4 percent. A 2017 release from Westbred, it provides producers with strong straw characteristics, high yield potential and moderately high protein content. WB 9590 is rated as good for milling and baking qualities.

**AP MURDOCK** moved into second place in North Dakota with 8.4 percent of the acres, and ranks seventh in Minnesota with 5.9 percent of the acres. Released in 2019 by Syngenta/AgriPro, AP Murdock shows balanced appeal across central and northern districts in North Dakota, and is replacing older varieties due to its higher yield potential, good straw strength, and moderately high protein levels. It is rated as good for milling and baking quality.

**SY VALDA** fell to the third spot in North Dakota a 7 percent share of acres, down from 11 percent last year, and the top position. In Minnesota, it is the third most popular variety at 9 percent of the acres, down slightly from last year. A 2015 release from Syngenta/AgriPro, it is popular in eastern parts of the HRS region for its elite yield potential. It is rated as average for milling and baking quality.

**SY INGMAR** slipped to fourth place in North Dakota in 2023 with a 6.4 percent share of acres. It had been the top variety in the state from 2017-2021, but has lost acreage share in recent years to new releases. SY Ingmar is most popular across the western and central regions of ND, and ranks ninth in Montana with 2.6 percent of the acres. SY Ingmar is a 2014 release from Syngenta/AgriPro with broad appeal because of good yield potential, very good straw strength, a high level of disease resistance and moderate to high protein levels. It has very good milling and baking quality.

### NORTH DAKOTA VARIETY SHARE OF PLANTED ACRES<sup>3</sup>

VARIETY	2023%	2022%
WB 9590	8.7	8.8
AP Murdock	8.4	8.8
SY Valda	6.9	11.0
SY Ingmar	6.4	9.4
MN Torgy	4.5	2.0
Shelly	3.3	3.9
WB 9719	3.1	4.1
Faller	3.1	2.9
Glenn	2.6	2.7
Ambush	2.5	0.8
Other <sup>2</sup>	45.6	50.5

1. Percentage may not add to 100 due to rounding.
2. Includes varieties with less than 1% of acreage and unknown varieties.
3. (1 acre = 0.405 hectares)  
2023 - 5,550,000 planted acres  
2022 - 5,300,000 planted acres

### TOP 3 NORTH DAKOTA VARIETIES BY CROP DISTRICT

	FIRST	SECOND	THIRD
Northwest	AP Murdock 10.5	SY Ingmar 9.5	SY Rockford 6.5
North Central	SY Valda 21.3	AP Murdock 10.0	WB 9590 9.2
Northeast	WB 9590 15.2	SY Valda 12.0	Faller 12.0
West Central	WB 9590 8.6	SY Ingmar 803	Elgin ND 6.9
Central	AP Murdock 15.3	SY Ingmar 14.6	WB 9590 10.3
East Central	WB 9590 30.0	AP Murdock 22.7	MN Torgy 10.8
Southwest	Shelly 16.9	Mott 9.7	MN Torgy 7.2
South Central	Ambush 24.7	SY Ingmar 16.0	LCS Trigger 11.0
Southeast	SY Valda 13.9	WB 9590 11.3	MN Torgy 8.4

1. Percentage may not add to 100 due to rounding.
2. Includes varieties with less than 1% of acreage and unknown varieties.
3. (1 acre = 0.405 hectares)  
2023 - 5,550,000 planted acres  
2022 - 5,300,000 planted acres

## MINNESOTA

### MINNESOTA VARIETY SHARE OF SURVEYED ACRES<sup>3</sup>

VARIETY	2023%	2022%
WB 9590	23.7	19.4
MN Torgy	18.6	21.7
SY Valda	9.1	11.0
WB 9479	7.1	7.9
MN Rothsay	6.3	0.3
Linkert	6.0	6.3
AP Murdock	5.9	7.6
Other <sup>2</sup>	23.3	25.7

1. Percentage may not add to 100 due to rounding.
2. Includes varieties with less than 1% of acreage and unknown varieties.
3. (1 acre = 0.405 hectares)  
2023 - 1,300,000 planted acres  
2022 - 1,250,000 planted acres

**MN TORGY** held relatively steady in acres across the region, with slight gains in North Dakota, but a slight decline in Minnesota. It is the second most popular variety in Minnesota with an 18.6 acreage share, and fifth in North Dakota with 4.5 percent of the acres. MN Torgy is a 2020 release from the University of Minnesota, that has very broad appeal across the region due to it having excellent disease resistant traits, very strong straw, and high yield potential. It is rated as good for milling and baking quality.

**WB 9479** remained the fourth most popular variety in Minnesota in 2023 with 7.1 percent of the acres, down slightly from a year ago. It is a 2017 release from Westbred with high protein content, strong straw, a high level of leaf rust resistance and high yield potential. WB 9479 has especially strong dough properties, and is rated as good for milling and baking qualities.

### TOP 3 MINNESOTA VARIETIES BY CROP DISTRICT

	FIRST	SECOND	THIRD
North	WB 9590 28.0	MN Torgy 14.0	SY Valda 8.0
Central	MN Torgy 36.0	SY Valda 14.0	MN Rothsay 10.0
South	MN Torgy 39.0	SY Ingmar 11.0	MN Rothsay 11.0

**MN-ROTHSAY** advanced to fifth in Minnesota in 2023, with a 6.3 percent acreage share, up from just 0.3 percent last year. A 2022 release from the University of Minnesota, it is a variety which touts exceptional straw strength and a high level of resistance to Fusarium head blight. MN-Rothsay is rated as average for milling and baking qualities.

**SOUTH DAKOTA** - No survey results in 2023

## MONTANA

### MONTANA VARIETY SHARE OF SURVEYED ACRES<sup>3</sup>

VARIETY	2023%	2022%
Vida	22.5	21.8
Reeder	11.7	7.2
Dagmar	9.0	0.9
SY Longmire	8.8	8.6
Lanning	4.4	6.2
Corbin	4.2	6.7
WB Gunnison	3.2	2.2
Duclair	2.7	2.1
SY Ingmar	2.6	4.2
Barlow	2.4	3.6
Other <sup>2</sup>	28.5	36.5

- Percentage may not add to 100 due to rounding.
- Includes varieties with less than 1% of acreage and unknown varieties.
- (1 acre = 0.405 hectares)  
2023 - 2,700,000 planted acres  
2022 - 2,700,000 planted acres

**VIDA** remains the leading variety planted in Montana, with 22.5 percent of the acres. It has been the top variety in the state for twelve straight years, holding consistent on acreage share. Vida is popular with producers for its high yield and moderate resistance to leaf rust and stripe rust. A 2006 release from the Montana Agricultural Experiment Station, it is most popular across northern and central areas, and is rated as good for milling and baking quality.

**SY LONGMIRE** is the fourth most popular variety in Montana, with 8.8 percent of the acres in 2023, steady with a year ago. It is a 2019 release from Syngenta/AgriPro. SY Longmire is a solid stem variety that is highly tolerant to the wheat stem sawfly which is a persistent pest challenge in parts of Montana, making it most popular in north central and northeast districts. SY Longmire has very good yield potential and good protein levels.

**DAGMAR** moved into third position with 9 percent of the acres. It is a 2019 release from the Montana Agricultural

Experiment Station. Dagmar is a solid stem variety with good yield and high protein content, and was developed to replace Vida in areas of the state where a higher level of resistance to the wheat stem sawfly is needed. It has good milling and baking quality.

### TOP 2 MONTANA VARIETIES BY CROP DISTRICT

	FIRST	SECOND
North Central	Vida 31.3	Dagmar 13.5
North East	Reeder 25.3	Vida 14.6
Central	Vida 27.8	Dagmar 22.7

### PNW VARIETAL INFORMATION

#### MAJOR VARIETIES PRODUCED IN WASHINGTON, OREGON AND IDAHO - QUALITY & END-USE FACTORS<sup>2</sup>

VARIETY	AGENT OR ORIGIN <sup>1</sup>	YEAR RELEASED	TEST WEIGHT LB/BU	TEST WEIGHT KG/HL	WHEAT PROTEIN %	FARINOGRAM STABILITY (MIN)	ABSORPTION %	LOAF VOLUME CC	MILL & BAKE QUALITY RATING <sup>3</sup>
Alum	WSU	2014	62.6	82.3	13.9	25.2	66.5	1072	MD
Chet	WSU	2014	63.1	82.9	14.7	18.4	68.0	1099	MD
Espresso	Westbred	2007	62.6	82.3	14.7	5.1	68.5	1032	*NR
Glee	WSU	2012	62.5	82.2	13.5	16.0	65.7	1050	MD
Jefferson	ID	1997	62.3	81.9	13.6	20.9	66.1	977	MD
Kelse	WSU	2008	62.0	81.5	14.4	19.0	67.7	1079	D
AP Renegade	Syngenta	2017	61.9	81.4	13.3	28.9	65.2	922	D
Net CL+	WSU	2019	63.6	83.6	12.7	15.6	65.7	995	MD
WB 9303	Bayer	2021	62.7	82.4	15.5	na	67.6	957	*NR
WB 9518	Bayer	2013	61.9	81.4	14.9	12.7	69.3	1118	*NR
WB 9662	Bayer	2014	62.4	82.0	14.5	5.5	67.7	998	LD
WB 9668	Bayer	2014	62.8	82.6	14.9	13.5	69.3	1083	D

- ID - University of Idaho (Public), WSU - Washington State University (Public), Bayer (Private), Syngenta - (Private), and Westbred (Private).
  - Western Wheat Quality Lab, Pullman, WA
  - Mill and bake quality rating based on protein content, milling performance, flour attributes, dough characteristics and baking. Western Wheat Quality Lab. Most Desirable (MD), Desirable (D), Acceptable (A).
- \* Insufficient data exists to produce rating scores.

# 2023

U.S. HARD RED  
SPRING WHEAT

*REGIONAL QUALITY REPORT*

FUNDING & SUPPORT PROVIDED BY:

U.S. WHEAT ASSOCIATES

NORTH DAKOTA WHEAT COMMISSION

MONTANA WHEAT AND BARLEY COMMITTEE

MINNESOTA WHEAT RESEARCH AND  
PROMOTION COUNCIL

SOUTH DAKOTA WHEAT COMMISSION

WASHINGTON GRAIN COMMISSION

IDAHO WHEAT COMMISSION

OREGON WHEAT COMMISSION

NORTH DAKOTA STATE UNIVERSITY  
PLANT SCIENCES DEPARTMENT