

2018
U.S.
HARD RED
SPRING
WHEAT
Regional Quality Report

U.S. HARD RED SPRING

Wheat

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

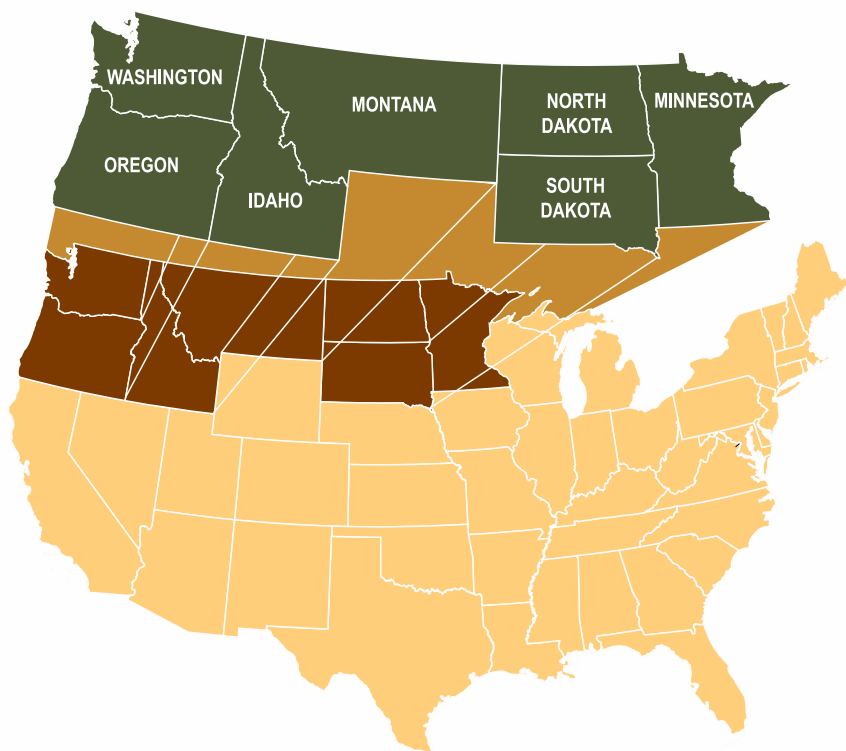
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THE ARISTOCRAT OF WHEAT

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 and specialty products such as hearth breads, whole grain breads, bagels and pizza crusts look and taste their best when baked 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.



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2018 OVERVIEW

THE 2018 U.S. hard red spring wheat (HRS) crop is large in production, high grading, high protein and laboratory analysis reveals a crop with many positives for key end-use quality traits. Production is up more than 50 percent from 2017's drought impacted crop, due to expanded planted area and a record national yield. Production is higher across all major HRS regions.

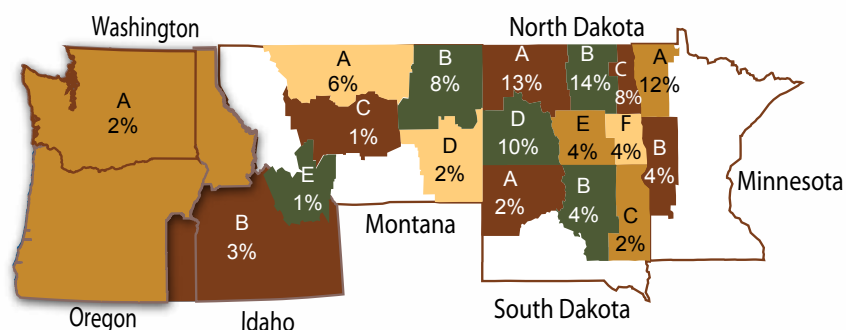
THE CROP averages a No. 1 Dark Northern Spring, up from a No. 1 Northern Spring in 2017, as the crop average vitreous kernel level is 86 percent as compared to 71 percent last year. Grade distributions, on samples collected in the survey, have 95 percent grading No. 1. The crop average test weight is 62.2 lbs/bu (81.8 kg/hl), higher than last year and the 5-yr average. Eighty-four percent of the crop is above 60 lbs/bu (78.9 kg/hl). The 2018 crop's average damaged kernel level is 0.4 percent, up slightly from last year and 5-yr average. Favorable weather during maturation and dry weather during harvest secured a crop with high vitreous kernel levels. Nearly 90 percent of the crop is above 75 percent vitreous kernel counts, or the minimum for Dark Northern Spring sub classification.

PROTEIN CONTENT is high in the 2018 crop, an unanticipated outcome given the record yields across the region. The crop average is 14.5 percent (12% moisture basis), equal to last year and one-half percentage point above average. By area, protein levels are down slightly from a year ago across western parts of the region, but steady to slightly higher across the east. Distribution of protein is nearly equal to a year ago with 71 percent of the crop above 14% protein, and only 11 percent below 13% protein.

IN 2018, disease pressures were higher than 2017 due to more plentiful moisture patterns. The heaviest pressure from Fusarium headlight was across eastern parts of the region. The crop average DON is 0.4 ppm, up from 0.0 last year and 0.2 ppm for a 5-yr average. The majority of cropping areas show <0.5 or 0.0, but a few areas average near 1 ppm. Thousand kernel weights are very good, with a crop average of 31.2 grams. The mostly dry harvest conditions are evident in the crop average falling number of 399 seconds. More than 95 percent of the crop is above 350 seconds.

MILLING ANALYSIS, based on a Buhler Lab Mill, averaged 68.1 percent extraction, down from 2017 but similar to the 5-yr average. Average flour ash is 0.52 percent, also lower than last year but similar to the 5-yr average. Starch damage averages 8.3 percent, up from both last year and the 5-yr average. Wet gluten values for the crop average 36.4 percent, higher than both last year and the 5-yr average.

APPROXIMATE SHARE OF REGIONAL PRODUCTION



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PRODUCTION DATA

	2018	2017	2013-17 AVERAGE
MILLION BUSHELLS			
Minnesota	93	76	73
Montana	96	48	82
North Dakota	318	207	265
South Dakota	41	21	50
ID/OR/WA	39	31	26
U.S. Total	587	384	496
MILLION METRIC TON			
Minnesota	2.53	2.07	2.00
Montana	2.61	1.31	2.23
North Dakota	8.66	5.63	7.20
South Dakota	1.12	0.57	1.37
ID/OR/WA	1.06	0.87	0.71
U.S. Total	15.9	10.5	13.51

Source: USDA 2018 Small Grains Summary

PHYSICAL

DOUGH tests indicate a crop that has 1.6 percentage points higher Farinograph absorption as compared to 2017. The crop average Farinograph stability time is 11.4 minutes, down slightly from 11.9

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minutes last year. Dough properties appear to be strongest across eastern portions of the region, and most areas still show stability times higher than the 5-year average. Alveograph and Extensigraph analysis of the crop shows a crop with less extensibility. The average P/L ratio on the Alveograph is 0.74 as compared to 0.57 a year ago. On the 135 minute pull on the Extensograph, the overall extensibility and resistance to extension is 14.2 and 847, slightly greater than 2017 crop values of 14.0 and 836.

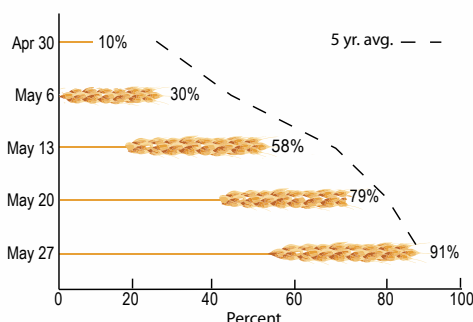
BAKING EVALUATIONS produced the highest loaf volumes and absorption values in the last six crop years. The crop average loaf volume is 988 cubic centimeters, up from 951, and bake absorption averages 69.5 percent, up from 66.2 percent, a year ago. Overall bread scores are very good, with improved crumb color, crust color and symmetry, with slightly lower grain and textures scores, compared to 2017.

THE 2018 U.S. HRS crop has many positive features for buyers, with improved supplies, a high grade profile, above average protein levels, and very good dough and bake qualities. In general, many quality features are quite balanced across the region, although some quality parameters, such as grade factors, DON and dough strength do differ. Diligent contract specifications are encouraged to ensure buyers receive the quality they demand.

SEASONAL CONDITIONS - 2018

PLANTING BEGAN in late April, later than normal, as a period of colder temperatures delayed soil warm-up in much of the region, and in isolated areas, late season snow impacted planting. Initial progress was slow, but progress accelerated rapidly in the second half of May on hot, dry conditions, allowing most of the crop to be planted by late May.

HRS Planting Progress

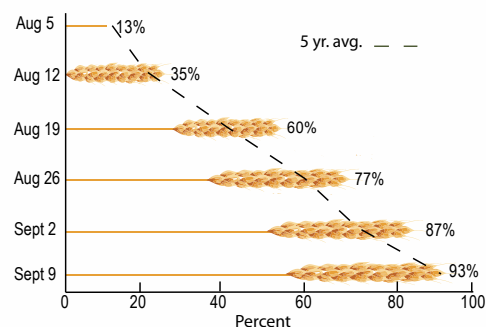


CROP EMERGENCE was hindered in parts of the region due to the lack of topsoil moisture, and hot temperatures. Fortunately, a shift in moisture patterns with timely and plentiful rainfall occurred throughout much of June. This benefited the crop, reviving previously stressed areas, and allowing the establishment of good stands and early growth. Temperatures in early June remained well above average but moderated into early July. Disease pressures were elevated in late June across central and eastern parts of the region due to the abundant moisture.

THE LATTER half of the growing season, was characterized by less frequent rains. In the second half of July, above normal temperatures returned to the region, accelerating crop maturity. Crops in much of the region were in very good condition with above average yield potential as they reached maturity.

HARVEST BEGAN in late July, near normal, and made steady and rapid progress into the second half of August. Generally, warm and dry conditions prevailed, favorable for harvest. The last third of the harvest, especially across northern areas, and into western areas was somewhat slower, due to rains, and delayed crop ripening. For the bulk of the region, harvest was generally completed by mid-September, slightly ahead of normal.

HRS Harvest Progress



WHEAT CHARACTERISTICS

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 (DND) – 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

Official U.S. Grades and Grade Requirements (Revised June 1993)

GRADING FACTORS	U.S. GRADES				
	1	2	3	4	5
HARD RED SPRING – MINIMUM TEST WEIGHTS					
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
MAXIMUM PERCENT LIMITS OF:					
Damaged kernels					
Heat (part of total)	0.2	0.2	0.5	1.0	3.0
Total	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 ¹	3.0	5.0	8.0	12.0	20.0
Wheat of other class ²					
Contrasting classes	1.0	2.0	3.0	10.0	20.0
Total ³	3.0	5.0	10.0	10.0	10.0
Stones	0.1	0.1	0.1	0.1	0.1
MAXIMUM COUNT LIMITS OF:					
Other material					
Animal filth	1	1	1	1	1
Castor beans	1	1	1	1	1
Crotalaria seeds	2	2	2	2	2
Glass	0	0	0	0	0
Stones	3	3	3	3	3
Unknown foreign material	3	3	3	3	3
Total ⁴	4	4	4	4	4
Insect-damaged kernels	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.

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.

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WHEAT GRADING DATA

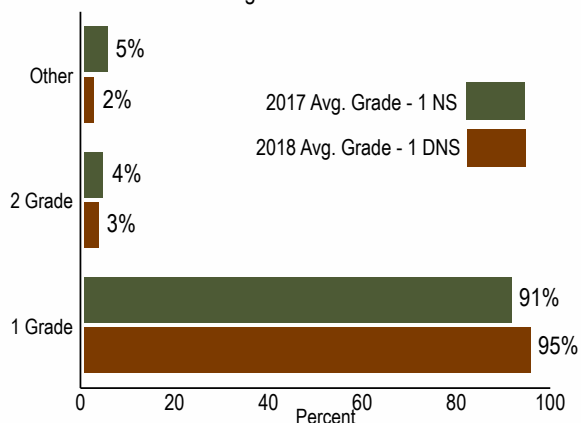
STATE AND CROP REPORTING AREA	TEST WEIGHT LBS/BU	TEST WEIGHT KG/HL	DAMAGE %	SHRUNKEN/ BROKEN KERNELS %	TOTAL DEFECTS	U.S GRADE SUBCLASS	VITREOUS KERNELS %
MINNESOTA							
Area A	62.4	82.0	0.6	0.7	1.3	1 DNS	86
Area B	60.5	79.6	0.6	0.7	1.3	1 NS	45
State Avg 2018	62.0	81.6	0.6	0.7	1.3	1 DNS	78
State Avg 2017	62.4	82.0	0.0	0.5	0.5	1NS	60
MONTANA							
Area A	60.6	79.7	0.3	1.3	1.6	1 DNS	88
Area B	61.0	80.3	0.2	1.4	1.6	1 DNS	93
Area C	62.6	82.3	0.2	0.7	0.9	1 NS	60
Area D	62.1	81.6	0.2	1.5	1.7	1 DNS	81
Area E	62.3	81.9	0.2	0.7	0.9	1 DNS	93
State Avg 2018	61.0	80.2	0.2	1.3	1.5	1 DNS	90
State Avg 2017	60.8	80.0	0.0	1.8	1.8	1 DNS	77
NORTH DAKOTA							
Area A	62.9	82.7	0.3	0.8	1.1	1 DNS	89
Area B	63.4	83.3	0.2	0.6	0.8	1 DNS	89
Area C	62.7	82.5	0.4	0.5	0.9	1 DNS	85
Area D	61.6	81.0	0.4	1.0	1.4	1 DNS	93
Area E	61.8	81.3	0.5	0.5	1.0	1 DNS	76
Area F	61.9	81.4	0.6	0.6	1.2	1 DNS	80
State Avg 2018	62.6	82.3	0.3	0.7	1.0	1 DNS	87
State Avg 2017	61.4	80.7	0.1	0.9	1.0	1 NS	71
SOUTH DAKOTA							
Area A	61.3	80.6	0.3	1.1	1.4	1 DNS	82
Area B	61.0	80.3	1.0	1.9	2.9	1 DNS	75
Area C	61.1	80.3	0.4	0.9	1.3	1 NS	66
State Avg 2018	61.1	80.4	0.8	1.6	2.4	1 DNS	75
State Avg 2017	60.5	79.6	0.0	1.0	1.0	1 NS	68
IDAHO - OREGON - WASHINGTON							
Area A	63.0	82.8	0.2	0.8	1.0	1 DNS	95
Area B	63.0	82.8	0.4	0.6	1.0	1 DNS	96
State Avg 2018	63.0	82.8	0.3	0.7	1.0	1 DNS	96
State Avg 2017	63.6	83.6	0.1	0.5	0.6	1 DNS	91
REGION AVERAGE							
Avg 2018	62.2	81.8	0.4	0.9	1.3	1 DNS	86
Avg 2017	61.6	81.0	0.1	0.9	1.0	1 NS	71
Five-Year Avg	61.8	81.2	0.2	0.8	1.0	1 NS	70

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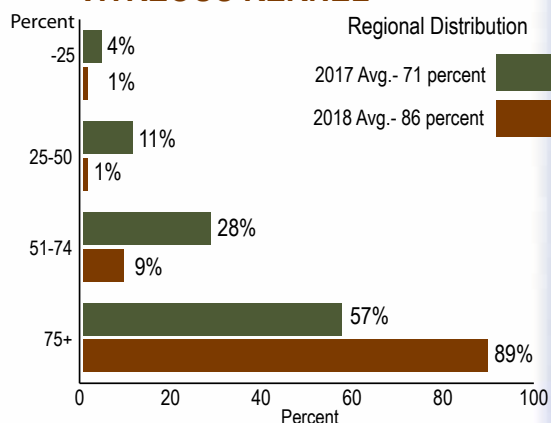
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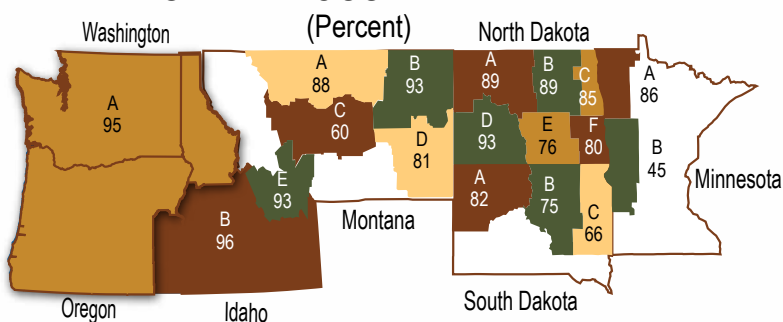
GRADE – Regional Distribution



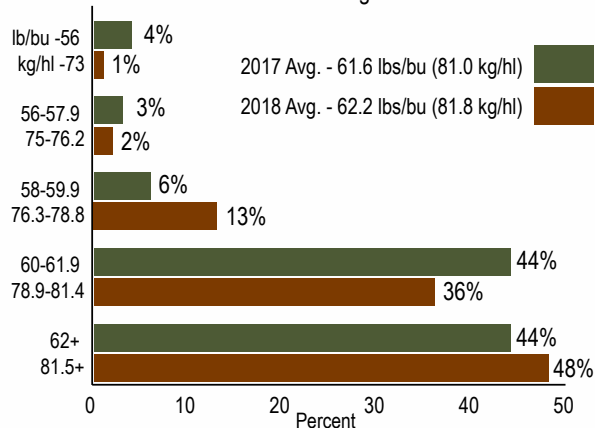
VITREOUS KERNEL



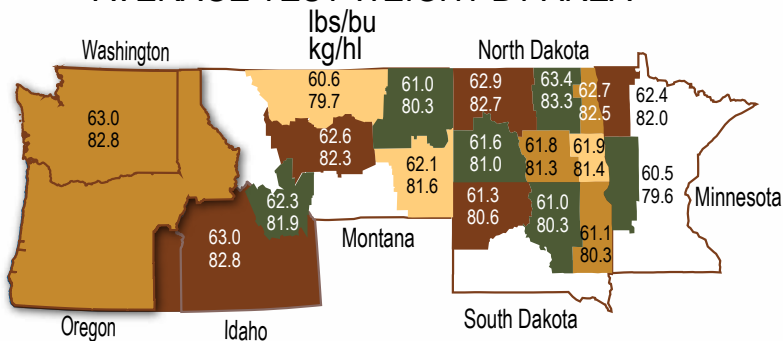
AVERAGE VITREOUS KERNEL BY AREA



TEST WEIGHT – Regional Distribution



AVERAGE TEST WEIGHT BY AREA



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OTHER KERNEL QUALITY DATA

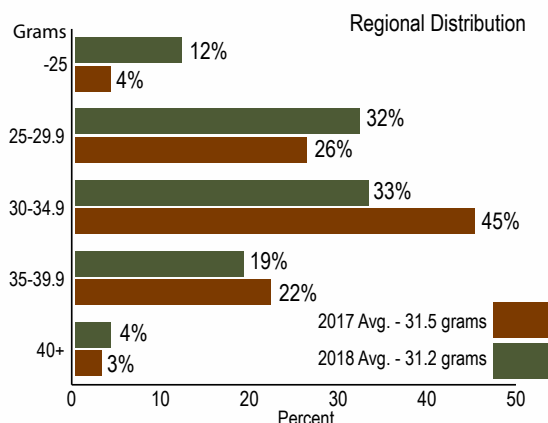
STATE AND CROP REPORTING AREA	DOCKAGE %	MOISTURE %	1000 KERNEL WEIGHT G	KERNEL DIST. MED./LGE %	PROTEIN 12%/0% MOISTURE BASIS	DON (PPM)	WHEAT ASH %	FALLING NUMBER (SEC)	ZELENY SED (CC)
MINNESOTA									
Area A	0.5	12.5	32.1	42/56	14.1/16.1	0.7	1.57	413	66
Area B	0.5	12.5	28.7	59/38	14.2/16.2	1.1	1.74	391	65
State Avg 2018	0.5	12.5	31.5	45/53	14.2/16.1	0.7	1.60	409	66
State Avg 2017	0.4	12.7	35.8	31/67	13.8/15.7	0.0	1.47	391	57
MONTANA									
Area A	0.4	10.9	29.1	69/26	13.7/15.5	0.0	1.42	389	64
Area B	0.7	10.5	26.2	72/23	14.9/16.9	0.0	1.50	401	64
Area C	0.4	12.1	33.9	43/55	12.6/14.3	0.2	1.57	366	63
Area D	0.6	10.8	26.9	60/36	13.6/15.5	0.0	1.56	378	55
Area E	0.6	11.9	31.3	55/42	13.7/15.6	0.0	1.49	412	67
State Avg 2018	0.6	10.8	27.8	69/26	14.3/16.2	0.0	1.47	395	64
State Avg 2017	0.5	10.7	27.2	76/18	14.8/16.8	0.0	1.53	395	60
NORTH DAKOTA									
Area A	0.4	12.2	31.8	48/49	14.6/16.5	0.2	1.54	388	67
Area B	0.4	12.5	33.7	37/61	14.1/16.0	0.7	1.54	403	65
Area C	0.6	12.7	32.1	43/55	14.2/16.1	1.0	1.60	404	68
Area D	0.6	11.8	29.8	57/40	15.4/17.5	0.2	1.58	405	68
Area E	0.5	12.4	31.0	43/55	15.0/17.1	0.3	1.66	384	65
Area F	1.0	12.4	31.6	43/55	14.7/16.7	1.1	1.62	411	67
State Avg 2018	0.5	12.3	31.9	45/52	14.6/16.6	0.5	1.57	398	67
State Avg 2017	0.5	12.6	30.4	57/40	14.6/16.6	0.1	1.50	382	65
SOUTH DAKOTA									
Area A	0.7	11.7	28.7	65/32	14.2/16.1	0.2	1.74	391	63
Area B	0.4	11.9	29.0	67/29	15.6/17.8	0.2	1.73	390	64
Area C	0.6	12.1	31.9	60/38	15.0/17.1	0.6	1.72	348	58
State Avg 2018	0.5	11.9	29.4	65/31	15.2/17.3	0.3	1.73	383	62
State Avg 2017	0.5	12.6	29.8	66/29	15.4/17.4	0.0	1.48	421	57
IDAHO - OREGON - WASHINGTON									
Area A	0.2	8.7	33.6	45/53	14.1/16.0	0.0	1.50	409	66
Area B	0.3	9.8	35.8	44/54	14.2/16.2	0.0	1.61	404	65
State Avg 2018	0.3	9.3	34.9	44/54	14.2/16.1	0.0	1.56	406	66
State Avg 2017	0.3	9.6	36.0	37/61	14.7/16.7	0.0	1.54	401	57
REGION AVERAGE									
State Avg 2018	0.5	11.9	31.2	50/47	14.5/16.5	0.4	1.57	399	66
State Avg 2017	0.5	12.1	31.5	53/44	14.5/16.5	0.0	1.50	389	62
Five-State Avg	0.6	12.2	31.8	48/49	14.0/15.9	0.2	1.51	382	62

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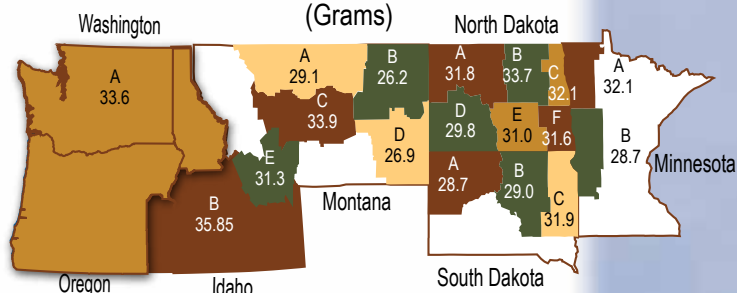
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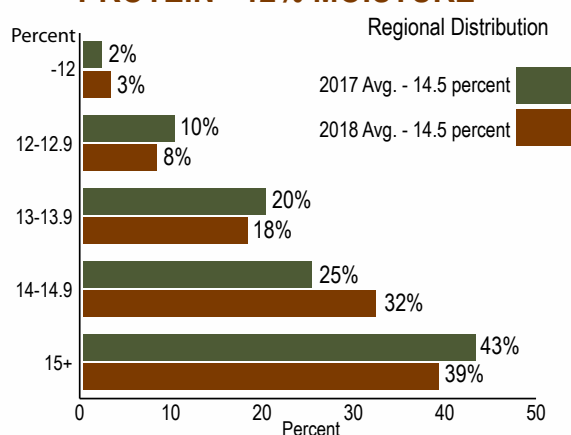
1000 KERNEL WEIGHT



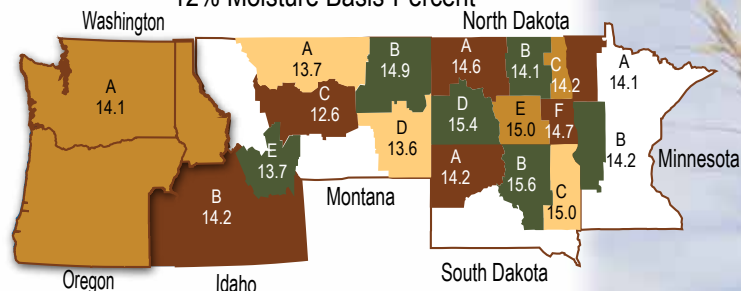
AVERAGE 1000 KERNEL WEIGHT BY AREA



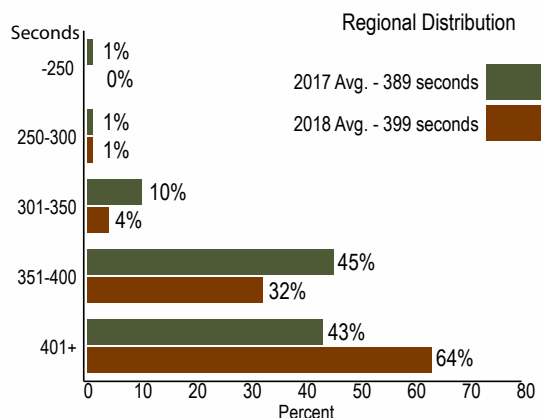
PROTEIN - 12% MOISTURE



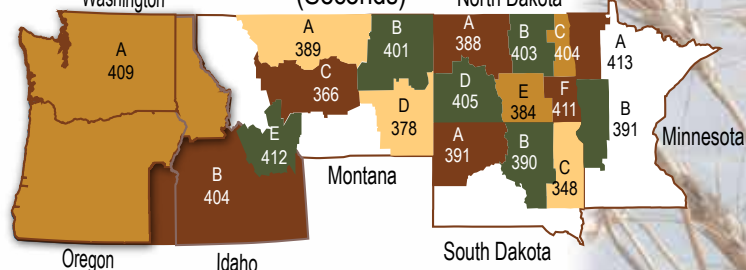
AVERAGE WHEAT PROTEIN BY AREA



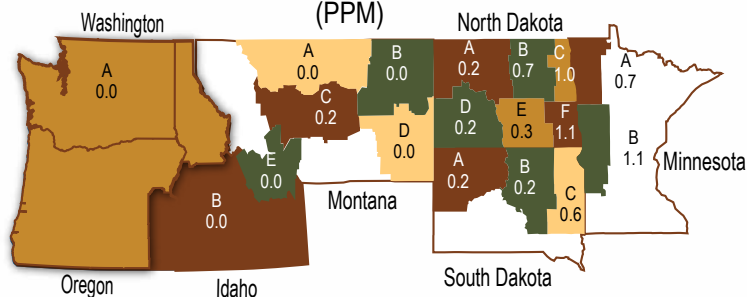
FALLING NUMBER



AVERAGE FALLING NUMBER BY AREA



AVERAGE DON BY AREA



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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_2CO_3	WET GLUTEN %	GLUTEN INDEX	FALLING NUMBER	AMYLOGRAPH VISCOSITY 65 G FL B.U.
MINNESOTA											
Area A	69.1	0.52	13.3	8.4	0.67	75/125	156/107	35.1	96	423	658
Area B	68.8	0.52	13.3	7.7	0.65	75/127	151/105	34.5	96	401	647
State Avg 2018	69.1	0.52	13.3	8.3	0.67	75/125	155/107	35.0	96	419	656
State Avg 2017	72.5	0.57	13.2	8.0	0.66	69/116	142/97	33.5	97	413	616
MONTANA											
Area A	68.3	0.54	13.1	8.7	0.66	80/129	166/120	35.2	87	421	672
Area B	66.6	0.52	14.0	7.4	0.64	76/130	154/109	38.5	79	420	765
Area C	67.8	0.52	11.7	8.5	0.65	78/123	157/116	30.7	97	387	475
Area D	66.4	0.52	12.7	7.7	0.63	76/124	146/107	33.5	87	413	647
Area E	67.0	0.52	13.2	9.2	0.65	82/130	166/124	35.5	88	418	680
State Avg 2018	67.3	0.52	13.5	8.0	0.65	78/129	159/114	36.7	83	419	714
State Avg 2017	70.0	0.57	14.0	6.1	0.65	69/117	139/98	38.4	81	427	696
NORTH DAKOTA											
Area A	67.3	0.51	13.8	8.1	0.70	77/124	162/109	36.4	88	408	607
Area B	69.4	0.53	13.3	9.1	0.67	79/123	157/113	35.8	90	413	676
Area C	68.5	0.49	13.3	8.1	0.65	73/126	150/103	34.7	95	419	606
Area D	67.9	0.53	14.5	8.3	0.62	77/127	148/110	39.6	83	442	619
Area E	68.0	0.53	14.2	8.3	0.63	76/122	144/106	38.7	84	403	651
Area F	66.9	0.50	13.4	7.9	0.67	74/126	149/95	35.2	94	435	641
State Avg 2018	68.2	0.52	13.7	8.4	0.66	77/124	154/108	36.7	89	418	633
State Avg 2017	71.1	0.57	13.8	6.4	0.69	69/116	145/95	35.0	93	390	505
SOUTH DAKOTA											
Area A	68.0	0.52	13.2	8.9	0.61	75/124	142/106	34.5	90	403	636
Area B	67.3	0.53	14.1	7.6	0.60	71/128	135/97	37.3	90	425	580
Area C	68.1	0.52	13.7	7.9	0.62	69/120	132/94	36.6	90	352	368
State Avg 2018	67.6	0.53	13.9	7.9	0.61	71/126	136/98	36.6	90	408	555
State Avg 2017	71.4	0.60	14.5	6.3	0.64	68/113	129/90	38.5	85	459	568
IDAHO - OREGON - WASHINGTON											
Area A	66.9	0.52	13.4	8.4	0.61	81/135	154/118	36.6	81	476	681
Area B	67.4	0.53	13.4	8.6	0.58	82/132	146/118	35.8	87	447	696
State Avg 2018	67.2	0.52	13.4	8.6	0.59	81/133	149/118	36.1	84	459	690
State Avg 2017	70.2	0.57	13.9	6.2	0.60	72/122	133/100	38.4	79	435	697
REGION AVERAGE											
Avg. 2018	68.1	0.52	13.6	8.3	0.65	77/126	153/109	36.4	89	421	649
Avg. 2017	71.2	0.57	13.8	6.7	0.67	69/116	142/96	35.6	91	407	570
Five-Year Avg.	68.1	0.52	12.9	7.0	0.65	72/125	144/98	34.4	92	399	603

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FLOUR is evaluated for several factors to determine overall milling efficiency, grade, 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.

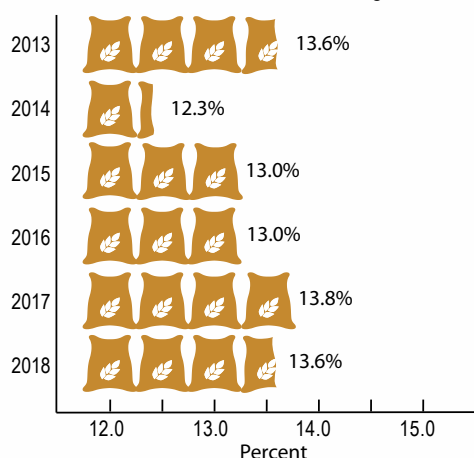
Another measure of milling efficiency and of flour grade is the ash content, or mineral residue, remaining after incineration of a sample.

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

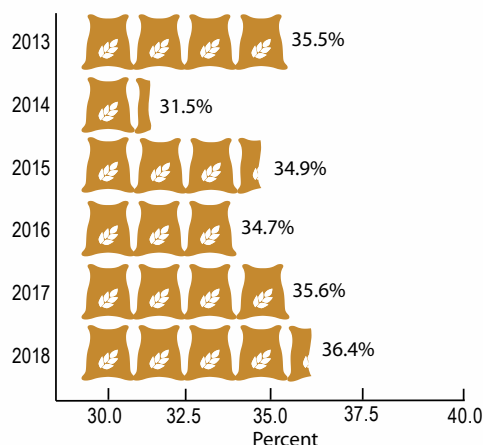
WET GLUTEN provides a quantitative measure of the gluten forming proteins in flour that are primarily responsible for its dough mixing and baking properties.

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.

FLOUR PROTEIN – Regional Average

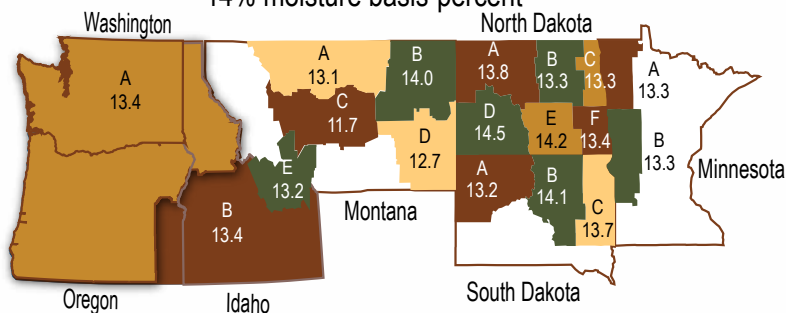


WET GLUTEN – Regional Average



AVERAGE FLOUR PROTEIN BY AREA

14% moisture basis-percent



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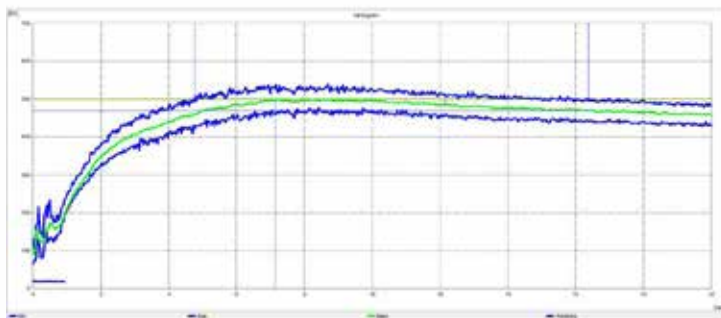
PHYSICAL DOUGH QUALITY

FARINOGRAPH					
STATE AND CROP REPORTING AREA	ABSORPTION %	PEAK TIME MIN	STABILITY MIN	MTI B.U.	QUALITY NUMBER MM
MINNESOTA					
Area A	62.6	7.0	14.0	13	171
Area B	60.4	6.7	14.1	17	152
State Avg 2018	62.1	6.9	14.0	14	167
State Avg 2017	61.8	7.3	13.3	18	156
MONTANA					
Area A	63.8	7.7	9.1	30	126
Area B	64.1	8.7	10.6	25	148
Area C	64.1	6.8	8.3	39	109
Area D	63.3	7.3	7.8	37	111
Area E	66.9	8.1	9.9	23	149
State Avg 2018	64.1	8.2	9.9	27	137
State Avg 2017	63.6	7.0	10.0	22	142
NORTH DAKOTA					
Area A	65.0	7.7	11.1	21	153
Area B	66.1	7.5	9.2	28	131
Area C	61.5	7.9	16.0	13	182
Area D	66.0	8.0	11.6	18	166
Area E	64.9	7.9	9.0	27	133
Area F	62.6	8.4	15.2	13	182
State Avg 2018	64.8	7.8	11.4	21	154
State Avg 2017	62.2	8.7	12.4	20	159
SOUTH DAKOTA					
Area A	63.5	8.2	10.6	28	135
Area B	62.4	8.4	11.3	22	151
Area C	62.3	7.4	8.6	30	124
State Avg 2018	62.6	8.2	10.7	24	143
State Avg 2017	63.5	8.6	11.4	24	155
IDAHO - OREGON - WASHINGTON					
Area A	65.5	7.3	9.8	24	142
Area B	66.5	8.5	10.1	22	151
State Avg 2018	66.0	7.9	9.9	23	147
State Avg 2017	65.0	7.4	8.5	32	123
REGION AVERAGE					
Avg. 2018	64.2	7.7	11.4	21	152
Avg. 2017	62.6	8.1	11.9	21	153
Five-Year Avg.	62.6	7.0	11.0	28	135

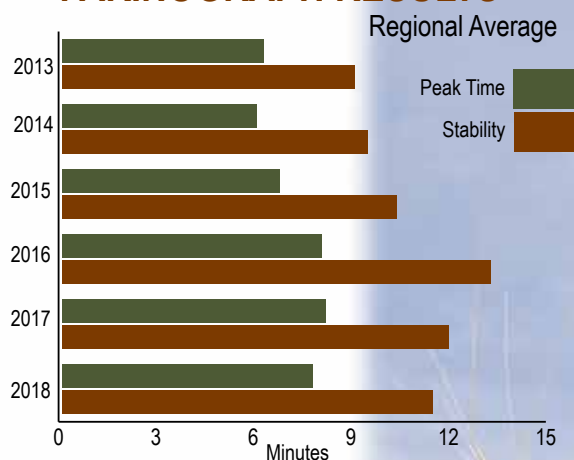
Physical characteristics of dough are evaluated to reveal useful information about variations in flour types, processing requirements and expected end-product quality.

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.

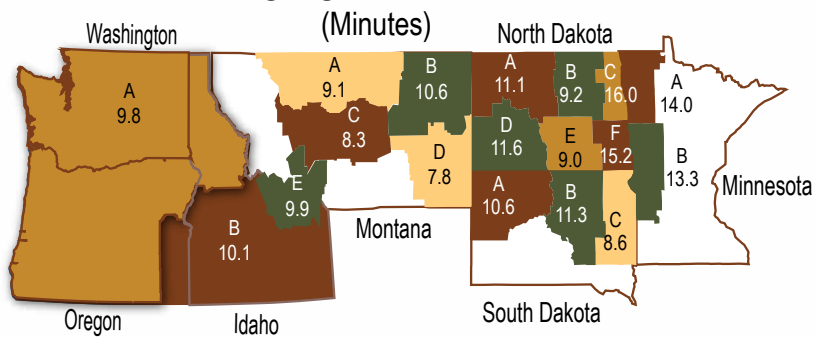
2018 AVERAGE FARINOGRAM



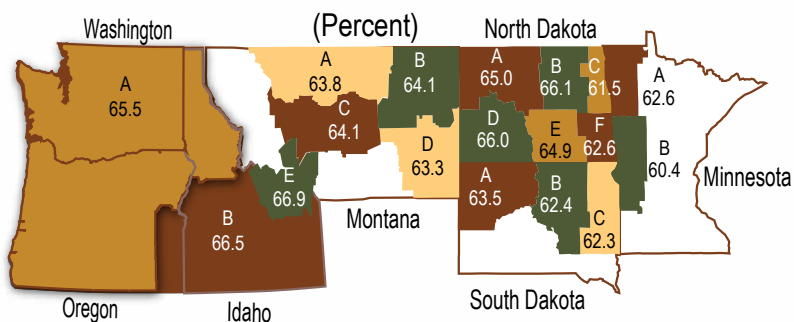
FARINOGRAPH RESULTS



AVERAGE STABILITY BY AREA



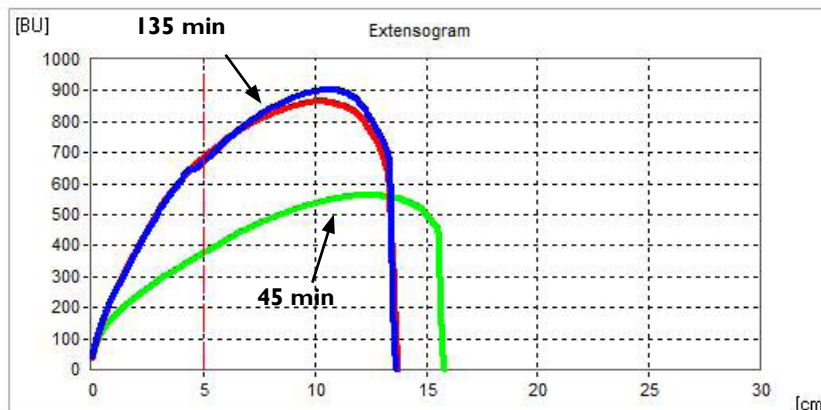
AVERAGE FARINOGRAM ABSORPTION BY AREA



PHYSICAL DOUGH QUALITY

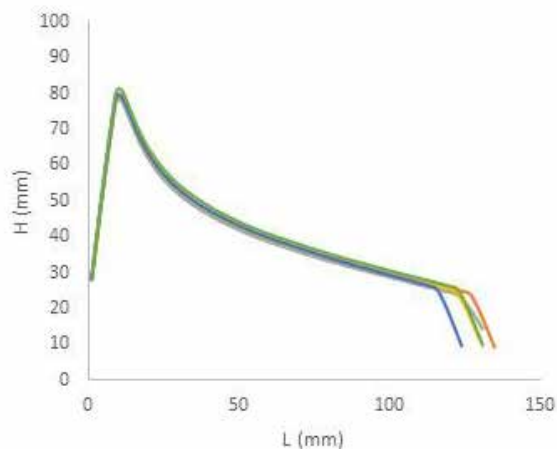
STATE AND CROP REPORTING AREA	EXTENSOGRAPH			ALVEOGRAPH						
	EXTENSIBILITY 45 MIN CM	RESISTANCE 45 MIN B.U.	AREA SQ CM	EXTENSIBILITY 135 MIN CM	RESISTANCE 135 MIN B.U.	AREA SQ CM	P MM	L MM	W P/L RATIO	JOULES X 10 ⁴
MINNESOTA										
Area A	15.8	697	143	13.2	1057	177	93	130	0.72	393
Area B	15.3	762	151	13.7	1045	192	80	129	0.62	353
State Avg 2018	15.7	709	145	13.3	1055	180	91	130	0.70	385
State Avg 2017	16.1	592	127	14.1	1015	188	86	133	0.65	403
MONTANA										
Area A	15.5	493	100	14.4	718	136	94	116	0.81	360
Area B	15.8	564	118	13.7	903	162	96	110	0.87	360
Area C	15.1	610	122	14.1	734	136	102	91	1.12	318
Area D	15.9	538	114	13.8	781	138	94	107	0.88	335
Area E	18.0	510	124	14.8	624	125	105	102	1.03	360
State Avg 2018	15.8	535	111	14.0	812	149	96	111	0.86	358
State Avg 2017	16.5	451	98	12.1	871	139	78	131	0.59	325
NORTH DAKOTA										
Area A	14.6	587	112	13.4	974	168	93	124	0.75	379
Area B	16.4	507	113	16.4	663	147	89	115	0.77	328
Area C	17.4	657	149	14.1	1111	205	80	121	0.66	333
Area D	17.2	532	121	15.1	602	125	88	120	0.73	339
Area E	19.6	431	117	16.8	552	125	77	110	0.70	267
Area F	15.1	604	115	13.1	979	172	73	130	0.56	314
State Avg 2018	16.4	553	120	14.9	808	156	86	120	0.72	337
State Avg 2017	17.2	533	119	14.3	809	155	78	147	0.53	379
SOUTH DAKOTA										
Area A	15.1	539	108	13.1	770	139	85	100	0.85	286
Area B	15.1	566	114	11.6	900	141	70	124	0.56	278
Area C	16.8	501	111	14.6	813	161	61	137	0.45	253
State Avg 2018	15.4	550	112	12.4	859	144	71	121	0.59	275
State Avg 2017	16.8	448	100	13.8	672	124	79	143	0.56	366
IDAHO - OREGON - WASHINGTON										
Area A	14.9	491	95	11.7	783	123	92	108	0.85	328
Area B	16.5	465	102	14.8	724	146	105	102	1.03	361
State Avg 2018	15.8	476	99	13.5	749	136	99	105	0.95	347
State Avg 2017	15.9	333	71	15.0	649	131	82	135	0.61	327
REGION AVERAGE										
Avg. 2018	16.1	570	120	14.2	847	157	88	119	0.74	345
Avg. 2017	16.8	513	113	14.0	836	156	80	141	0.57	372
Five-Year Avg.	16.7	476	103	13.5	806	145	87	122	0.75	354

2018 AVERAGE EXTENSOGRAM



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.

2018 AVERAGE ALVEOGRAM



An alveograph traces a curve that measures the air pressure necessary to inflate a piece of dough to the point of rupture. The overpressure (P) value reflects the maximum pressure needed to deform the piece of dough during the inflation process and is an indication of resistance, or dough stability. The length (L) measurement reflects dough extensibility. The deformation energy (W) measurement is the amount of energy needed to inflate the dough to the point of rupture and is indicative of dough strength.

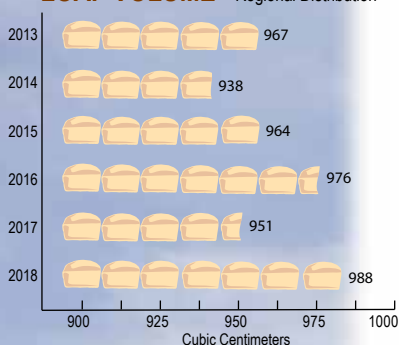
U.S. HARD RED SPRING WHEAT

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BAKING DATA

STATE AND CROP REPORTING AREA	BAKING ABSORPTION %	DOUGH HANDLING PROPERTIES	LOAF VOLUME CC	GRAIN AND TEXTURE	CRUMB COLOR	CRUST COLOR	SYMMETRY
MINNESOTA							
Area A	68.2	9.0	945	7.5	8.0	10.0	9.0
Area B	66.2	9.0	983	8.0	7.8	10.0	9.5
State Avg 2018	67.9	9.0	952	7.6	8.0	10.0	9.1
State Avg 2017	64.4	9.0	903	7.4	7.4	9.0	8.8
MONTANA							
Area A	70.4	8.5	900	7.3	7.3	10.0	9.5
Area B	69.5	9.0	958	7.5	7.8	10.0	9.0
Area C	69.5	8.0	840	7.0	7.5	10.0	7.5
Area D	69.6	8.5	900	7.5	7.5	10.0	8.0
Area E	71.8	9.0	988	7.3	7.5	10.0	10.0
State Avg 2018	69.9	8.8	932	7.4	7.5	10.0	9.2
State Avg 2017	68.1	9.0	978	7.8	7.3	10.0	9.4
NORTH DAKOTA							
Area A	70.7	9.5	1000	7.5	7.5	10.0	9.5
Area B	71.0	9.0	1003	7.8	8.0	10.0	9.0
Area C	65.8	9.0	1010	8.3	8.0	10.0	9.0
Area D	71.4	9.0	1040	7.5	7.3	10.0	9.5
Area E	69.8	8.5	1063	8.0	8.0	10.0	10.0
Area F	66.1	9.0	1013	7.0	7.5	10.0	10.0
State Avg 2018	69.8	9.1	1016	7.7	7.7	10.0	9.4
State Avg 2017	65.8	9.0	957	7.9	8.0	9.9	9.1
SOUTH DAKOTA							
Area A	68.2	9.0	955	7.8	7.8	10.0	9.0
Area B	67.1	9.0	983	7.0	7.8	10.0	8.5
Area C	66.3	8.0	978	8.0	8.3	10.0	9.0
State Avg 2018	67.2	8.8	976	7.3	7.8	10.0	8.7
State Avg 2017	68.0	8.7	972	7.8	8.2	10.0	9.4
IDAHO - OREGON - WASHINGTON							
Area A	71.5	8.0	958	7.8	7.8	10.0	9.5
Area B	71.9	8.5	1010	7.8	8.0	10.0	10.0
State Avg 2018	71.7	8.3	987	7.8	7.9	10.0	9.8
State Avg 2017	68.7	9.0	979	7.8	8.0	10.0	9.4
REGION AVERAGE							
Avg 2018	69.5	9.0	988	7.6	7.7	10.0	9.3
Avg 2017	66.2	9.0	951	7.8	7.8	9.8	9.1
Five-Year Avg	66.9	9.1	959	7.7	7.7	9.7	8.9

LOAF VOLUME – Regional Distribution



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RECENT QUALITY TRENDS

SUMMARY INFORMATION							
CROP YEAR	2018	2017	2016	2015	2014	2013	FIVE-YEAR AVERAGE
WHEAT GRADING							
Total Weight (lbs/bu)	62.2	61.7	61.6	61.6	61.4	62.5	61.8
Test Weight (kg/hl)	81.8	81.1	81.0	81.0	80.7	82.2	81.2
Vitreous Kernels (%)	86	71	77	83	53	68	70
1000 Kernel Weight (gm)	31.2	31.5	30.9	31.3	32.4	32.9	31.8
Protein: 12%/0% moisture	14.5/16.5	14.5/16.5	14.2/16.1	14.1/16.0	13.6/15.4	14.6/16.6	14.0/15.9
Ash: 14% moisture (%)	1.57	1.50	1.53	1.53	1.46	1.54	1.51
Falling Number (sec)	399	389	406	372	339	403	382
FLOUR DATA							
Extractions (%)	68.1	71.2	66.9	67.1	66.0	69.1	68.1
Ash: 14% moisture (%)	0.52	0.57	0.53	0.52	0.45	0.53	0.52
Protein: 14% moisture (%)	13.6	13.8	13.0	13.0	12.3	12.6	12.9
Wet Gluten (%)	36.4	35.6	34.7	34.9	31.5	35.5	34.4
Falling Number (sec)	421	407	415	386	370	417	399
Amylograph Peak Viscosity 65g FL (B.U.)	649	570	659	676	518	590	603
PHYSICAL DOUGH PROPERTIES							
*FARINOGRAPH:							
Absorption (%)	64.2	62.6	62.7	61.9	61.9	63.0	62.6
Peak Time (min)	7.7	8.1	8.0	6.7	6.0	6.2	7.0
Stability (min)	11.4	11.9	13.2	10.3	9.4	9.0	11.0
EXTENSOGRAPH:							
Extensibility-45 min (cm)	16.1	16.8	16.6	16.5	16.2	17.2	16.7
Resistance-45 min (B.U.)	570	513	536	442	475	413	476
Area-45 min (sq cm)	120	113	115	95	100	94	103
ALEOGRAPH:							
P (mm)	88	80	84	80	103	89	87
L (mm)	119	141	130	120	101	116	122
W (joules x10 ⁴)	345	372	376	324	364	335	354
BAKING DATA							
Absorption (%)	69.5	66.2	67.6	67.5	67.2	66.1	66.9
Dough Handling Properties	9.0	9.0	9.3	9.5	8.6	9.1	9.1
Loaf Volume (CC)	988	951	976	964	938	967	959
Grain and Texture	7.6	7.8	7.6	7.4	7.9	8.0	7.7
Crumb Color	7.7	7.8	7.7	7.5	7.9	8.0	7.7
Crust Color	10.0	9.8	9.8	9.4	9.7	9.8	9.7
Symmetry	9.3	9.1	9.1	9.0	9.3	8.0	8.9

U.S. HARD RED SPRING WHEAT

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2018 QUALITY FACTORS BY PROTEIN RANGE/AREA WEST

Samples in this region were collected from Montana, North Dakota areas A and D, South Dakota area A, and Idaho, Oregon and Washington. Please reference page 3.

To illustrate the correlation between higher protein and other quality parameters, samples of the regional crop were segregated by protein levels:

LOW

<13.5%

MEDIUM

13.5 to 14.5 %

HIGH

> 14.5%

* (12% moisture basis)

Data contained on pages 18-20 represent the composites of samples by West and East production regions and a low, medium and high protein range.

PROTEIN RANGES			
WHEAT GRADING DATA	LOW	MEDIUM	HIGH
WHEAT GRADING DATA			
Total Weight (lbs/bu)/kg/hl)	62.4/82.0	62.8/82.6	61.4/80.7
Damage (%)	0.2	0.2	0.4
Shrunken/Broken (1%)	1.3	1.0	1.1
Total Defects (%)	1.5	1.2	1.5
Vitreous Kernels (%)	82	92	92
Grade	1 DNS	1 DNS	1DNS
WHEAT DATA			
Dockage (%)	0.5	0.6	0.4
Moisture (%)	11.3	11.6	11.0
Protein:12%/0% moisture (%)	12.3/14.0	14.0/15.9	15.8/17.9
Ash: 14%/0% moisture (%)	1.47/1.71	1.55/1.80	1.53/1.78
1000 Kernel Weight	29.5	31.6	29.5
Falling Number (sec)	398	413	437
Sedimentation (cc)	63.0	67.0	69.0
FLOUR DATA			
Extraction (%)	67.7	68.3	67.2
Color: L	91.0	90.8	90.6
a/b	-1.2/9.1	-1.1/9.5	-1.1/9.5
Protein: 14%/0% moisture (%)	11.7/13.6	13.3/15.4	14.7/17.0
Ash: 14%/0% moisture (%)	0.52/0.61	0.52/0.61	0.52/0.61
Wet Gluten (%)	29.0	34.6	40.2
Gluten Index (%)	95	92	84
Falling Number (sec)	398	413	437
Amylograph Viscosity: 65g FL (BU)	594	655	655
BAKING DATA			
Farinograph: Absorption (%)	62.4	65.7	66.1
Peak Time (min)	6.6	7.7	9.1
Stability (min)	9.0	9.2	10.9
Alveograph: P (mm)	108	106	96
L (mm)	104	114	146
P/L Ratio	1.04	0.93	0.66
W (10 ⁻⁴ joules)	382	403	441
Extensograph (45/135 min): Resistance	551/801	504/863	466/967
Extensibility (sm)	16.3/12.9	15.4/13.9	15.7/13.4
Area (sq cm)	173/139	106/155	94/170
BAKING DATA			
Absorption (%)	68.2	71.5	71.3
Crumb Grain and Texture	7.5	7.5	8.3
Loaf Volume (cc)	848	910	1020
PRODUCTION %	22	23	55

U.S. HARD RED SPRING WHEAT

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EAST

PROTEIN RANGES			
WHEAT GRADING DATA	LOW	MEDIUM	HIGH
WHEAT GRADING DATA			
Total Weight (lbs/bu)/kg/hl)	63.0/82.8	62.7/82.4	61.9/81.4
Damage (%)	0.3	0.2	0.2
Shrunken/Broken (1%)	0.8	0.9	0.8
Total Defects (%)	1.1	1.1	1.0
Vitreous Kernels (%)	75	85	87
Grade	1 DNS	1 DNS	1 DNS
WHEAT DATA			
Dockage (%)	0.5	0.5	0.4
Moisture (%)	12.8	12.5	12.2
Protein: 12%/0% moisture (%)	12.7/14.5	14.0/15.9	15.4/17.5
Ash: 14%/0% moisture (%)	1.61/1.87	1.61/1.87	1.66/1.93
1000 Kernel Weight	34.5	32.4	30.9
Falling Number (sec)	371	401	382
Sedimentation (cc)	62.2	65.2	68.3
FLOUR DATA			
Extraction (%)	70.0	68.8	66.6
Color: L	90.8	90.5	90.7
a/b	-0.9/8.7	-0.9/8.8	-0.9/8.5
Protein: 14%/0% moisture (%)	12.0/13.9	13.1/15.3	14.3/16.6
Ash: 14%/0% moisture (%)	0.52/0.60	0.51/0.60	0.51/0.60
Wet Gluten (%)	29.7	33.8	36.8
Gluten Index (%)	97	94	94
Falling Number (sec)	392	420	402
Amylograph Viscosity: 65g FL (BU)	599	636	638
BAKING DATA			
Farinograph: Absorption (%)	62.9	62.5	63.5
Peak Time (min)	6.0	6.9	8.1
Stability (min)	8.8	10.1	13.8
Alveograph: P (mm)	101	97	88
L (mm)	114	131	154
P/L Ratio	0.89	0.74	0.57
W (10 ⁻⁴ joules)	373	417	423
Extensograph (45/135 min): Resistance	460/695	564/776	583/576
Extensibility (sm)	15.0/13.4	16.1/13.9	17.0/12.4
Area (sq cm)	90/126	121/140	130/137
BAKING DATA			
Absorption (%)	68.7	68.2	68.9
Crumb Grain and Texture	7.3	7.8	7.5
Loaf Volume (cc)	880	963	1053
PRODUCTION %	22	29	49

Samples in this region were collected from North Dakota areas B, C, E and F, South Dakota areas B and C, and Minnesota. Please reference pg 3.

To illustrate the correlation between higher protein and other quality parameters, samples of the regional crop were segregated by protein levels:

LOW

<13.5%

MEDIUM

13.5 to 14.5 %

HIGH

> 14.5%

* (12% moisture basis)

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OVERALL REGION

To illustrate the correlation between higher protein and other quality parameters, samples of the regional crop were segregated by protein levels:

LOW

<13.5%

MEDIUM

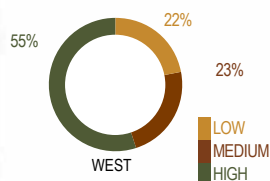
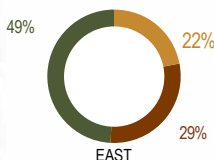
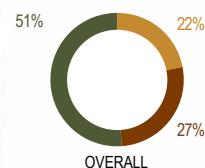
13.5 to 14.5 %

HIGH

> 14.5%

* (12% moisture basis)

PRODUCTION DISTRIBUTION
BY PROTEIN



PROTEIN RANGES			
WHEAT GRADING DATA	LOW	MEDIUM	HIGH
WHEAT GRADING DATA			
Total Weight (lbs/bu)/kg/hl)	62.7/82.4	62.7/82.5	61.6/81.0
Damage (%)	0.3	0.2	0.3
Shrunken/Broken (1%)	1.0	0.9	1.0
Total Defects (%)	1.3	1.1	1.3
Vitreous Kernels (%)	78	88	90
Grade	1 DNS	1 DNS	1 DNS
WHEAT DATA			
Dockage (%)	0.5	0.5	0.4
Moisture (%)	12.1	12.1	11.6
Protein: 12%/0% moisture (%)	12.5/14.3	14.0/15.9	15.6/17.7
Ash: 14%/0% moisture (%)	1.54/1.79	1.59/1.84	1.59/1.85
1000 Kernel Weight	32.1	32.1	30.2
Falling Number (sec)	384	406	410
Sedimentation (cc)	62.6	66.0	68.6
FLOUR DATA			
Extraction (%)	68.9	68.6	66.9
Color: L	90.9	90.6	90.6
a/b	-1.0/8.9	-1.0/9.1	-1.0/9.0
Protein: 14%/0% moisture (%)	11.8/13.8	13.2/15.3	14.5/16.8
Ash: 14%/0% moisture (%)	0.52/0.60	0.52/0.60	0.52/0.60
Wet Gluten (%)	29.4	34.1	38.5
Gluten Index (%)	96	93	89
Falling Number (sec)	395	417	420
Amylograph Viscosity: 65g FL (BU)	597	644	647
BAKING DATA			
Farinograph: Absorption (%)	62.6	63.8	64.8
Peak Time (min)	6.3	7.2	8.6
Stability (min)	8.9	9.7	12.3
Alveograph: P (mm)	104	101	92
L (mm)	109	124	150
P/L Ratio	0.96	0.81	0.61
W (10 ⁻⁴ joules)	377	411	432
Extensograph (45/135 min): Resistance	504/746	538/813	523/922
Extensibility (sm)	15.6/13.2	15.8/13.9	16.3/12.9
Area (sq cm)	130/132	115/146	112/154
BAKING DATA			
Absorption (%)	68.5	69.6	70.1
Crumb Grain and Texture	7.4	7.6	7.9
Loaf Volume (cc)	864	940	1036
PRODUCTION %	22	27	51

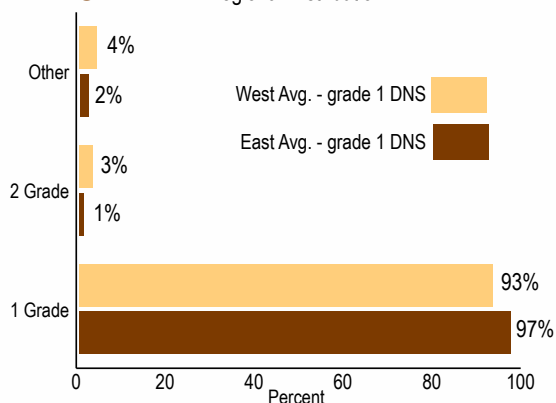
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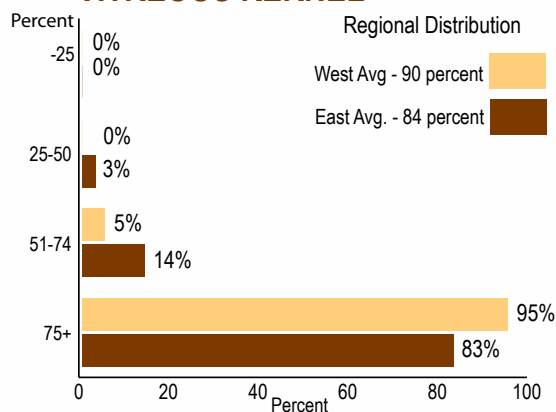
21

DISTRIBUTIONS BY EAST/WEST PRODUCTION REGIONS

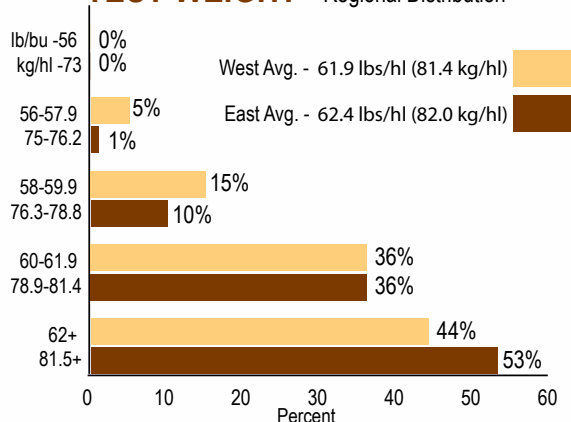
GRADE – Regional Distribution



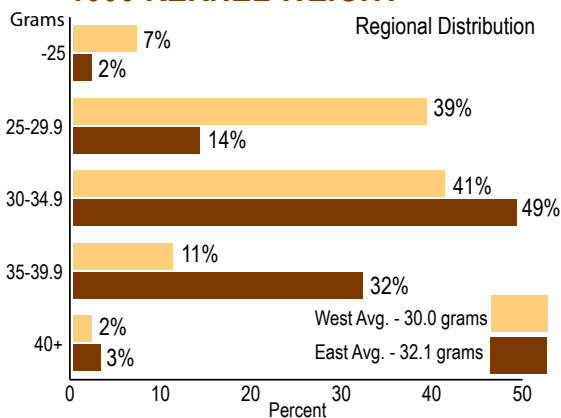
VITREOUS KERNEL



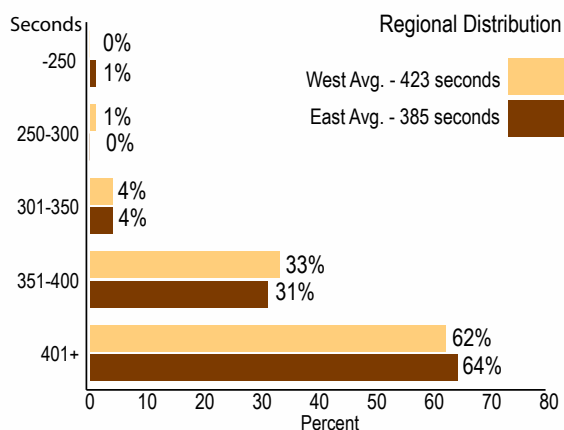
TEST WEIGHT – Regional Distribution



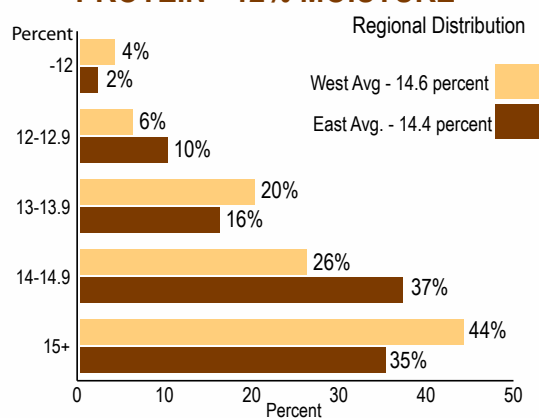
1000 KERNEL WEIGHT



FALLING NUMBER



PROTEIN - 12% MOISTURE



The sample base collection samples as shown in the area specific data displayed on previous pages were used for the West/East and protein splits.

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HANDLING AND TRANSPORTATION

The hard red spring wheat growing region utilizes truck, rail and water to get wheat from farms to export facilities. The Northern Plains has a vast network of country elevators to facilitate efficient and precise movement to domestic and export markets. On average, nearly 80 percent of the region's wheat moves to markets by rail. The dominant railroads are the Burlington Northern Santa Fe, the Union Pacific and the Canadian Pacific.

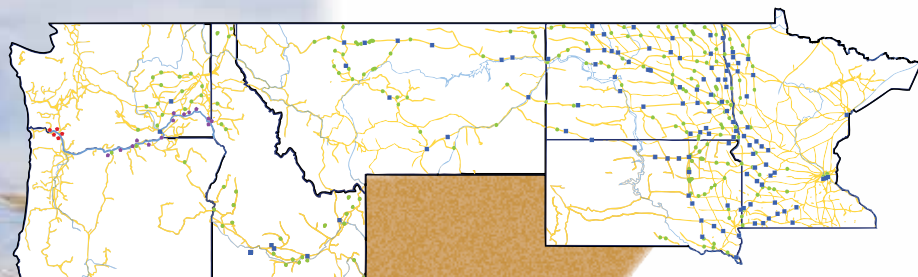
In the Pacific Northwest, a large river system is used along with rail to move wheat to export points.

An increasing number of the elevators in the region are investing in facilities and rail capacity to ship 100-110 car units in "shuttle" trains. Each rail car holds

approximately 3,500 bushels (95 metric tons) of wheat. Shuttle-equipped facilities receive the lowest rates, sharing volume and transaction efficiencies with the railroad.

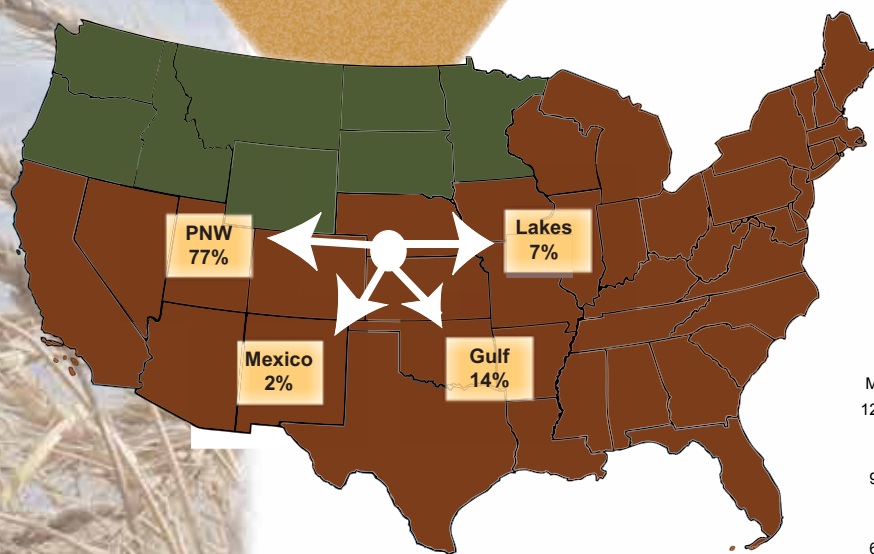
The diverse rail and water shipping capacities and a widespread network of elevators are strengths that buyers can capitalize on, especially as their demand heightens for more precise quality specifications and consistency between shipments. Buyers are encouraged to explore origin-specific shipments to optimize the quality and value of wheat they purchase.

The elevator network in the U.S. hard red spring wheat region is well suited for meeting the increasing quality demands of both domestic and international customers.



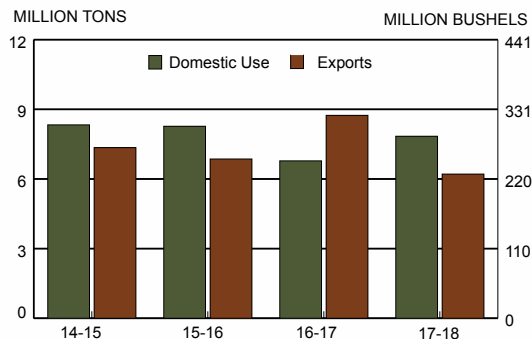
Grain Handling and Transportation Facilities in the U.S. HRS Region

- 100+ rail car track
- 50 - 99 rail car track
- ◆ Export terminals
- ◆ River terminals
- River system
- Rail network



AVERAGE SHARE OF U.S. HRS EXPORTS BY PORT (2014-2017)

2014-2017 U.S. HRS DOMESTIC USE AND EXPORTS



2018 SURVEY BACKGROUND

All quality data contained in this report are the result of testing and analysis conducted under the supervision of Dr. Senay Simsek, Wheat Quality Specialist, and by her team members, DeLane Olsen, Kelly McMonagle, and Kristin Whitney, with the Hard Red Spring Wheat Quality Laboratory in the Department of Plant Science at North Dakota State University, Fargo, USA.

COLLECTION - The North Dakota, South Dakota, Montana and Minnesota state offices of the National Agricultural Statistics Service obtained wheat samples during harvest directly from growers either in the fields or farm bins and local elevators. These samples reflect the condition of the grain at the point of origin. Collection began in early August when approximately 10 percent of the hard red spring wheat had been harvested and continued until mid September when about 95 percent of the region's crop was harvested.

Sample collection was weighted by county production histories with a total of 777 samples being

collected during harvest from Minnesota (123), Montana (150), North Dakota (379), South Dakota (85) and PNW (40).

ANALYSIS - Approximately 60 percent of the total wheat samples collected were analyzed for grade and other physical kernel characteristics. Distributions as a percentage of the harvested crop were calculated for key factors including test weight, thousand kernel weight, protein, falling number, and overall grade. Distribution results may differ from data presented in the various tables, because the latter are derived from production adjusted averages, rather than simple averages.

Quality tests, including milling, flour evaluation, physical dough and bread properties, were conducted on composite samples representing each crop reporting area. Again, all state and regional averages have been adjusted to reflect production as opposed to simple averaging.

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.



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KERNEL SIZE DISTRIBUTION – Percent-ages 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 56.81.03; 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 7.0 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 76.31.02. Proportion of starch granules that have incurred physical damage from milling.

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

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 – AACCI Method 54-21.02; constant flour weight method, small (50 g) mixing bowl. (Flour weight 14 percent moisture basis). Farinograph-E.

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

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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 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.

EXTENSOGRAM – AACC 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 extensogram 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 Method 54.30.02. Measurement of 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 Method 10-09.01, modified as follows: (a) fungal amylase (SKB 15) replacing malt dry powder, (b) Instant dry yeast (1 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.



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VARIETAL INFORMATION

MAJOR VARIETIES PRODUCED ACROSS ND, SD AND MN • AGRONOMIC FACTORS										
VARIETY	AGRONOMIC DESCRIPTION			REACTION TO DISEASE ³			AVERAGE YIELD			
	AGENT OR ORIGIN ¹	YEAR RELEASED	STRAW STRENGTH ²	DAYS TO HEAD	LEAF RUST	HEAD (SCAB)	EASTERN, ND ⁴		WESTERN ND ⁵	
							BU/ACRE	MT/HECT	BU/ACRE	MT/HECT
Barlow	ND	2009	6	57	6	5	67.2	4.52	49.7	3.34
Bolles	MN	2015	4	61	3	5	65.1	4.38	49.2	3.31
Elgin-ND	ND	2012	5	60	6	5	68.2	4.59	58.6	3.94
Faller	ND	2007	5	61	7	5	69.2	4.65	52.8	3.55
Glenn	ND	2005	4	56	6	3	64.4	4.33	50.3	3.38
Lang-MN	MN	2017	4	61	2	5	n/a	n/a	n/a	n/a
Linkert	MN	2013	2	58	3	4	66.6	4.48	49.6	3.33
ND VitPro	ND	2016	3	58	4	4	n/a	n/a	n/a	n/a
Shelly	MN	2016	5	62	6	5	n/a	n/a	n/a	n/a
SY Ingmar	AgriPro/Syngenta	2011	3	60	3	5	69.8	4.69	54.2	3.64
SY Soren	AgriPro/Syngenta	2011	3	59	2	5	66.9	4.50	51.7	3.48
SY Valda	AgriPro/Syngenta	2015	4	58	2	4	76.2	5.12	55.7	3.74
WB Mayville	Westbred	2011	3	57	3	8	69.9	4.70	50.1	3.37
WB 9479	Westbred	2017	4	58	1	6	n/a	n/a	n/a	n/a

1. ND – North Dakota State University (Public), MN – University of Minnesota (Public), Westbred (Private), and AgriPro/Syngenta (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. 2015-17 ND average yield data from Carrington, Casselton, Langdon and Prosper, ND.
5. 2015-17 ND average yield data from Dickinson, Hettinger, Minot and Williston, ND.



VARIETAL INFORMATION

MAJOR VARIETIES PRODUCED ACROSS ND, SD AND MN • QUALITY & END-USE FACTORS									
VARIETY	TEST WEIGHT LB/BU	TEST WHEAT KG/HL	QUALITY FACTORS ⁶			FARINOGRAM STABILITY (MIN)	ABSORPTION %	LEAF VOLUME CC	MILL & BAKE QUALITY RATING ⁷
			WHEAT PROTEIN %	WHEAT FALLING & SECONDS					
Barlow	61.8	81.3	14.6	396	12.3	64.9	1000	★★★	
Bolles	60.5	79.6	15.5	430	22.8	62.8	1011	★★★★★	
Elgin-ND	60.5	79.6	14.4	414	10.8	64.0	970	★★★	
Faller	60.0	78.9	13.7	406	10.6	62.2	964	★★★	
Glenn	63.5	83.5	14.8	397	17.9	63.6	1077	★★★★★	
Lang-MN	62.1	81.7	14.3	427	11.8	63.1	959	★★★	
Linkert	61.1	80.4	15.0	442	28.8	62.6	989	★★★★★	
ND VitPro	62.9	82.7	14.8	418	9.4	63.6	980	★★★	
Shelly	61.5	80.9	13.4	431	15.6	59.5	909	★★	
SY Ingmar	61.5	80.9	14.4	425	11.7	61.2	1001	★★★	
SY Soren	61.4	80.7	14.5	450	12.0	61.7	978	★★★	
SY Valda	60.8	80.0	13.6	405	8.2	60.9	896	★★	
WB Mayville	60.9	80.1	14.3	432	13.4	63.3	936	★★★	
WB 9479	60.7	79.8	15.1	428	31.0	62.4	933	★★★	

6. Source: NDSU Plant Science Department, Hard Red Spring Wheat Quality Laboratory, 2015-2017 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.

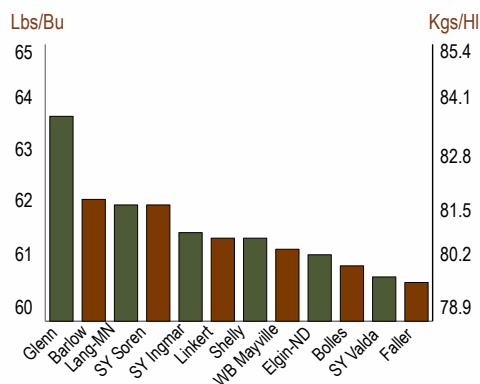


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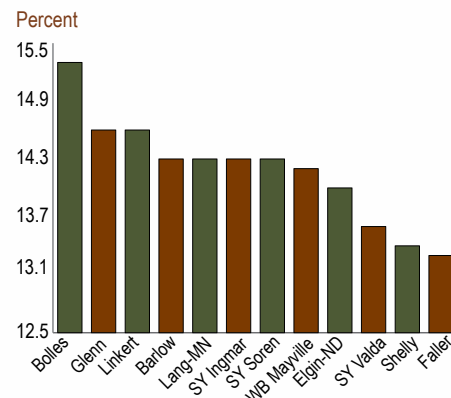
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QUALITY COMPARISON BY POPULAR VARIETIES

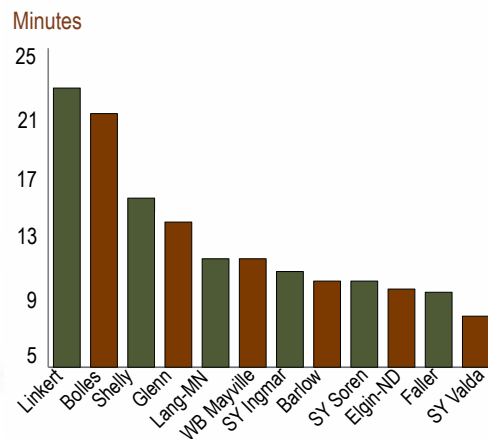
TEST WEIGHT



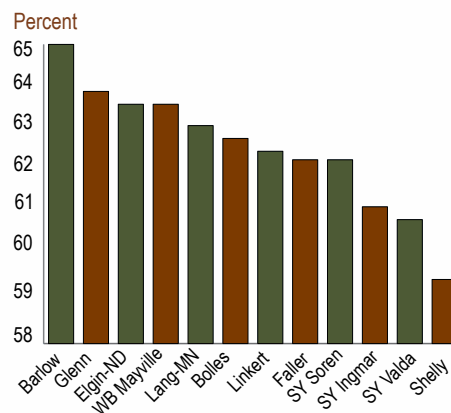
PROTEIN - 12% MOISTURE BASIS



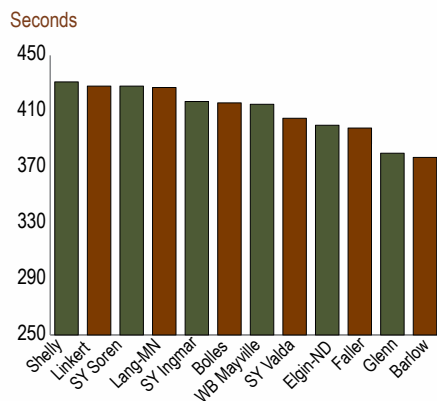
FARINOGRAPH STABILITY



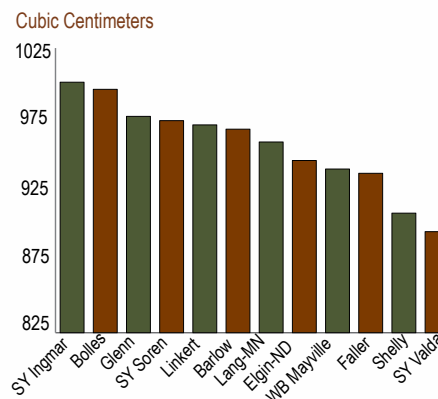
FARINOGRAPH ABSORPTION



FALLING NUMBER



LOAF VOLUME



THE ACCOMPANYING tables illustrate the quality evaluation of some of the most popular varieties (cultivars), for key kernel and end-use parameters during the 2015-2017 growing seasons. A commitment to extensive end-use quality testing of new cultivars during the development stages is a major priority for producers in the region. The goal is to develop and release cultivars that excel in numerous kernel, milling and end-product parameters, across a broad environment.

NORTH DAKOTA

SY INGMAR remains the dominant variety planted in the state in 2018 with one-fifth of the acres, up from 18 percent in 2017. It has broad appeal state wide, but is most popular in the western half. SY Ingmar is a 2014 release from AgriPro/Syngenta with high 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.

SY VALDA jumped to second place in 2018 with nearly 9 percent of the acres, up from the sixth spot and 5 percent of the acres in 2017. It is a 2015 release which touts elite yield potential amongst current variety choices and has strong disease tolerance, especially for Fusarium headblight. SY Valda is most popular across the eastern third of the state, and is the fourth most popular variety in Minnesota in 2018 with 9 percent of the acres. It is rated as average for milling and baking quality.

NORTH DAKOTA VARIETY SHARE OF PLANTED ACRES³

VARIETY	2018% ¹	2017% ¹
SY Ingmar	20.3	17.8
SY Valda	8.7	5.0
SY Soren	7.7	10.8
Barlow	6.4	6.7
Bolles	6.1	3.3
Faller	6.0	3.8
Linkert	5.8	6.9
Elgin-ND	4.6	5.6
Glenn	3.9	4.9
Rollag	2.6	2.9
Other ²	27.9	32.3

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)
2018 – 6,550,000 planted acres
2017 – 5,350,000 planted acres

TOP 3 NORTH DAKOTA VARIETIES BY CROP DISTRICT

	FIRST	SECOND	THIRD
	PERCENTAGE (%)		
Northwest	SY Ingmar 33.9	Barlow 16.8	Glenn 6.9
North Central	SY Ingmar 31.2	SY Valda 11.9	SY Soren 7.8
Northeast	Faller 18.2	SY Valda 14.9	Linkert 12.7
West Central	SY Ingmar 24.6	SY Soren 16.1	Elgin-ND 11.5
Central	SY Soren 19.6	SY Ingmar 17.2	SY Valda 8.6
East Central	WB Mayville 15.4	Linkert 11.6	SY Ingmar 10.9
Southwest	Barlow 20.5	SY Ingmar 16.0	Glenn 14.0
South Central	SY Ingmar 33.3	SY Soren 14.4	Barlow 11.7
Southeast	Bolles 14.3	SY Valda 11.4	SY Ingmar 9.9

SY SOREN slipped to third place in 2018 with 7.7 percent of the acres, down from 11 percent last year and it's peak of 15 percent in 2016. It is most popular in central parts of the state. A 2011 release, SY Soren has a balance of yield potential, moderately high protein levels, disease resistance and straw strength, but is being slowly replaced by newer genetics. SY Soren is rated as good for milling and baking quality.

BARLOW is the fourth most popular variety in North Dakota in 2018 with a 6.4 percent share, steady with 2017. It was released in 2009 from NDSU, and was the leading variety across the state in 2014 and 2015. Barlow remains most popular in western areas of the state and is the leading variety in the southwest district. It provides producers with a good balance of test weight, protein and leaf disease resistance, and is rated as good for milling and baking quality.

U.S. HARD RED SPRING WHEAT

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

MINNESOTA

MINNESOTA VARIETY SHARE OF SURVEYED ACRES³

VARIETY	2018% ¹	2017% ¹
Linkert	27.3	28.2
Bolles	10.5	14.4
WB-Mayville	9.6	13.5
SY Valda	8.9	6.6
Shelly	8.2	5.6
Lang-MN	4.4	0.5
SY Ingmar	3.7	4.0
WB 9479	3.5	0.2
TCG Spitfire	3.1	4.2
WB 9590	2.5	0.3
Other	18.3	22.5

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)
2018 – 1,610,000 planted acres
2017 – 1,160,000 planted acres

TOP 3 MINNESOTA VARIETIES BY CROP DISTRICT

	FIRST	SECOND	THIRD
	PERCENTAGE (%)		
North	Linkert 29.3	WB Mayville 11.7	SY Valda 9.7
Central	Bolles 23.7	Linkert 20.6	Shelly 9.5
South	Linkert 24.2	Bolles 20.4	Shelly 14.2

MONTANA

VIDA remains the dominant variety in Montana, accounting for nearly one-fourth of the acres in 2018. It has been the leading variety since 2011. Vida is a 2005 release from the Montana Agricultural Experiment Station, and it is popular with producers for its high yield and moderate resistance to leaf and stripe rust. It is rated as good for milling and baking quality.

REEDER is the second most popular variety with nearly 18 percent of the acres in the state. It is most popular in the north east district. Reeder remains popular for its high protein content and stay-green trait which allows for longer head fill. A 1999 release from NDSU, it is rated as average for milling and baking quality.

LINKERT remains the dominant variety in Minnesota in 2018 with 27 percent of the acres, down slightly from 28 percent in 2017. It is the seventh most popular variety in North Dakota with 6 percent of the acres. Linkert is a 2013 release from the University of Minnesota, and is sought after by producers for its very strong straw, high protein levels and disease resistance traits. It has excellent milling and baking qualities, with especially strong dough properties.

BOLLES held onto second place with 10.5 percent of the acres in Minnesota, down slightly from 14.4 percent in 2017. In North Dakota it moved into fifth place in 2018, increasing its share of acres to 6 percent. Released in 2015 from the University of Minnesota, Bolles is gaining popularity for its ability to produce high kernel protein, along with competitive yields and agronomic traits. It is rated as excellent for milling and baking qualities with strong dough properties.

Four new varieties which made notable gains in acres in Minnesota in 2018 include, **SHELLY** and **LANG-MN**, released from the University of Minnesota in 2016 and 2017, respectively, and **WB 9479** and **WB 9590**, both 2017 releases from Westbred.

SOUTH DAKOTA did not conduct a variety survey in 2018.

PNW VARIETAL INFORMATION

MAJOR VARIETIES GROWN IN WASHINGTON, OREGON AND IDAHO • QUALITY & END-USE FACTORS									
VARIETY	AGENT OR ORIGIN ¹	YEAR RELEASED	END USE ³		WHEAT PROTEIN %	QUALITY FACTORS ²			MILL & BAKE QUALITY RATING*
			TEST WEIGHT LB/BU	TEST WHEAT KG/HL		FARINOGRAM STABILITY (MIN)	ABSORPTION %	LOAF VOLUME CC	
Alum	WSU	2014	62.5	82.2	14.4	24.1	66.9	1118	MD
Buck Pronto	Buck Semillas S.A.	2001	61.5	80.9	15.3	21.7	67.9	937	A
Espresso	Westbred	2000	62.6	82.2	14.7	5.1	68.5	1032	*Not Rated
Glee	WSU	2012	62.4	82.0	14.1	16.0	66.2	1099	MD
Jefferson	ID	1997	62.3	82.0	13.7	20.9	66.1	977	D
Kelse	WSU	2008	61.8	81.3	14.9	19.8	68.2	1113	D
SY Selway	Syngenta	2015	60.8	80.0	14.4	19.1	67.2	1033	MD
SY605CL	Syngenta	2010	62.3	81.9	15.7	n/a	68.5	1040	MD
WB 9518L	Westbred	2014	61.9	81.4	15.0	12.7	69.4	1138	D
WB 9668	Westbred	2014	62.4	82.0	15.8	10.8	70.0	1151	D

1. ID – University of Idaho (Public), WSU – Washington State University (Public), Buck Semillas S.A. (Private), Syngenta (Private) and Westbred (Private).

2. Western Wheat Quality Lab, Pullman, WA.

3. 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

DUCLAIR is the fourth most popular variety, accounting for roughly 8 percent of the acres in Montana, but it is the leading solid stemmed variety. It is most popular in areas of Montana where the wheat stem sawfly is a perpetual problem. Duclair was released in 2011 from the Montana Agricultural Experiment Station. It is rated as good for milling and baking quality.

TOP 3 MONTANA VARIETIES BY CROP DISTRICT

	FIRST PERCENTAGE (%)	SECOND PERCENTAGE (%)
North Central	Vida 34.1	Corbin 15.8
North East	Reeder 34.8	Brennan 16.2
Central	Vida 38.1	Duclair 21.0

MONTANA VARIETY SHARE OF SURVEYED ACRES³

VARIETY	2018% ¹	2016 ¹
Vida	24.6	18.8
Reeder	17.6	9.9
Brennan	8.2	6.7
Duclair	7.7	6.4
Sy-Ingmar	7.6	0.5
Corbin	6.6	7.5
SY Coren	5.0	0.0
WB Gunnison	3.8	3.4
McNeal	2.0	1.6
Mott	1.7	7.0
Other	15.4	38.1

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)

2018 – 2,900,000 planted acres

2016 – 2,100,000 planted acres



2018

U.S. HARD RED SPRING WHEAT

Regional Quality Report

Funding & Support Provided by

U.S. Wheat Associations

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