



U.S. WHEAT  
ASSOCIATES

## 2018 CROP QUALITY REPORT





Dear friends:

It is my pleasure to introduce the 2018 U.S. Wheat Associates (USW) Crop Quality Report. This objective information comes at a time when market conditions are creating excellent value for U.S. wheat. Considering price in relation to quality, performance and service, this is a year with exceptional opportunities to buy and commit to future purchases of U.S. wheat.

As you review the quality data for all U.S. wheat classes, we recommend using the data as a baseline of performance that you may compare your own results. Combined with the services of our professional staff, it will help you specify your needs in your purchase contracts.

We thank our state wheat commission members and many public and private service providers who collect and analyze the samples and tabulate results. As always, the U.S. wheat farmers we represent continue to produce six classes of wheat with excellent quality in very sustainable ways while supporting our organization. We cannot thank them enough.

Their stewardship has produced in 2018 what many in our industry believe is among the best hard red winter (HRW) crops in many years, with high protein, very good absorption, stability and bake performance. The rain-challenged soft red winter (SRW) crop still offers good qualities for crackers and segments of the crop have good cookie and cake qualities. Another excellent soft white (SW) crop offers improved protein levels and typically low moisture and high flour yields. At the time this letter was written, the 2018 hard red spring (HRS) crop was showing increased test weights and protein levels.

This past year, unfortunately, unprecedented trade disputes may have diminished the trust in the United States as a champion of free market principles. I want our customers to know that in the face of these challenges, USW will not abandon our mission to do all we can to enhance the value of U.S. wheat. It is also good to remember that when wheat stocks are tight, we have and will always keep our doors open. With U.S. wheat, reliability is not just a word, it is a fact.

It is our privilege to work with the world's most talented, dedicated wheat buyers, millers, bakers and wheat food processors. So, on behalf of our producers, our 17 state wheat commission members and the USDA's Foreign Agricultural Service who fund our work, thank you for choosing U.S. wheat. Please do not hesitate to contact me any time with questions, ideas or concerns, and know that our team and I will do all we can to continue earning your business.

Sincerely,

Vince Peterson, President  
U.S. Wheat Associates

**U.S. Wheat Associates  
is funded by the U.S.  
Department of Agriculture's  
Foreign Agricultural Service,  
and by wheat producers  
through the following  
member organizations:**

Arizona Grain Research and  
Promotion Council

California Wheat Commission

Colorado Wheat  
Administrative Committee

Idaho Wheat Commission

Kansas Wheat Commission

Maryland Grain Producers  
Utilization Board

Minnesota Wheat Research and  
Promotion Council

Montana Wheat &  
Barley Committee

Nebraska Wheat Board

North Dakota Wheat Commission

Ohio Small Grains  
Marketing Program

Oklahoma Wheat Commission

Oregon Wheat Commission

South Dakota Wheat Commission

Texas Wheat Producers Board

Washington Grain Commission

Wyoming Wheat  
Marketing Commission



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# 2018 CROP QUALITY REPORT OVERVIEW



## SUMMARY OF CLASSES

	Hard Red Winter <sup>1</sup>		Hard Red Spring		Northern Durum <sup>2</sup>		Desert Durum <sup>®</sup>		Soft White		Soft Red Winter	
	2018	5-Year Avg	2018	5-Year Avg	2018	5-Year Avg	2018	5-Year Avg	2018	5-Year Avg	2018	5-Year Avg
Test Weight (lb/bu)	60.9	60.1	62.2	61.7	61.4	60.4	62.8	62.7	61.7	60.5	57.9	58.2
(kg/hl)	80.2	79.1	81.7	81.1	79.9	78.6	81.8	81.6	81.1	79.6	76.2	76.6
Grade	1 HRW	1 HRW	1 DNS	1 NS	1 HAD	1 HAD	1 HAD	1 HAD	1 SW	1 SW	3 SRW	2 SRW
Dockage (%)	0.5	0.6	0.5	0.6	0.7	0.8	0.3	0.5	0.5	0.5	0.4	0.5
Wheat Moisture (%)	10.9	11.2	11.8	12.2	11.2	11.7	6.7	6.8	8.6	9.2	12.8	13.0
Wheat Protein (%) <sup>3</sup>	12.4	12.4	14.5	14.0	14.5	13.6	13.4	13.6	9.3	10.3	9.9	9.7
Wheat Ash (%) <sup>3</sup>	1.49	1.53	1.58	1.50	1.54	1.57	1.70	1.71	1.36	1.35	1.45	1.47
1000 Kernel Weight (g)	30.7	29.8	31.1	31.1	41.2	39.9	46.3	49.2	35.7	34.4	29.9	32.6
Wheat Falling Number (sec)	374	393	403	374	425	374	615	557	315	341	322	304
Flour/Semolina Extraction (%)	75.1	75.7	67.8	68.2	69.3	66.3	71.0	63.7	72.5	74.5	68.0	70.0
Flour/Semolina Ash (%) <sup>3</sup>	0.44	0.59	0.52	0.51	0.73	0.69	0.80	n/a	0.42	0.46	0.47	0.44
Wet Gluten (%)	28.1	28.5	35.3	34.2	37.4	33.8	32.3	33.7	23.2	24.9	23.6	21.6
Farinograph:												
Peak Time (min)	5.2	5.0	7.7	7.1	n/a	n/a	n/a	n/a	2.7	2.5	1.2	1.3
Stability (min)	12.2	8.3	10.8	10.8	n/a	n/a	n/a	n/a	2.9	2.7	1.8	2.5
Absorption (%)	58.4	59.9	64.1	62.9	n/a	n/a	n/a	n/a	52.2	53.6	51.9	52.9
Alveograph W (10 <sup>-4</sup> J)	280	228	415	361	162	143	231	240	83	96	81	82
Loaf Volume (cm <sup>3</sup> )	901	843	973	967	n/a	n/a	n/a	n/a	n/a	n/a	735	712
Production (MMT)	18.0	22.6	16.0	13.6	1.8	1.5	0.3	0.4	6.5	6.2	7.7	11.0

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<sup>1</sup>Hard red winter data does not include California.

<sup>2</sup>Durum extraction and ash values are for semolina.

<sup>3</sup>Protein - 12% moisture basis; ash - 14% moisture basis.





## U.S. PRODUCTION BY CLASS

Crop Year (beginning June 1) (million metric tons)

	2018	2017	2016	2015	2014
Hard Red Winter	18.0	20.4	29.5	22.6	20.1
Hard Red Spring	16.0	10.5	13.4	15.4	15.1
Hard White	0.9	0.9	0.9	0.6	0.6
Durum	2.1	1.5	2.8	2.3	1.5
Soft White	6.5	6.1	6.9	5.4	5.5
Soft Red Winter	7.8	7.9	9.4	9.8	12.4
<b>Total</b>	<b>51.3</b>	<b>47.3</b>	<b>62.8</b>	<b>56.1</b>	<b>55.1</b>

Based on USDA crop estimates as of September 28, 2018.

## U.S. SUPPLY AND DEMAND

Estimated for 2018/19 (year beginning June 1)

	HRW	HRS	Durum	White	SRW	TOTAL
Beginning Stocks	15.8	5.2	1.0	2.4	5.6	29.9
Production	18.0	16.0	2.1	7.4	7.8	51.3
Imports	0.1	1.9	1.4	0.2	0.2	3.8
<b>Total Supply</b>	<b>34.0</b>	<b>23.1</b>	<b>4.4</b>	<b>10.0</b>	<b>13.6</b>	<b>85.0</b>
Domestic Use	12.5	7.9	2.4	2.6	5.7	31.1
Exports	9.9	8.0	0.8	5.9	3.3	27.9
<b>Total Demand</b>	<b>22.4</b>	<b>16.0</b>	<b>3.2</b>	<b>8.4</b>	<b>9.0</b>	<b>59.0</b>
<b>Ending Stocks</b>	<b>11.5</b>	<b>7.1</b>	<b>1.2</b>	<b>1.6</b>	<b>4.6</b>	<b>26.0</b>
<b>Stocks Five-year Average</b>	<b>11.7</b>	<b>5.9</b>	<b>0.8</b>	<b>2.1</b>	<b>4.6</b>	<b>25.0</b>

Based on USDA Supply/Demand estimates as of October 11, 2018.



## PLANTING AND HARVEST DATES

Wheat		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HRW	Planting												
	Harvest												
HRS	Planting												
	Harvest												
HW	Planting												
	Harvest												
Durum	Planting												
	Harvest												
SW	Planting												
	Harvest												
SRW	Planting												
	Harvest												

California-Arizona Planting Dates
  California-Arizona Harvest Dates
  Other States Planting Dates
  Other States Harvest Dates





# WHAT THE TESTS MEAN

## WHEAT GRADE TESTS

Wheat grades reflect the physical quality and condition of a sample and thus may indicate the general suitability for milling. The U.S. grade for a sample is determined by measurement of such factors as test weight, damaged kernels, foreign material, shrunken and broken kernels and wheat of contrasting classes. (See table on page 44.) All numeric factors other than test weight are reported as a percentage by weight of the sample. Grade determining factors include:

**TEST WEIGHT** is a measure of the density of the sample and may be an indicator of milling yield and the general condition of the sample, as problems during growing season or at harvest often reduce test weight.

**DAMAGED KERNELS** are kernels which may be undesirable for milling because of disease, insect activity, frost or sprout damage, etc.

**FOREIGN MATERIAL** is any material other than wheat that remains after dockage is removed. Because foreign material may not be removed by normal cleaning equipment, it may have an adverse effect on milling and flour quality.

**SHRUNKEN AND BROKEN KERNELS** are kernels that were insufficiently filled during growing and have a shrunken or shriveled appearance or were broken in handling. Such kernels may reduce milling yield.

**TOTAL DEFECTS** is the sum of damaged kernels, foreign material and shrunken and broken kernels.

**VITREOUS KERNELS** in hard red spring wheat are kernels that are uniformly dark and have no spots that appear chalky or soft. In durum, vitreous kernels have a glassy and translucent appearance without any spots that appear chalky.

## WHEAT NON-GRADE TESTS

**DOCKAGE** is the percentage by weight of any material easily removed from a wheat sample using the Carter Dockage Tester. Dockage, because it can be removed, should not have any affect on milling quality but may have other economic effects for buyers. Grade factors are determined only after dockage is removed.

**MOISTURE** content is the percentage of water by weight of a sample and is an important indicator of profitability in milling. Flour millers add water to adjust wheat moisture to a standard level before milling. Lower wheat moisture allows more water to be added, increasing the weight of grain to be milled at virtually no cost. Moisture content is also an indicator of grain storability as wheat and flour with low moisture are more stable during storage. Because moisture can be readily added to or physically removed from a sample, other analysis results are often mathematically converted to a standard moisture basis (mb), such as 14%, 12% or dry matter, so results can be compared.

**PROTEIN** content is the percentage of protein by weight in a sample. Protein can be quickly and easily measured and therefore is an important factor in determining the value of wheat since it relates to many processing properties, such as water absorption and gluten strength. Low protein is desired for products such as snacks or cakes.

High protein is desired for products such as pan breads, pasta, buns and frozen yeast-raised products.

**ASH** content is the percentage of minerals by weight in wheat or flour. In wheat, ash is primarily concentrated in the bran and is an indication of the flour yield that can be expected during milling. In flour, ash content indicates milling performance by indirectly revealing the amount of bran contamination in flour. Ash in flour can impart a darker color to finished products. Products requiring white flour call for low ash content, while whole wheat flour has higher ash content.

**1000 KERNEL WEIGHT** is the weight in grams of 1,000 kernels of wheat and may indicate grain size and expected milling yield.

**SINGLE KERNEL CHARACTERIZATION SYSTEM (SKCS)** measures 300 individual kernels from a sample for size (diameter), weight, hardness (based on the force needed to crush) and moisture. Detailed SKCS results (not reported in this booklet) include the distribution of these factors, which may be an indicator of the uniformity of the sample and help millers experienced with the system optimize flour milling yields. Kernel characteristics are related to milling properties such as tempering, roll gap settings and flour starch damage content.

**SEDIMENTATION** value is a measure of the sediment that results when lactic acid



**KERNEL SIZE** is a measure of the percentage by weight of large, medium and small kernels in a sample. Large kernels or a more uniform kernel size may help improve milling yield.

Photo courtesy of Wheat Marketing Center



is added to a sifted, ground wheat sample and can be used as an indicator of gluten quality and thus the baking quality of wheat flour.

**FALLING NUMBER** indirectly indicates alpha-amylase activity, which results from sprout damage. High falling number values indicate low alpha-amylase activity. Sufficient alpha-amylase activity is required in flour for some products such as yeast-raised bread. However, excessive alpha-amylase in wheat cannot be removed and it is difficult to blend to a lower alpha-amylase content. The resulting flour produces a sticky dough that can cause problems during processing and products with poor color and weak texture. Falling number usually correlates closely with amylograph results.

**DON (DEOXYNIVALENOL)** is a mycotoxin produced by Fusarium fungi in grain.

## FLOUR DATA

**EXTRACTION** is the percentage by weight of flour obtained from a wheat sample. In a commercial flour mill, the extraction rate is critically important to mill profitability. In a laboratory, milling with the Buhler laboratory mill is mainly done to obtain flour for other tests. The Buhler laboratory mill extraction rate is always significantly lower than the rate that can be obtained on a commercial mill, but may be useful for comparison between crop years.

**WET GLUTEN** is a measure of the quantity of gluten in wheat or flour samples as determined using the Glutomatic system. Gluten forms when water is added to the protein in wheat and is responsible for the elasticity and extensibility characteristics of flour dough.

**GLUTEN INDEX** is also determined by the Glutomatic system and is a measure of gluten strength regardless of the quantity of gluten present. Gluten index is used commercially to select durum samples with strong gluten characteristics. In bread wheat, a variety of factors other than gluten quality can affect the results though very low gluten index may be an indication of protein damage from insect or disease activity.

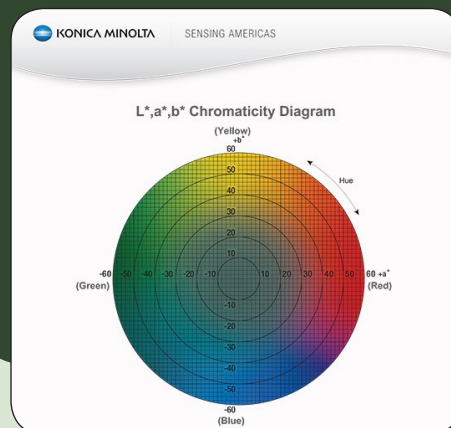
**AMYLOGRAPH** measures flour starch pasting properties that are important to end products such as sheeted Asian noodles. Amylograph also measures enzyme (alpha-amylase) activity which results from sprout damage. Amylograph results usually correlate closely with falling number results.

**STARCH DAMAGE** is the percentage by weight of damaged starch in a flour sample, which is a measure of the physical damage done to starch granules during milling. Bread (hard) wheat flour typically has higher starch damage than soft wheat flour. Highly damaged starch readily absorbs more water, which affects dough mixing and other processing properties. Because starch damage depends on how the sample was milled, starch damage is important for interpreting other results reported.

**SOLVENT RETENTION CAPACITY (SRC)** is the weight of solvent held by flour after centrifugation, expressed as a percent of the flour weight on a 14% mb. The results can be useful for predicting commercial baking performance, especially for low protein soft wheat flours. The different solvents used relate to the functionality of specific flour components as follows:

- **WATER** – Water absorption
- **SUCROSE** – Pentosans
- **LACTIC ACID** – Glutenins
- **SODIUM CARBONATE** – Damaged starch
- **GLUTEN PERFORMANCE INDEX (GPI)** – is defined as a ratio of three of the SRC values, lactic acid/(sodium carbonate + sucrose), and is a good predictor of overall performance of flour glutenins, especially for bread wheat flour.

**COLOR** measures a sample's lightness ( $L^*$ ) on a scale of 0 to 100 and "chromaticity" or hue on two scales from -60 to +60 for green-red ( $a^*$ ) and blue-yellow ( $b^*$ ). High  $L^*$  values indicate a bright color, and higher  $b^*$  values indicate more yellow. Flour color is influenced by endosperm color, particle size and ash content and often affects the color of the finished product. Durum semolina color is heavily influenced by particle size.



## EVALUATION OF END-PRODUCTS

**BAKING ABSORPTION** is the water required for optimum dough mixing performance, expressed as a percent of flour weight on a 14% mb.

**CRUMB GRAIN AND TEXTURE** is determined on a scale of 1 to 10 by visual comparison to a standard using a constant illumination source. Higher scores are preferred.

**LOAF VOLUME** is the volume of the test loaf after baking. Higher loaf volumes indicate better baking performance for pan breads.

**SPECKS** are small particles of bran or other material that escaped the wheat cleaning and semolina purifying process and thus depend on the milling process as well as the characteristics of the durum. Specks, which can detract from pasta appearance and desirability, are visually counted in a semolina sample and reported as the number in 10 square centimeters.

**SUGAR SNAP COOKIE, SPONGE CAKE, CHINESE SOUTHERN-TYPE STEAMED BREAD, SPAGHETTI, AND HARD WHITE NOODLE AND STEAMED BREAD** tests all use standardized methods to prepare specific end products to evaluate the suitability of the sample for that product or similar products. Details on many of these tests can be found in the Analysis Methods section of this booklet.



## DOUGH PROPERTIES

**ALVEOGRAPH** generates a curve indicating the air pressure necessary to inflate a piece of dough like a bubble to the point of rupture and indicates the gluten strength and extensibility of dough. Values reported include:

- **P** ("overpressure" or resistance), measured in millimeters to the maximum height of the curve, reflects the maximum pressure while blowing the bubble of dough and indicates dough resistance to extension.
- **L** (length), the length of the curve measured in millimeters, reflects the size of the bubble and indicates dough extensibility.
- **W** (the area under the curve) reflects the amount of energy needed to inflate the dough to the point of rupture and indicates dough strength.

The alveograph is well suited for measuring the dough characteristics of weaker gluten wheat and, with adaptive hydration and mix time, of stronger wheats including durum. Requirements differ depending on intended flour use. Low P values (indicating weak gluten) and long L values (high extensibility) are preferred for cakes and confectionery products; P/L close to 1 and high W values (strong gluten) are preferred for pan breads; and low P and long L values are favored for durum for pasta semolina.

**EXTENSOGGRAPH** generates a force-time curve for a piece of dough stretched until it breaks. Results include:

- **RESISTANCE**, measured at the maximum curve height in Brabender units (BU), reflects the maximum force applied and indicates the resistance of the dough to extension.
- **EXTENSIBILITY**, measured as the total length of the curve at the base line in centimeters, reflects how far the dough was stretched.
- **AREA** is the area under the curve reported in square centimeters.

These factors help describe the gluten strength and dough extensibility characteristics of flour for a wide range of end products. The extensograph can also evaluate the effects of fermentation time and additives on dough performance.

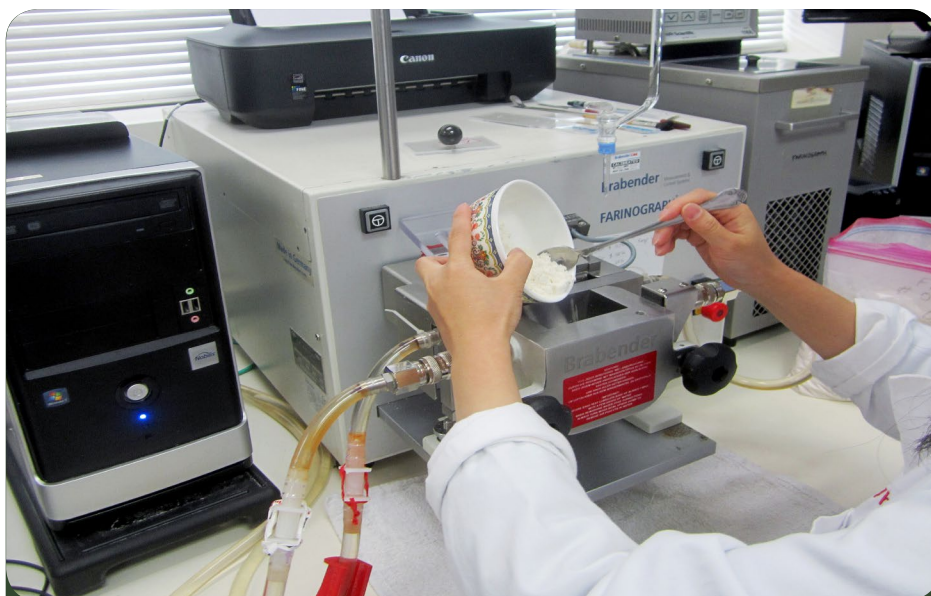


Photo courtesy of Wheat Marketing Center

**FARINOGRAPH** generates a curve that indicates the power used over time as flour and water are mixed into dough. The results describe the mixing properties of the dough and include:

- **PEAK TIME** is the time interval from the first addition of water to the maximum consistency immediately prior to the first indication of weakening. Long peak times indicate strong gluten and dough properties while short peak times may indicate weak gluten.
- **STABILITY** is the interval between the point where the top of the curve first intersects the 500-BU line (called the "arrival time") and the point where the top of the curve departs the 500-BU line ("departure time"). Long stability times also indicate strong gluten and dough properties, useful in products such as yeast-raised breads while short stability times indicate weaker gluten useful in many confectionary products.
- **ABSORPTION** is the amount of water (as a percent by weight of 14% moisture wheat flour) required to center the curve peak on the 500-BU line. High water absorption provides economic advantages for producing more dough pieces than flour with lower water absorption.

**MIXOGRAPH** generates a graph that records the force needed to mix flour or semolina and water into dough. The mixograph is similar to the farinograph but is quicker and uses a pin mixer and a smaller flour sample. Peak height and peak time are common mixing parameters that are determined from mixogram.

- **CLASSIFICATION** indicates dough characteristics for durum milled fractions on a scale of 1 to 8 with higher values indicating stronger dough properties.
- **PEAK TIME** is the interval from the first addition of water to when the curve peaks and is considered an indicator of both the rate of dough development and hydration rate. Short peak time indicates a quick

hydration rate and long peak time a slow hydration rate.

- **PEAK HEIGHT** is the height of the curve at peak time measured from the bottom of the mixogram paper to the middle of the band width at the curve peak. Peak height is primarily a function of protein content, but is affected by water absorption and dough strength. Peak height increases with protein content and dough strength, decreases with water absorption and is measured in "Mixograph units (MU)". An MU is one rectangle on the mixogram.



Pan Bread

Versatile, with excellent milling and baking characteristics for wheat foods like hearth breads, hard rolls, croissants and flat breads. HRW is also an ideal wheat choice for some types of Asian noodles, general purpose flour and as an improver for blending.

## PLAINS AND PNW HARVEST SURVEY

**OVERVIEW:** Despite dry growing conditions in the southern states, the 2018 hard red winter (HRW) crop has above average kernel characteristics and in most cases higher protein than the previous two crops. Quality attributes significantly exceed the last two years and many of the 5-year averages, results which indicate that this is one of the highest quality HRW crops in several years and will make high quality end products. This crop meets or exceeds typical HRW contract specifications and should provide high value to the customer.

**WEATHER AND HARVEST:** The 2018 HRW planted area was 2.5% below the historically low planted area of the 2017 crop. With reduced yields and reduced area, 2018 HRW production is estimated to be 18.0 MMT, down 12% from 2017's 20.4 MMT and 20% below the 5-year average production. Despite reduced production, the total HRW supply available for the 2018/19 marketing year is larger than three of the previous five years because of large beginning stocks.

Growing conditions varied among HRW growing regions. Texas, Oklahoma and Kansas were extremely dry during most of the growing season. By early June, USDA rated 85% of HRW in these three states to be in fair, poor or very poor condition. Late season precipitation helped to establish good kernel characteristics even though rains were too late and insufficient to improve yield. In contrast, 75 to 90% of the crop rated fair, good or excellent in the remaining HRW states north to eastern Montana. Because of dry conditions disease and insect pressure was low.

Washington, Oregon, Idaho and central/north central Montana had adequate moisture during all phases of crop development which helped to maximize

production. More than 90% of the HRW grown in these four states was rated fair, good or excellent in late June.

**WHEAT AND GRADE DATA:** Despite challenging growing conditions in many areas, the 2018 crop has generally good kernel characteristics. Overall 93% of Composite, 91% of Gulf-Tributary and 98% of Pacific Northwest (PNW)-Tributary samples graded U.S. No. 2 or better. Test weight averages 60.9 lb/bu (80.2 kg/hl), above the 5-year average of 60.3 lb/bu (79.3 kg/hl) and above last year's average of 60.5 lb/bu (79.6 kg/hl). The total defects average of 1.4% is above last year's 1.2%, but below the 5-year average of 1.6%. Foreign material is 0.2%, slightly above last year's 0.1%, damaged kernels at 0.1% is below last year and the 5-year average, while shrunken and broken at 1.1% is above last year's 0.9% and equal to the 5-year average. Average 1000 kernel weight of 30.7 g exceeds the 5-year average of 29.8 g. The average wheat falling number is 374 sec, comparable to the 2017 and 5-year averages, and is indicative of sound wheat.

The average protein of 12.4% (12% mb) is significantly higher than last year and equal to the 5-year average. Protein content distribution varies by growing region; the Gulf-Tributary average is 12.7% and the PNW-Tributary average is 11.7%. Of the samples tested 12% were less than 11.5% protein, 29% between 11.5 to 12.5% and 59% greater than 12.5%.

**FLOUR AND BAKING DATA:** The Buhler laboratory flour yield average is 75.1%, lower than the 2017 average of 78.1% and similar to the 5-year average of 75.7%. The 2018 flour ash of 0.44% (14% mb) is significantly lower than last year's 0.64% and the 5-year

average of 0.59%. Composite average sedimentation and wet gluten values, 54.2 cc and 28.1%, respectively, are both higher than last year. Farinograph peak and stability times, 5.2 and 12.2 min, respectively, are significantly higher than last year's 4.5 and 6.1 min. The alveograph W value of 280 ( $10^{-4}$  J), extensograph resistance of 408 BU, extensograph area of 107 cm<sup>2</sup> and loaf volume of 901 cc are all well above last year and the 5-year averages. Average bake absorption is 63.7%, above the 62.8% value for both 2017 and the 5-year average.



**479**  
SAMPLES

Collected from grain elevators in 40 reporting areas when at least 30% of the local harvest was complete.

**USDA/ARS Hard Winter Wheat Quality Lab, Manhattan, KS, and Plains Grains, Inc. collected samples and conducted quality analyses.**

Official grade and non-grade factors were determined on each sample. Functionality tests were conducted on 90 composite samples categorized by growing region and protein ranges of <11.5%, 11.5 to 12.5% and >12.5%. Production weighted results are presented as Composite, Gulf-Tributary and PNW-Tributary averages.

Gulf-Tributary states, PNW-Tributary states and California are highlighted on the map on page 9. The methods are described in the Analysis Methods section of this booklet.



## HARD RED WINTER PRODUCTION

for the major producing states (million metric tons)

	2018	2017	2016	2015	2014
California	0.2	0.2	0.3	0.3	0.3
Colorado	1.7	2.1	2.7	2.1	2.3
Idaho	0.3	0.3	0.4	0.4	0.3
Kansas	7.2	8.8	12.3	8.5	6.5
Montana	2.1	1.8	2.9	2.5	2.5
Nebraska	1.3	1.2	1.8	1.2	1.9
Oklahoma	1.9	2.7	3.7	2.7	1.3
Oregon	0.1	0.1	0.1	0.0	0.1
South Dakota	0.9	0.6	1.7	1.2	1.6
Texas	1.4	1.7	2.4	2.7	1.7
Washington	0.5	0.5	0.5	0.3	0.3
Wyoming	0.1	0.1	0.1	0.1	0.1
<b>Twelve-State Total</b>	<b>17.7</b>	<b>20.1</b>	<b>28.9</b>	<b>22.0</b>	<b>19.0</b>
<b>Total HRW Production</b>	<b>18.0</b>	<b>20.4</b>	<b>29.4</b>	<b>22.6</b>	<b>20.1</b>

Based on USDA crop estimates as of September 28, 2018.



### EXPORT CARGO SURVEY

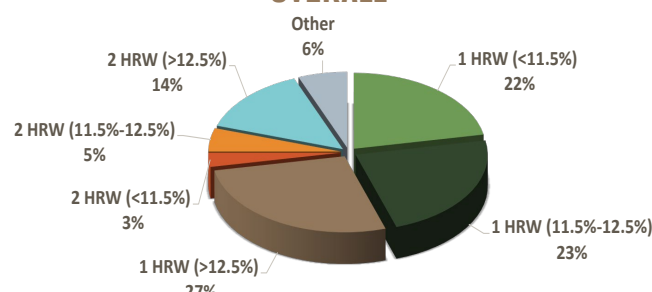
The export cargo data represent 393 subplot samples provided by USDA's Federal Grain Inspection Service for crop years 2018 and 2017. Of 82 2018-crop samples collected in July and August, 35 are from Gulf and 47 from PNW

ports. Of the 311 2017-crop samples, 179 are from Gulf and 132 from PNW ports. Grade data are the official grades on the individual sublots. Great Plains Analytical Laboratory conducted the milling and baking analyses.

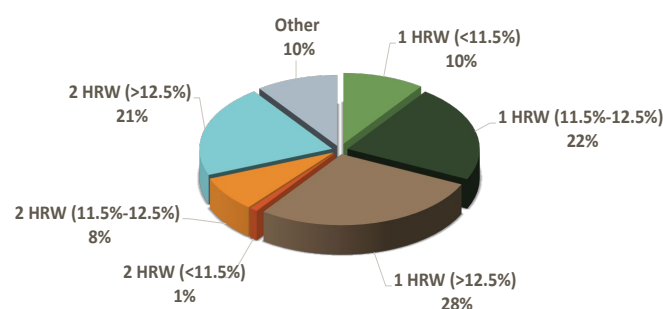
## GRADE DISTRIBUTIONS

(Values in parentheses denote protein level, 12% MB)

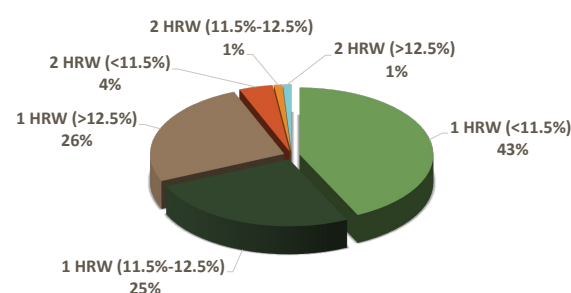
### OVERALL



### GULF EXPORTABLE



### PNW EXPORTABLE



## CALIFORNIA HARVEST SURVEY

California's wheat growing regions are defined by climate, value of alternative crops and distinct differences in variety selection. Most California hard wheat is planted from October to January, irrigated as needed and harvested in June and July. With the strong demand for new crop wheat in the domestic marketplace, importers are encouraged to express their interest in purchasing California wheat in early spring.

**WEATHER AND HARVEST:** The 2017/18 California growing season began warmer and drier than usual. Most of the wheat growing regions received below-average precipitation and had low disease pressure. Mild weather

during grain filling contributed to better than average yields in most of the Central Valley.

**SUMMARY:** California hard wheat varieties are known for their low moisture and large and uniform kernel size. Because wheat is predominantly grown under irrigation, growers achieve high yields and consistent quality. Overall, the 2018 crop has medium- to high-protein. Consistent with other years, the 2018 crop has low moisture, high flour extraction and strong baking performance – all of which make California wheat suitable for blending.



**198**  
SAMPLES

Collected from grain elevators during local harvest.

California Wheat Commission Laboratory and Federal Grain Inspection Service (FGIS) conducted tests and analyses.

Official grade and non-grade factors and functionality tests were determined on each sample. Results are weighted averages. The methods are described in the Analysis Methods section of this booklet.

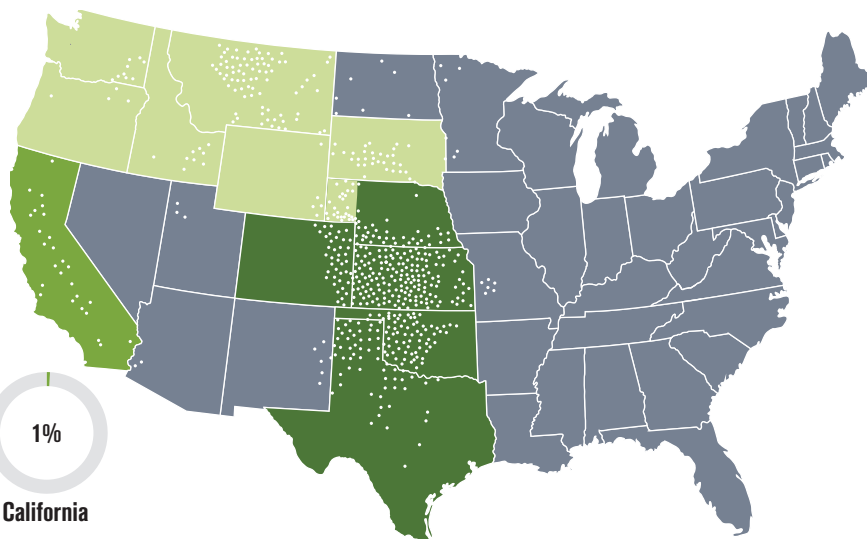
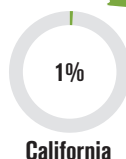
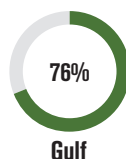
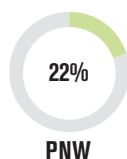


**12** STATES  
SURVEYED

**98%**

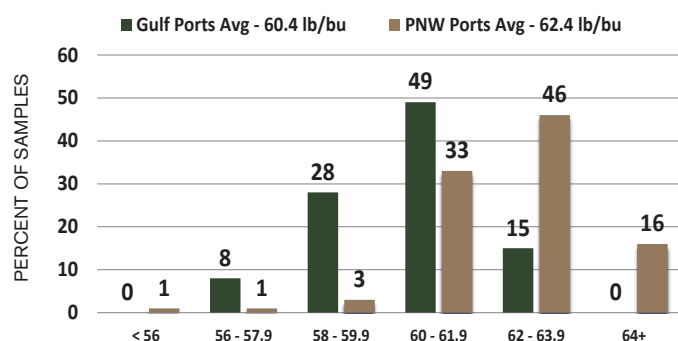
OF TOTAL HRW PRODUCTION  
REPRESENTED

Percentage of  
total U.S. HRW  
production by export  
tributary region.



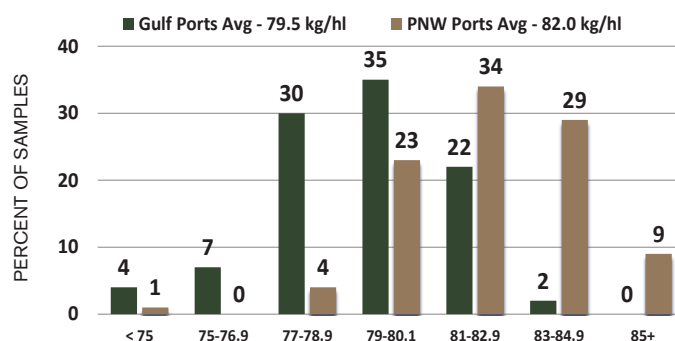
## TEST WEIGHT

Pounds/Bushel



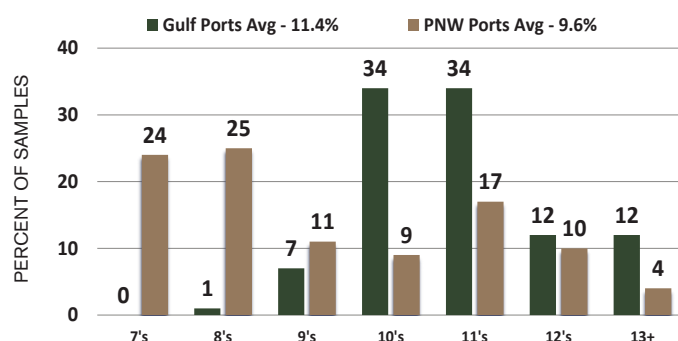
## HECTOLITER WEIGHT

Kilograms/Hectoliter



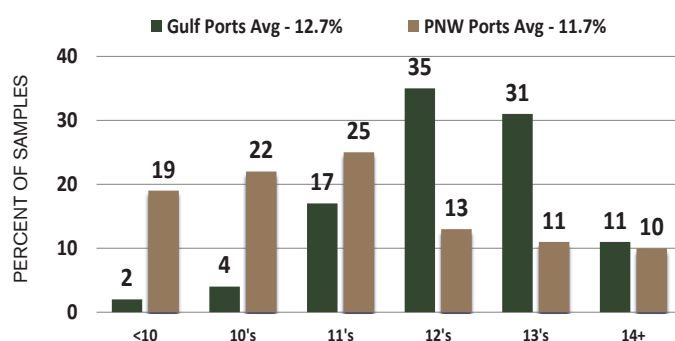
## WHEAT MOISTURE

Percent



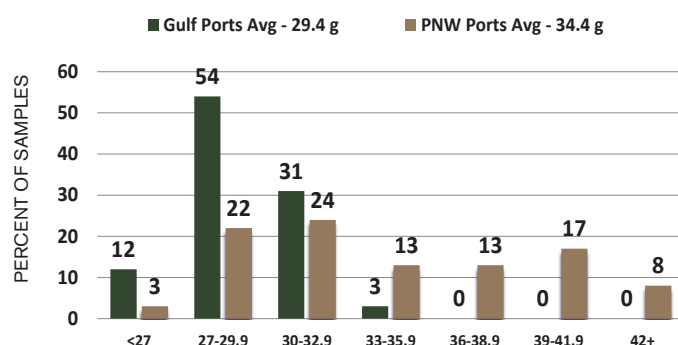
## PROTEIN (12% MB)

Percent



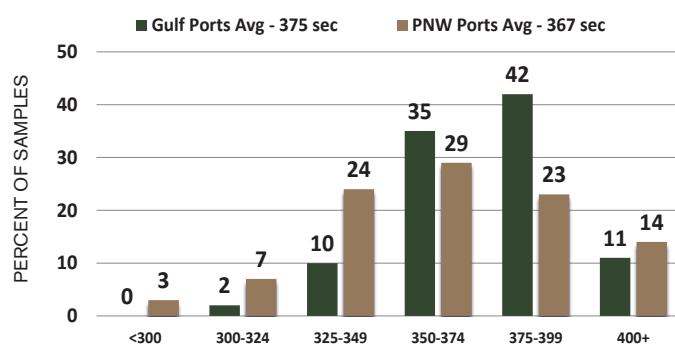
## 1000 KERNEL WEIGHT

Grams



## FALLING NUMBER

Seconds





# HARD RED WINTER



Instant Noodles

## HARVEST DATA

## COMPOSITE AVERAGE

	2018 BY PROTEIN <sup>1</sup>				2017	5-YEAR
	Low	Med	High	Overall	OVERALL	AVERAGE
<b>WHEAT GRADE DATA:</b>						
Test Weight (lb/bu)	62.0	61.1	60.4	60.9	60.5	60.1
(kg/hl)	81.6	80.4	79.5	80.2	79.6	79.1
Damaged Kernels (%)	0.1	0.1	0.2	0.1	0.2	0.3
Foreign Material (%)	0.2	0.1	0.2	0.2	0.1	0.1
Shrunken and Broken (%)	1.0	1.0	1.1	1.1	0.9	1.1
Total Defects (%)	1.3	1.2	1.5	1.4	1.2	1.6
Grade	1 HRW	1 HRW	1 HRW	1 HRW	1HRW	1 HRW
<b>WHEAT NON-GRADE DATA:</b>						
Dockage (%)	0.5	0.5	0.5	0.5	0.6	0.6
Moisture (%)	10.9	10.6	11.3	10.9	11.0	11.2
Protein (%) 12%/0% moisture basis	10.6/12.1	12.0/13.6	13.4/15.3	12.4/14.1	11.4/13.0	12.4/14.1
Ash (%) 14%/0% moisture basis	1.45/1.68	1.49/1.73	1.53/1.78	1.49/1.74	1.50/1.74	1.53/1.78
1000 Kernel Weight (g)	32.0	30.4	29.6	30.7	31.0	29.8
Kernel Size (%) lg/md/sm	70/29/1	62/37/1	55/43/2	61/38/2	68/31/1	68/31/1
Single Kernel: Hardness	65.1	65.9	66.2	65.8	64.3	62.6
Weight (mg)	32.0	30.4	29.6	30.7	31.0	29.8
Diameter (mm)	2.64	2.58	2.54	2.60	2.56	2.59
Sedimentation (cc)	43.9	52.0	57.8	54.2	43.5	49.2
Falling Number (sec)	367	373	377	374	378	393
DON (ppm)	<0.5	<0.5	<0.5	<0.5	<0.5	
<b>FLOUR DATA:</b>						
Lab Mill Extraction (%)	74.8	74.8	75.2	75.1	78.1	75.7
Color: L*	91.8	91.8	91.5	91.6	89.9	89.9
a*	-1.9	-1.8	-1.7	-1.7	-1.1	-1.5
b*	10.3	10.3	10.1	10.2	10.3	10.1
Protein (%) 14%/0% moisture basis	9.3/10.8	10.8/12.6	11.9/13.8	11.2/13.0	10.7/12.4	11.4/13.3
Ash (%) 14%/0% moisture basis	0.44/0.51	0.43/0.50	0.45/0.53	0.44/0.52	0.64/0.74	0.59/0.68
Wet Gluten (%)	20.6	25.9	30.8	28.1	25.3	28.5
Gluten Index	98	99	97	98	93	93
Falling Number (sec)	394	417	416	413	401	402
Amylograph Viscosity: 65g (BU)	590	675	664	664	478	490
Starch Damage (%)	6.9	6.4	6.1	6.3	6.8	6.5
SRC: GPI	0.73	0.75	0.75	0.75	0.58	
Water / 50% Sucrose	63/101	63/107	64/110	64/108	69/109	
5% Lactic Acid / 5% Na <sub>2</sub> CO <sub>3</sub>	135/85	143/84	147/85	145/85	120/97	
<b>DOUGH PROPERTIES:</b>						
Farinograph: Peak Time (min)	2.7	4.4	6.3	5.2	4.5	5.0
Stability (min)	7.0	11.7	13.5	12.2	6.1	8.3
Absorption (%)	57.3	57.9	58.6	58.4	60.5	59.9
Alveograph: P (mm)	88	84	79	83	88	82
L (mm)	62	87	101	92	70	88
P/L Ratio	1.42	0.97	0.78	0.90	1.26	0.93
W (10 <sup>-4</sup> J)	210	272	291	280	199	228
Extensograph: Resistance (BU)	528/795	574/954	586/1047	570/991	362/551	320/473
(45/135 min) Extensibility (cm)	14.3/11.7	12.9/10.2	15.2/12.9	14.3/11.8	13.8/13.0	14.5/14.0
Area (cm <sup>2</sup> )	107/130	98/119	115/162	107/145	67/92	80/109
<b>BAKING EVALUATION:</b>						
Pan Bread: Bake Absorption (%)	60.7	63.0	64.5	63.7	62.8	62.7
Crumb Grain and Texture (1-10)	5.0	6.3	6.8	6.6	6.6	6.4
Loaf Volume (cc)	772	861	953	901	806	843
<b>PRODUCTION OF 11 STATES (%):</b>	<b>12</b>	<b>29</b>	<b>59</b>	<b>100</b>		

<sup>1</sup>Protein Range: Low, <11.5%; Med, 11.5 - 12.5%; High, >12.5%.



GULF EXPORTABLE AVERAGE						PNW EXPORTABLE AVERAGE					
2018 BY PROTEIN <sup>1</sup>			Overall	OVERALL	5-YEAR AVERAGE	2018 BY PROTEIN <sup>1</sup>			Overall	OVERALL	5-YEAR AVERAGE
Low	Med	High				Low	Med	High			
61.7	60.7	60.0	60.4	60.1	59.8	63.0	62.4	61.5	62.4	61.9	61.0
81.2	79.8	79.0	79.5	79.1	78.8	82.8	82.1	80.8	82.0	81.4	80.1
0.2	0.1	0.2	0.1	0.2	0.4	0.0	0.0	0.1	0.1	0.0	0.2
0.2	0.1	0.2	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1
1.1	1.2	1.3	1.3	0.9	1.2	0.6	0.6	0.7	0.6	0.9	0.9
1.5	1.4	1.7	1.6	1.2	1.6	0.8	0.7	0.9	0.8	1.0	1.3
1 HRW	1 HRW	1 HRW	1 HRW	1 HRW	1 HRW	1 HRW	1 HRW	1 HRW	1 HRW	1 HRW	1 HRW
0.5	0.5	0.5	0.5	0.6	0.6	0.3	0.4	0.5	0.4	0.4	0.6
11.5	11.1	11.5	11.4	11.3	11.4	9.3	9.3	10.6	9.6	10.0	10.7
10.8/12.3	12.1/13.7	13.3/15.2	12.7/14.4	11.2/12.7	12.5/14.2	10.1/11.5	11.9/13.5	13.7/15.6	11.7/13.3	12.0/13.6	12.1/13.8
1.48/1.72	1.50/1.75	1.52/1.77	1.51/1.76	1.51/1.76	1.50/1.80	1.35/1.57	1.45/1.68	1.55/1.80	1.44/1.67	1.43/1.67	1.49/1.73
30.6	28.9	29.1	29.4	30.4	29.2	36.1	34.7	30.9	34.4	34.1	31.7
65/34/1	56/42/2	52/46/2	55/43/2	68/31/1	59/40/1	84/15/1	79/21/1	64/35/1	77/22/1	66/33/1	67/32/1
65.4	64.5	65.2	65.0	63.2	62.3	64.3	69.8	69.0	67.9	68.1	64.0
30.6	28.9	29.1	29.4	30.4	29.2	36.1	34.7	30.9	34.4	33.0	31.7
2.56	2.50	2.51	2.53	2.55	2.57	2.86	2.80	2.62	2.78	2.60	2.65
42.8	50.3	55.5	53.8	41.3	47.9	46.9	57.0	64.5	55.4	51.2	53.5
371	371	378	375	370	395	356	377	376	370	378	386
<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	
74.5	74.8	75.0	75.0	78.8	75.9	75.8	74.9	75.6	75.3	75.6	75.1
91.8	91.8	91.4	91.5	89.9	89.8	91.9	91.8	91.7	91.8	90.1	90.2
-1.9	-1.8	-1.7	-1.7	-1.1	-1.5	-1.8	-1.7	-1.5	-1.7	-1.0	-1.5
10.3	10.3	10.3	10.3	10.3	10.2	10.2	10.2	9.7	10.1	10.2	9.9
9.2/10.7	10.9/12.7	11.7/13.6	11.4/13.3	10.4/12.1	11.5/13.4	9.6/11.2	10.5/12.2	12.4/14.4	10.6/12.3	11.6/13.5	11.2/13.0
0.44/0.51	0.44/0.51	0.45/0.53	0.45/0.53	0.65/0.75	0.60/0.70	0.43/0.50	0.42/0.49	0.45/0.52	0.43/0.50	0.59/0.69	0.53/0.62
19.6	25.9	30.0	28.6	24.6	29.2	23.3	26.0	33.3	26.7	27.9	26.9
98	99	97	98	93	92	98	99	96	98	94	96
395	413	413	412	400	406	392	428	423	416	406	392
612	713	709	705	474	486	529	566	536	548	490	500
6.8	6.2	6.1	6.1	6.8	6.4	7.0	7.1	6.2	6.9	7.0	6.6
0.72	0.77	0.74	0.76	0.58		0.74	0.70	0.78	0.73	0.61	
61/101	60/106	64/109	63/108	68/108		69/101	69/110	64/110	68/107	72/111	
132/82	144/81	146/83	145/83	118/96		143/93	142/93	150/82	144/91	130/103	
2.8	4.5	6.0	5.5	4.3	5.1	2.5	4.0	7.2	4.2	5.4	5.0
7.0	11.7	13.4	12.7	5.7	8.1	7.0	11.8	14.0	10.7	7.5	8.7
56.8	57.0	58.2	57.9	60.0	60.2	58.9	60.4	59.6	59.8	62.4	59.6
86	79	80	80	84	81	93	98	77	92	101	86
59	88	99	95	70	88	70	83	108	84	69	88
1.46	0.90	0.81	0.84	1.20	0.92	1.33	1.18	0.71	1.09	1.46	0.99
199	260	289	278	187	220	242	306	297	284	243	252
528/795	574/954	586/1047	581/1014	345/530	304/451	511/840	548/945	566/1004	540/924	411/611	371/539
14.3/11.6	12.7/10.0	14.9/12.4	14.3/11.8	13.9/13.0	14.6/14.1	14.2/11.8	13.4/10.8	16.1/14.4	14.2/11.8	13.5/12.7	14.4/13.6
110/133	97/117	113/159	109/149	65/90	76/106	99/121	99/125	120/170	103/133	75/100	93/121
60.1	63.0	64.4	63.9	62.5	62.6	62.4	63.1	64.8	63.2	63.8	63.2
4.7	6.4	7.0	6.8	6.5	6.3	5.9	5.9	6.4	6.0	6.8	6.5
771	876	949	924	802	847	776	817	963	835	821	833
4	16	54	74			8	13	5	26		

<sup>1</sup>Protein Range: Low, <11.5%; Med, 11.5 - 12.5%; High, >12.5%.



# HARD RED WINTER

## CALIFORNIA HARVEST DATA

## EXPORT CARGO DATA

	MEDIUM PROTEIN <sup>1</sup>		HIGH PROTEIN <sup>1</sup>			GULF		PNW	
	2018	2017	2018	2017		2018	2017	2018	2017
<b>WHEAT GRADE DATA:</b>									
Test Weight (lb/bu)	62.8	63.3	61.9	62.1		60.9	60.6	63.4	62.6
(kg/hl)	82.6	83.2	81.3	81.7		80.1	79.7	83.3	82.3
Damaged Kernels (%)	0.9	0.0	1.3	0.1		0.9	0.9	0.1	0.1
Foreign Material (%)	0.2	0.1	0.2	0.1		0.2	0.2	0.0	0.1
Shrunken and Broken (%)	0.6	0.7	1.1	1.0		1.4	1.4	1.0	1.0
Total Defects (%)	0.8	0.8	1.3	1.2		2.5	2.5	1.1	1.2
Grade	1 HRW	1 HRW	1 HRW	1 HRW		1 HRW	1 HRW	1 HRW	1 HRW
<b>WHEAT NON-GRADE DATA:</b>									
Dockage (%)	0.9	1.0	1.3	0.9		0.7	0.7	0.3	0.3
Moisture (%)	8.3	10.0	8.3	8.2		11.3	11.2	10.3	9.7
Protein (%) 12%/0% moisture basis	12.4/14.1	11.8/13.4	13.3/15.2	13.1/14.9		11.7/13.2	11.3/12.9	11.9/13.6	11.8/13.4
Ash (%) 14%/0% moisture basis	1.51/1.76	1.54/1.79	1.57/1.82	1.53/1.78		1.49/1.73	1.50/1.75	1.35/1.56	1.34/1.55
1000 Kernel Weight (g)	43.1	41.5	43.1	42.4		27.4	28.1	31.2	30.1
Kernel Size (%) lg/md/sm	87/13/0	85/15/0	82/18/0	83/16/1		65/33/2	68/30/2	70/29/1	67/32/1
Single Kernel: Hardness	70.0	71.0	72.1	62.8			66.5		73.7
Weight (mg)	42.1	41.7	39.3	41.8			32.4		34.2
Diameter (mm)	3.09	2.98	2.98	2.96			2.62		2.66
Sedimentation (cc)	52.0	44.4	55.0	46.6		28.6	28.2	42.0	37.3
Falling Number (sec)	360	369	382	452		438	433	437	429
DON (ppm)	<0.5	<0.5	<0.5	<0.5			<0.5		0.0
<b>FLOUR DATA:</b>									
Lab Mill Extraction (%)	67.1	66.3	67.4	68.2		71.5	68.4	71.2	68.0
Color: L*	92.5	93.6	93.0	93.0		89.6	89.8	89.5	89.8
a*	-0.8	-1.0	-0.9	-1.0		-2.0	-2.1	-2.0	-2.1
b*	7.3	7.1	7.7	7.9		9.6	9.6	9.6	9.6
Protein (%) 14%/0% moisture basis	11.6/13.5	11.0/12.7	11.9/13.8	11.7/13.6		10.4/12.1	10.0/11.6	10.9/12.6	10.5/12.2
Ash (%) 14%/0% moisture basis	0.51/0.59	0.41/0.47	0.52/0.60	0.43/0.50		0.51/0.59	0.47/0.54	0.48/0.56	0.45/0.52
Wet Gluten (%)	31.6	32.6	33.0	35.4		28.0	26.0	28.0	27.4
Gluten Index	93	63	87	77		97	97	97	97
Falling Number (sec)	408	375	385	509		438	447	432	419
Amylograph Viscosity: 65g (BU)	823	795	910	986		724	789	676	721
Starch Damage (%)	7.9	9.5	8.7	9.1					
SRC: GPI	0.69	0.79	0.72	0.82					
Water / 50% Sucrose	67/111	69/105	68/114	70/108					
5% Lactic Acid / 5% Na <sub>2</sub> CO <sub>3</sub>	138/88	149/84	144/86	158/84					
<b>DOUGH PROPERTIES:</b>									
Farinograph: Peak Time (min)	6.8	4.7	6.6	9.6		6.1	6.5	6.0	6.6
Stability (min)	13.4	11.0	15.1	15.2		11.4	12.8	10.3	12.5
Absorption (%)	63.2	64.0	64.0	65.0		59.8	59.4	61.5	61.2
Alveograph: P (mm)	118	125	114	128		100	108	109	119
L (mm)	71	75	109	89		87	86	85	82
P/L Ratio	1.66	1.67	1.05	1.22		1.15	1.25	1.29	1.45
W (10 <sup>-4</sup> J)	295	363	390	394		294	305	323	338
Extensograph: Resistance (BU)	255/267	234/400	268/300	334/475					
(45/135 min) Extensibility (cm)	21.3/21.4	17.7/15.8	22.2/19.9	15.8/14.8					
Area (cm <sup>2</sup> )	136/145	89/119	150/145	102/132					
<b>BAKING EVALUATION:</b>									
Pan Bread: Bake Absorption (%)	63.3	64.0	64.0	64.0		61.8	61.4	63.3	63.0
Crumb Grain and Texture (1-10)	8.0	8.0	8.0	9.0		6.8	6.8	6.7	6.7
Loaf Volume (cc)	973	891	1005	948		864	849	877	848
<b>SAMPLE COUNT:</b>									
						35	179	47	132

<sup>1</sup>California HRW Protein Range: Med, 11.0 - 12.5%; High, >12.5%.





Hard Rolls

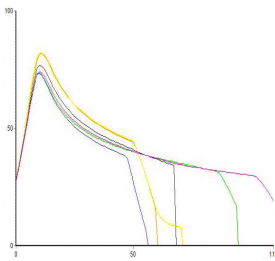
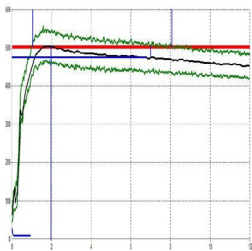
# COMPOSITE DOUGH PROPERTIES

FARINOGRAMS

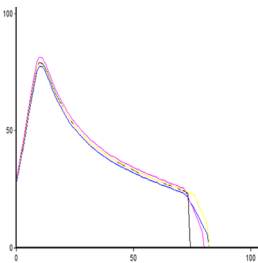
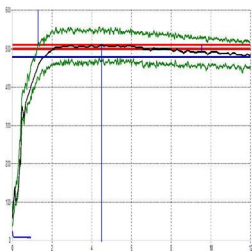
ALVEOGRAMS

EXTENSOGRAMS

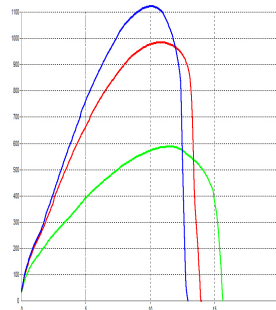
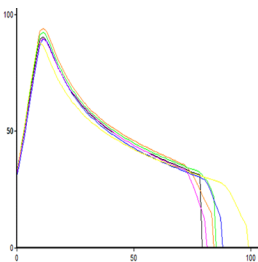
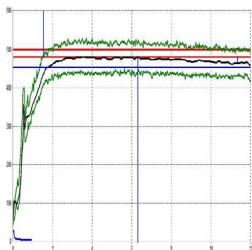
LOW  
PROTEIN



MEDIUM  
PROTEIN



HIGH  
PROTEIN



# HARD RED SPRING

The aristocrat of wheat when it comes to “designer” wheat foods like hearth breads, rolls, croissants, bagels and pizza crust. HRS is also a valued improver in flour blends.



**777**  
SAMPLES

Collected from fields, on-farm bin sites or elevators, and separated by export region.

**The HRS Wheat Quality Lab**  
Department of Plant Sciences, North Dakota University (NDSU), Fargo, ND, collected samples and conducted quality analyses.

Official grade and non-grade factors were determined on 60% of samples. Functionality tests were conducted on 24 composite samples categorized by export region and protein ranges of <13.5%, 13.5 to 14.5% and >14.5%. Production-weighted results are presented as Composite, Eastern and Western Region averages based on composite samples. Eastern and Western Region states are highlighted on the map on page 16. The methods are described in the Analysis Methods section of this booklet.

**OVERVIEW:** The 2018 U.S. hard red spring wheat (HRS) crop has many positive features for buyers including improved supplies, a high-grade profile, above average protein levels and very good dough and bake qualities. In general, many quality features are 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.

**WEATHER AND HARVEST:** Planting began in late April, later than normal, due to isolated snow, colder temperatures and delayed soil warming. Planting continued to be slow until mid-May when weather patterns shifted to hot and dry, allowing most of the crop to be planted by early June.

Overly dry soils challenged emergence in some parts of the growing region, but a shift to more frequent and beneficial rains throughout much of June benefited the crop. Previously stressed crops were revived, and much of the region experienced robust stand establishment and good crop growth. Warmer temperatures for much of the growing season accelerated crop maturity. Frequent moisture elevated disease pressure, but drier conditions later in the growing season minimized and isolated the extent of the pressure.

Harvest began in late July and made steady, rapid progress into the latter half of August. Weather conditions were favorably warm and dry for much of the harvest. The last one-third of the harvest, primarily in more northern areas, was slow due to periodic rain and delayed crop ripening. Most of the crop was harvested by mid-September.

The 2018 HRS production, estimated at 16.0 million metric tons (MMT), is the largest crop in 22 years and up significantly from 10.5 MMT in 2017. Higher planted area and a record national yield contributed to the higher production.

**WHEAT AND GRADE DATA:** The 2018 HRS crop is high grading and high in protein. Laboratory analysis reveals a crop with many positives for key end-use quality traits. The average grade is a U.S. No. 1 Dark Northern Spring (DNS), up from U.S. No. 1 Northern Spring (NS) in 2017; 97% of Eastern Region samples and 93% of Western Region samples graded U.S. No. 1. The overall average test weight is 62.2 lb/bu (81.7 kg/hl), higher than 2017 and the 5-year average. Eighty-nine percent of Eastern samples and 80% of Western samples are above 60 lb/bu (78.9 kg/hl). Average damage is 0.3%, up from 2017, and shrunken and broken kernels average is 1.0%, similar to 2017. The crop in both regions shows excellent kernel color, with average vitreous kernel content (DHV) of 87% compared to 71% for the 5-year average. Average DHV is 90% for Western samples and 84% for Eastern.

The average protein is 14.5% (12% mb), similar to 2017. Western average protein is 14.6%, down slightly from 2017, while Eastern average protein held steady at 14.4%. One-half of all samples have greater than 14.5% protein in 2018, and 22% fall below 13.5% protein.

Disease pressures were higher than in 2017 due to moisture patterns, with the heaviest pressure from Fusarium head blight across the Eastern Region. The crop's overall DON average is 0.3 ppm, ranging from 0.0 to 0.2 ppm for Western composites and from 0.5 to 0.7 ppm for

Bagels



Eastern composites. Thousand kernel weight (TKW) is slightly higher than 2017 at 31.1 grams; TKW averages 32.1 g in Eastern and 30.0 g in Western samples. A dry harvest period supported a high average falling number of 399 sec, with more than 95% of the crop above 350 sec, indicating sound wheat.

**FLOUR, DOUGH AND BAKING DATA:** Buhler laboratory mill flour yield averages 67.8%, down 3.5% from 2017, but similar to the 5-year average. Flour ash fell to 0.52%, compared to 0.58% a year ago. Wet gluten averages 35.3%. Amylograph values average 635 BU for

65 g of flour, up notably from 2017 and the 5-year average.

Farinograph dough tests indicate slightly higher absorption than last year with the Western average at 65.2% and Eastern at 63.0%. The average farinograph stability is 10.8 min, similar to 2017 and the 5-year average. The Eastern crop has slightly stronger dough properties compared to the Western, but dough strength increases at higher protein levels in both regions.

Alveograph and extensograph analyses show more resistance and less extensibility. The average alveograph

P/L ratio is 0.61 compared to 0.72 in 2017, and the W value is 415 ( $10^{-4}$  J) compared to 360 in 2017. The overall extensibility and resistance to extension of the 135 min extensograph are 13.2 cm and 855 BU compared to 2017 crop values of 13.5 and 770.

The average loaf volume is 973 cc, up marginally from 968 in 2017 with Western volumes down slightly but Eastern volumes higher. Average bake absorption is 69.6%, up sharply from both last year and the 5-year average. Bread scores are slightly lower in both Western and Eastern crops compared to 2017.

## HARD RED SPRING PRODUCTION

for the major producing states (million metric tons)

	2018	2017	2016	2015	2014
Idaho	0.6	0.5	0.4	0.4	0.4
Minnesota	2.5	2.1	2.0	2.3	1.8
Montana	2.6	1.3	2.1	2.1	2.9
North Dakota	8.7	5.7	7.3	8.7	8.0
Oregon	0.1	0.1	0.0	0.0	0.0
South Dakota	1.1	0.6	1.3	1.6	1.9
Washington	0.4	0.3	0.3	0.2	0.2
<b>Seven-State Total</b>	<b>16.0</b>	<b>10.5</b>	<b>13.4</b>	<b>15.4</b>	<b>15.1</b>
<b>Total HRS Production</b>	<b>16.0</b>	<b>10.5</b>	<b>13.4</b>	<b>15.4</b>	<b>15.1</b>

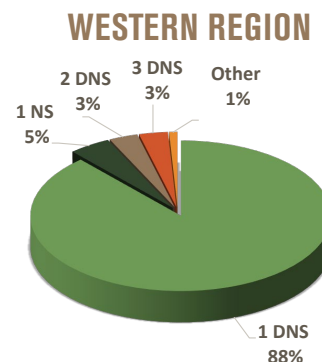
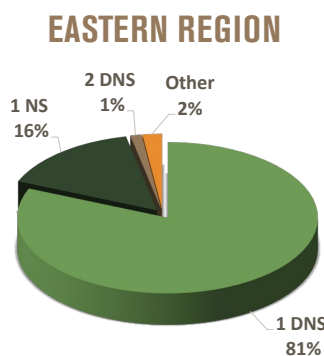
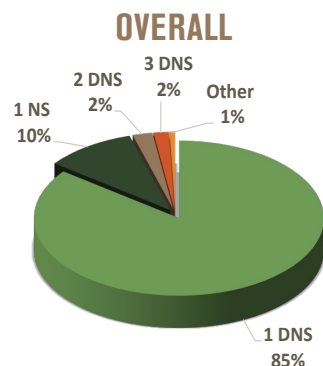
Based on USDA crop estimates as of September 28, 2018.



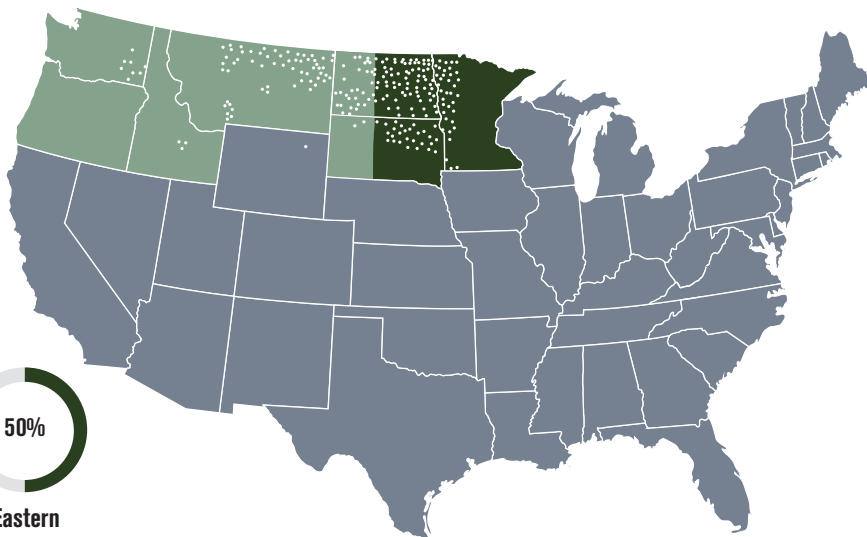
## EXPORT CARGO SURVEY

The export cargo data represent 412 individual subplot samples provided by USDA's Federal Grain Inspection Service for crop years 2017 (collected from October 2017 through June 2018) and 2016. Of 171 2017-crop samples, 117 were from the PNW, 18 from Gulf ports and 36 from Great Lakes ports. Grade data are the official grades on the individual sublots. North Dakota State University conducted the milling and baking analyses.

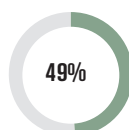
## GRADE DISTRIBUTIONS



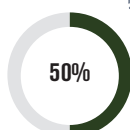
**7 STATES SURVEYED**  
**99%**  
**OF TOTAL HRS PRODUCTION REPRESENTED**



Percentage of total U.S. HRS production by region.



Western Region

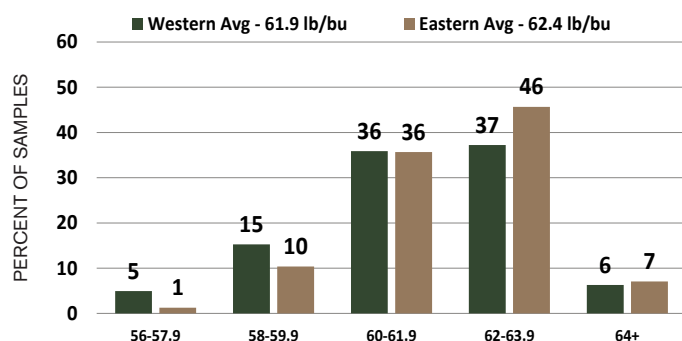


Eastern Region



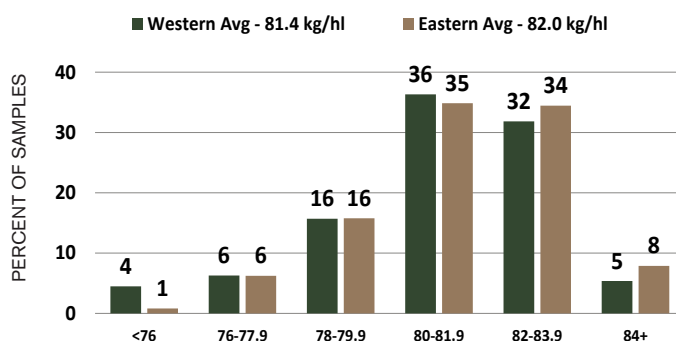
## TEST WEIGHT

Pounds/Bushel



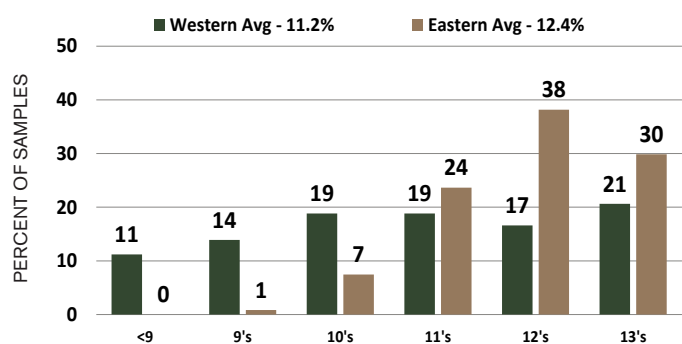
## HECTOLITER WEIGHT

Kilograms/Hectoliter



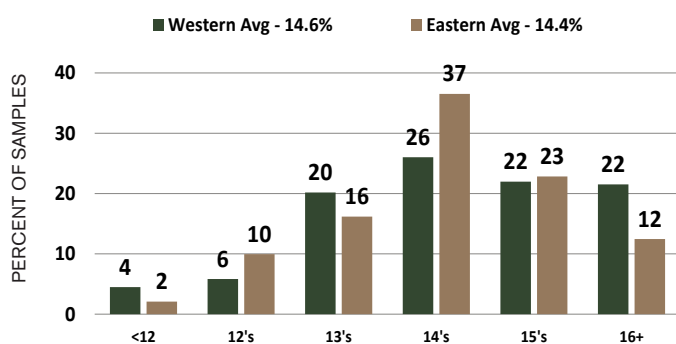
## WHEAT MOISTURE

Percent



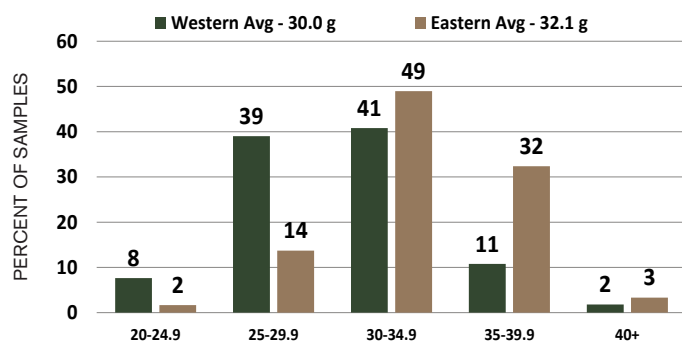
## PROTEIN (12% MB)

Percent



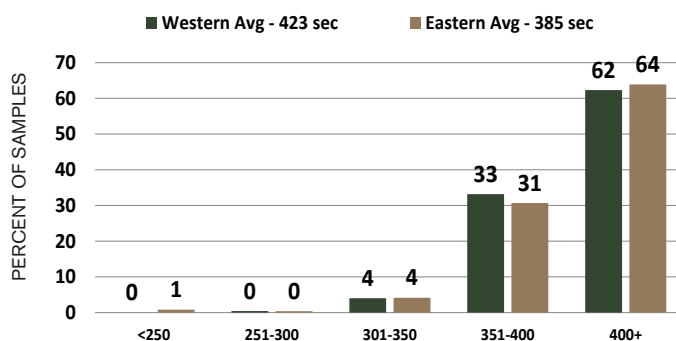
## 1000 KERNEL WEIGHT

Grams



## FALLING NUMBER

Seconds







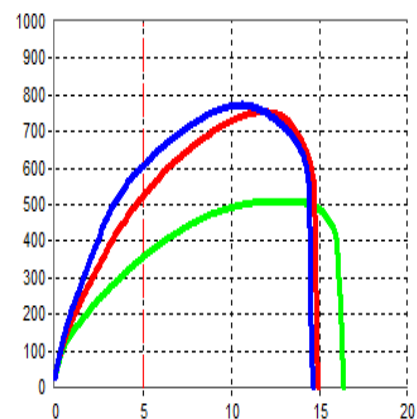
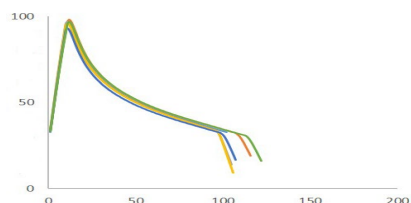
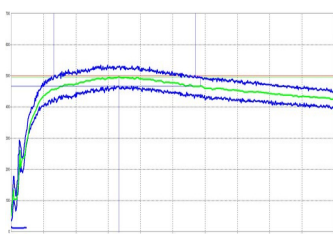
## COMPOSITE DOUGH PROPERTIES

### FARINOGRAMS

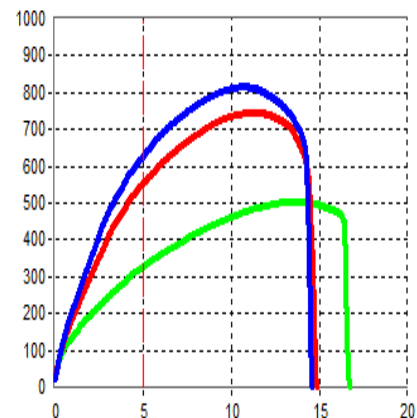
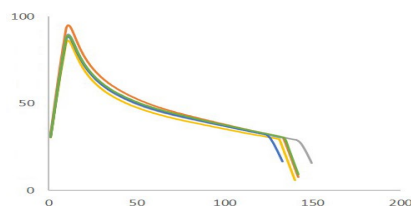
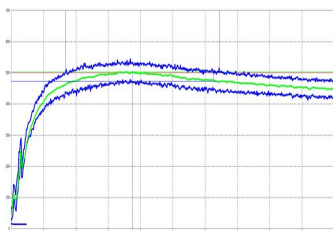
### ALVEOGRAMS

### EXTENSOGRAMS

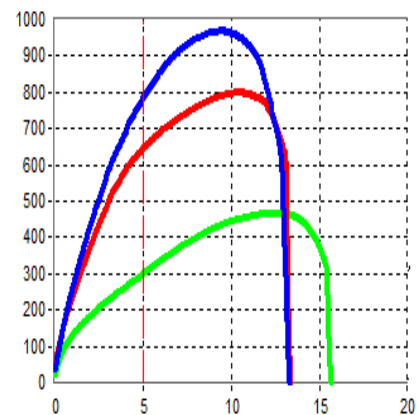
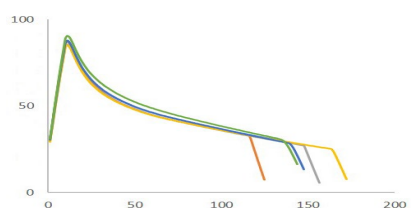
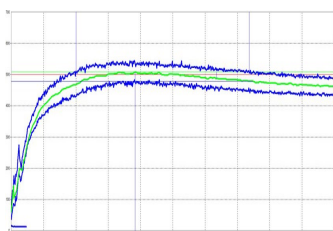
LOW  
PROTEIN



MEDIUM  
PROTEIN



HIGH  
PROTEIN



# HARD RED SPRING



Artisan Bread

## HARVEST DATA

## COMPOSITE AVERAGE

	2018 BY PROTEIN <sup>1</sup>				2017	5-YEAR
	Low	Med	High	Overall	Overall	Average
<b>WHEAT GRADE DATA:</b>						
Test Weight (lb/bu)	62.7	62.7	61.6	62.2	61.6	61.7
(kg/hl)	82.4	82.5	81.0	81.7	81.0	81.1
Damaged Kernels (%)	0.3	0.2	0.3	0.3	0.0	0.1
Foreign Material (%)	0.0	0.0	0.0	0.0	0.0	0.0
Shrunken & Broken (%)	1.0	0.9	1.0	1.0	0.9	0.9
Total Defects (%)	1.3	1.1	1.3	1.2	0.9	1.0
Vitreous Kernels (%)	78	88	90	87	73	71
Grade	1 DNS	1 DNS	1 DNS	1 DNS	1 NS	1 NS
<b>WHEAT NON-GRADE DATA:</b>						
Dockage (%)	0.5	0.5	0.4	0.5	0.5	0.6
Moisture (%)	12.1	12.1	11.6	11.8	12.0	12.2
Protein (%) 12%/0% moisture basis	12.5/14.3	14.0/15.9	15.6/17.7	14.5/16.5	14.6/16.6	14.0/15.9
Ash (%) 14%/0% moisture basis	1.54/1.79	1.59/1.84	1.59/1.85	1.58/1.84	1.51/1.76	1.50/1.75
1000 Kernel Weight (g)	32.1	32.1	30.2	31.1	30.7	31.1
Kernel Size (%) lg/md/sm	49/49/2	49/49/2	41/56/3	45/52/3	39/58/4	47/50/3
Single Kernel: Hardness	75	73	70	72	80	81
Weight (mg)	35.4	34.0	32.8	33.7	32.1	32.6
Diameter (mm)	2.79	2.77	2.69	2.74	2.31	2.37
Sedimentation (cc)	62.6	66.0	68.6	66.6	65.5	63.2
Falling Number (sec)	384	406	410	403	383	374
DON (ppm)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
<b>FLOUR DATA:</b>						
Lab Mill Extraction (%)	68.9	68.6	66.9	67.8	71.2	68.2
Color: L*	90.9	90.6	90.6	90.7	90.0	90.6
a*	-1.0	-1.0	-1.0	-1.0	-1.0	-1.1
b*	8.9	9.1	9.0	9.0	9.7	9.6
Protein (%) 14%/0% moisture basis	11.8/13.8	13.2/15.3	14.5/16.8	13.6/15.8	13.9/16.1	13.0/15.1
Ash (%) 14%/0% moisture basis	0.52/0.60	0.52/0.60	0.52/0.60	0.52/0.60	0.58/0.67	0.51/0.60
Wet Gluten (%)	29.4	34.1	38.5	35.3	35.8	34.2
Gluten Index	96	93	89	92	90	93
Falling Number (sec)	395	417	420	414	406	392
Amylograph Viscosity: 65g (BU)	597	644	647	635	588	608
Starch Damage (%)	9.1	8.4	7.6	8.1	6.8	7.1
SRC: GPI	0.60	0.62	0.63	0.62	0.66	0.67
Water / 50% Sucrose	79/123	77/125	75/129	76/127	70/117	73/123
5% Lactic Acid / 5% Na <sub>2</sub> CO <sub>3</sub>	145/118	147/114	151/108	149/112	141/97	147/101
<b>DOUGH PROPERTIES:</b>						
Farinograph: Peak Time (min)	6.3	7.2	8.6	7.7	7.5	7.1
Stability (min)	8.9	9.7	12.3	10.8	10.7	10.8
Absorption (%)	62.6	63.8	64.8	64.1	63.0	62.9
Alveograph: P (mm)	104	101	92	97	78	87
L (mm)	109	124	150	134	142	124
P/L Ratio	0.96	0.81	0.61	0.72	0.55	0.72
W (10 <sup>-4</sup> J)	377	411	432	415	360	361
Extensograph: Resistance (BU)	504/746	538/813	523/922	523/855	469/770	460/791
(45/135 min) Extensibility (cm)	15.6/13.2	15.8/13.9	16.3/12.9	16.0/13.2	16.4/13.5	16.7/13.6
Area (cm <sup>2</sup> )	130/132	115/146	112/154	116/147	101/137	100/139
<b>BAKING EVALUATION:</b>						
Pan Bread: Bake Absorption (%)	68.5	69.6	70.1	69.6	67.1	65.7
Crumb Grain and Texture (1-10)	7.4	7.6	7.9	7.7	8.2	7.9
Loaf Volume (cc)	864	940	1036	973	968	967
<b>PRODUCTION OF 7 STATES (%):</b>	<b>22</b>	<b>27</b>	<b>52</b>	<b>100</b>		

<sup>1</sup>Protein Range: Low, <13.5%; Med, 13.5 to 14.5%; High, >14.5%.



WESTERN REGIONAL AVERAGE						EASTERN REGIONAL AVERAGE					
2018 BY PROTEIN <sup>1</sup>			2017			2018 BY PROTEIN <sup>1</sup>			2017		
Low	Med	High	Overall	Overall	Average	Low	Med	High	Overall	Overall	Average
62.4	62.8	61.4	61.9	61.2	61.4	63.0	62.7	61.9	62.4	62.0	62.0
82.0	82.6	80.7	81.4	80.4	80.7	82.8	82.4	81.4	82.0	81.5	81.5
0.2	0.2	0.4	0.3	0.0	0.1	0.3	0.2	0.2	0.2	0.0	0.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.3	1.0	1.1	1.1	1.0	1.1	0.8	0.9	0.8	0.8	0.7	0.6
1.5	1.2	1.5	1.4	1.0	1.2	1.1	1.1	1.0	1.1	0.7	0.8
82	92	92	90	82	74	75	85	87	84	62	67
1 DNS	1 DNS	1 DNS	1 DNS	1 DNS	1 NS	1 DNS	1 DNS	1 DNS	1 DNS	1 NS	1 NS
0.5	0.6	0.4	0.5	0.5	0.6	0.5	0.5	0.4	0.4	0.5	0.5
11.3	11.6	11.0	11.2	11.2	11.5	12.8	12.5	12.2	12.4	12.7	12.8
12.3/14.0	14.0/15.9	15.8/17.9	14.6/16.6	14.9/16.9	14.2/16.1	12.7/14.5	14.0/15.9	15.4/17.5	14.4/16.4	14.4/16.3	13.8/15.7
1.47/1.71	1.55/1.80	1.53/1.78	1.52/1.77	1.52/1.76	1.51/1.75	1.61/1.87	1.61/1.87	1.66/1.93	1.64/1.90	1.51/1.75	1.50/1.75
29.5	31.6	29.5	30.0	28.7	30.6	34.5	32.4	30.9	32.1	32.9	32.3
38/59/3	44/54/2	38/59/3	39/58/3	27/68/5	40/57/3	60/39/1	53/45/2	45/52/3	51/47/2	52/46/3	55/43/2
74	75	68	71	79	81	75	71	73	73	81	82
34.4	33.5	32.0	32.9	30.5	32.1	36.3	34.4	33.6	34.4	33.9	33.2
2.72	2.74	2.64	2.68	2.20	2.33	2.86	2.79	2.75	2.79	2.43	2.41
63.0	67.0	69.0	67.2	66.1	64.8	62.2	65.2	68.3	66.1	64.8	61.4
398	413	437	423	372	367	371	401	382	385	396	381
<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	0.7	0.6	<0.5	<0.5
67.7	68.3	67.2	67.6	70.6	67.8	70.0	68.8	66.6	68.0	71.9	68.7
91.0	90.8	90.6	90.7	89.9	90.7	90.7	90.5	90.7	90.7	90.0	90.5
-1.2	-1.1	-1.1	-1.1	-1.0	-1.1	-0.9	-0.9	-0.9	-0.9	-0.9	-1.0
9.1	9.5	9.5	9.4	10.0	9.8	8.7	8.8	8.5	8.7	9.4	9.4
11.7/13.6	13.3/15.4	14.7/17.0	13.7/15.9	14.2/16.5	13.2/15.4	12.0/13.9	13.1/15.3	14.3/16.6	13.4/15.6	13.5/15.7	12.7/14.8
0.52/0.61	0.52/0.61	0.52/0.61	0.52/0.61	0.58/0.68	0.51/0.60	0.52/0.60	0.51/0.60	0.51/0.60	0.51/0.60	0.58/0.67	0.52/0.60
29.0	34.6	40.2	36.4	37.1	35.1	29.7	33.8	36.8	34.4	34.4	33.2
95	92	84	89	86	91	97	94	94	95	94	95
398	413	437	423	399	391	392	420	402	405	413	394
594	655	655	642	586	592	599	636	638	629	591	624
9.1	8.6	7.6	8.2	6.7	6.9	9.0	8.2	7.5	8.1	7.0	7.2
0.61	0.62	0.64	0.63	0.66	0.66	0.60	0.62	0.63	0.62	0.66	0.68
79/125	79/126	77/130	78/128	70/119	72/124	78/122	76/125	73/129	75/126	70/114	73/121
148/119	151/119	154/112	152/115	143/98	149/106	143/116	145/111	147/105	146/109	139/95	145/96
6.6	7.7	9.1	8.2	7.7	7.4	6.0	6.9	8.1	7.2	7.3	6.9
9.0	9.2	10.9	10.0	9.6	10.3	8.8	10.1	13.8	11.6	12.0	11.4
62.4	65.7	66.1	65.2	63.6	63.3	62.9	62.5	63.5	63.0	62.4	62.4
108	106	96	101	76	88	101	97	88	93	80	88
104	114	146	129	149	126	114	131	154	139	135	121
1.04	0.93	0.66	0.78	0.51	0.71	0.89	0.74	0.57	0.67	0.60	0.74
382	403	441	419	355	359	373	417	423	410	366	362
551/801	504/863	466/967	494/906	422/771	435/794	460/695	564/776	583/876	551/807	522/768	488/787
16.3/12.9	15.4/13.9	15.7/13.4	15.8/13.4	16.7/13.4	16.8/13.4	15.0/13.4	16.1/13.9	17.0/12.4	16.3/13.1	16.2/13.7	16.6/14.7
173/139	106/155	94/170	114/160	91/137	95/138	90/126	121/140	130/137	119/136	111/137	105/140
68.2	71.5	71.3	70.7	67.9	68.3	68.7	68.2	68.9	68.6	66.2	67.1
7.5	7.5	8.3	7.9	8.3	7.9	7.3	7.8	7.5	7.5	8.0	7.9
848	910	1020	956	989	977	880	963	1053	989	944	955
11	11	26	48			11	15	25	52		

<sup>1</sup>Protein Range: Low, <13.5%; Med, 13.5 to 14.5%; High, >14.5%.

## EXPORT CARGO DATA

	PNW AVERAGE		GREAT LAKES AVERAGE		GULF AVERAGE	
	2017	2016	2017	2016	2017	2016
<b>WHEAT GRADE DATA:</b>						
Test Weight (lb/bu)	62.4	62.1	62.5	62.2	62.1	61.8
(kg/hl)	82.0	81.7	82.2	81.8	81.6	81.2
Damaged Kernels (%)	0.3	0.4	1.1	1.2	0.9	1.1
Foreign Material (%)	0.1	0.1	0.0	0.1	0.2	0.1
Shrunken & Broken (%)	1.1	1.1	0.8	0.8	0.7	0.8
Total Defects (%)	1.5	1.5	1.9	2.1	1.8	2.1
Vitreous Kernels (%)	74	69	39	40	56	55
Grade	1 NS	1 NS	1 NS	1 NS	1 NS	1 NS
<b>WHEAT NON-GRADE DATA:</b>						
Dockage (%)	0.3	0.3	0.5	0.5	0.7	0.7
Moisture (%)	11.3	11.3	11.9	11.5	12.3	11.8
Protein (%) 12%/0% moisture basis	14.1/16.0	14.2/16.2	13.6/15.5	14.1/16.0	13.6/15.5	13.7/15.6
Ash (%) 14%/0% moisture basis	1.42/1.65	1.56/1.82	1.43/1.66	1.55/1.80	1.48/1.72	1.56/1.81
1000 Kernel Weight (g)	31.0	30.9	33.1	31.8	33.3	32.4
Kernel Size (%) lg/md/sm	44/53/3	45/47/3	56/42/2	54/46/2	60/38/2	55/45/2
Single Kernel: Hardness	79	77	79	78	77	78
Weight (mg)	32.8	33.9	34.5	34.7	34.9	34.9
Diameter (mm)	2.67	2.68	2.76	2.76	2.77	2.75
Sedimentation (cc)						
Falling Number (sec)	415	407	404	405	402	423
DON (ppm)	<0.5	0.7	<0.5	1.1	<0.5	1.1
<b>FLOUR DATA:</b>						
Lab Mill Extraction (%)	70.0	71.1	71.0	71.6	70.7	71.2
Color: L*	90.4	89.6	90.3	89.4	90.2	89.6
a*	-0.9	-1.0	-0.8	-0.9	-0.8	-0.9
b*	9.0	9.7	8.7	9.4	8.7	9.1
Protein (%) 14%/0% moisture basis	13.4/15.6	13.4/15.5	13.0/15.1	13.1/15.2	13.0/15.1	12.8/14.9
Ash (%) 14%/0% moisture basis	0.58/0.67	0.58/0.68	0.59/0.69	0.59/0.68	0.60/0.70	0.59/0.68
Wet Gluten (%)	34.0	35.3	31.9	33.7	32.0	32.5
Gluten Index	84	81	91	86	89	90
Falling Number (sec)	436	453	408	434	397	456
Amylograph Viscosity: 65g (BU)	530	570	533	543	465	604
Starch Damage (%)						
SRC: GPI						
Water / 50% Sucrose						
5% Lactic Acid / 5% Na <sub>2</sub> CO <sub>3</sub>						
<b>DOUGH PROPERTIES:</b>						
Farinograph: Peak Time (min)	7.4	6.8	7.6	7.2	7.6	7.7
Stability (min)	9.9	8.5	11.8	9.9	11.1	11.3
Absorption (%)	65.7	63.4	64.7	62.4	64.8	61.7
Alveograph: P (mm)	109	76	110	78	108	79
L (mm)	110	138	106	135	106	129
P/L Ratio	0.99	0.55	1.04	0.58	1.02	0.62
W (10 <sup>-4</sup> J)	396	313	399	328	387	336
Extensograph: Resistance (BU)						
(45/135 min) Extensibility (cm)						
Area (cm <sup>2</sup> )						
<b>BAKING EVALUATION:</b>						
Pan Bread: Bake Absorption (%)	73.6	70.3	72.5	69.8	72.8	69.3
Crumb Grain and Texture (1-10)	7.6	7.7	7.3	7.8	7.6	7.7
Loaf Volume (cc)	967	959	977	969	962	923
<b>SAMPLE COUNT</b>	<b>117</b>	<b>197</b>	<b>18</b>	<b>28</b>	<b>36</b>	<b>16</b>





Asian Noodles

HW receives enthusiastic reviews when used for Asian noodles, whole wheat or high extraction applications, pan breads or flat breads.

**OVERVIEW:** This year's hard white (HW) samples show good quality performance in milling, dough rheological properties and end products, including pan breads, Asian noodles and steamed breads. Pacific Northwest (PNW) high-protein and Southern Plains high-protein composites have good bread baking potential. For Asian noodle applications, using 60% extraction patent flour will improve noodle color while maintaining good noodle texture. For steamed breads, it is recommended that high protein HW flour be blended with a small portion of soft white (SW) flour to improve product quality.

**HARVEST SURVEY:** The 2018 HW crop was grown primarily in Idaho, Kansas, Colorado, California and Nebraska, with some production in Montana, North Dakota and South Dakota. U.S. Wheat Associates estimates 2018 HW production at 894,300 metric tons (MT), up slightly from 2017's 883,300 MT reported by USDA.

**WHEAT AND GRADE DATA:** All six composites graded U.S. No. 1 with test weight ranging from 60.5 to 64.2 lb/bu (79.6 to 84.4 kg/hl). The ranges of values found in the composites are: dockage from 0.0 to 0.6%; wheat moisture from 8.4 to 11.2%; wheat protein from 11.1 to 13.3% (12% mb); wheat ash from 1.37 to 1.59% (14% mb); kernel hardness from 53.3 to 78.2; and kernel diameters from 2.61 to 2.99 mm. The thousand kernel weights (TKW) of PNW and California low- and high-protein composites are greater than 31.8 g. The TKW values of Southern Plains medium- and high-protein composites are 34.7 and 29.7 g, respectively. Falling number values of 360 sec or higher for all composites indicate all samples are sound.

**FLOUR, DOUGH AND BAKING DATA:** Buhler laboratory mill straight-grade flour extractions range from 71.1 to 74.4%; L\* values (whiteness) from 90.4 to 91.9; flour protein from 10.3 to 13.0% (14% mb); and flour ash from 0.42 to 0.48% (14% mb). These values are within the historical ranges of HW flour.

Flour wet gluten contents range from 27.2 to 35.2% depending on flour protein content. Amylograph peak viscosities are between 873 and 946 BU, which show good starch pasting properties suitable for Asian noodle applications for all samples. Starch damage values are in the range of 3.6 to 7.8%. Lactic acid SRC values are 139 to 160%, indicating medium to strong gluten strength.

Farinograph water absorptions range from 56.9 to 63.3% and stability times from 9.3 to 19.5 min, exhibiting the typical HW medium to strong dough characteristics. HW farinograph water absorption is usually similar to that of HRW, but longer stability time indicates more tolerance to over-mixing. The ranges of alveograph values are: P values 64 to 98 mm; L values 76 to 109 mm; and W values 220 to 317 (10<sup>-4</sup> J). Extensograph data at 135 min resting show maximum resistance in the range of 741 to 1237 BU, extensibility from 14.5 to 22.7 cm and area from 147 to 218 cm<sup>2</sup>.

Most samples show good baking performance relative to protein content, with bake absorptions in the range of 61.8 to 68.5%, loaf volumes of 754 to 883 cc and crumb grain and texture scores of 6.8 to 7.0 points.

**NOODLE EVALUATION:** HW flours and a control flour were evaluated for both Chinese raw noodles (white salted) and Chinese wet noodles (yellow alkaline).



## 53 SAMPLES

Collected by state and private inspection agencies; commercial wheat handlers, Plains Grains, Inc., and state wheat commissions.

The Wheat Marketing Center (WMC) conducted the quality analyses. The Federal Inspection Service (FGIS) graded the samples.

Official grade factors were determined on each sample. Non-grade factors and functionality tests were conducted on 6 composite samples categorized by growing region and protein ranges of <11.5%, 11.5 to 12.5% and >12.5%. The growing regions are highlighted on the map on page 23. The methods are described in the Analysis Methods section of this booklet.

For Chinese raw noodles, the L\* values at 0 hr of production and after 24 hr of storage at room temperature are acceptable for all samples except for the PNW, California and Southern Plains high-protein composites, which have L\* 24 hr values of 71.9, 70.5, and 71.5, respectively (values above 72 are preferred). The sensory color stability scores of all samples are lower than the control noodle score of 7.0. Cooked noodle texture is softer for PNW and California low-protein composites due to the protein content. For Chinese wet noodles, sensory color stability scores are acceptable except for the California low- and high-protein composites

and Southern Plains high-protein composites. The cooked noodle texture values of all Chinese wet noodles are acceptable. Overall, this year's HW samples will produce noodles with more acceptable color if low ash patent flour is used.

**STEAMED BREAD EVALUATION:** HW flours were evaluated for Asian steamed breads in comparison with a control flour. Results show most samples are acceptable for steamed breads except for the PNW low- and high-protein

composites, the total scores of which are low. Blending a small percentage of SW flour with high-protein HW flour would improve overall steamed bread quality.

## HARD WHITE PRODUCTION

for the major producing states (million metric tons)

	2018	2017	2016	2015	2014
California	0.02	0.01	0.02	0.02	0.03
Colorado	0.17	0.26	0.20	0.12	0.12
Idaho	0.36	0.23	0.20	0.14	0.21
Kansas	0.23	0.27	0.38	0.26	0.13
Nebraska	0.09	0.09	0.08	0.04	0.02
<b>Five-State Total</b>	<b>0.87</b>	<b>0.87</b>	<b>0.88</b>	<b>0.58</b>	<b>0.51</b>
<b>Total HW Production</b>	<b>0.89</b>	<b>0.88</b>	<b>0.90</b>	<b>0.59</b>	<b>0.61</b>

Based on USDA crop estimates as of September 28, 2018.

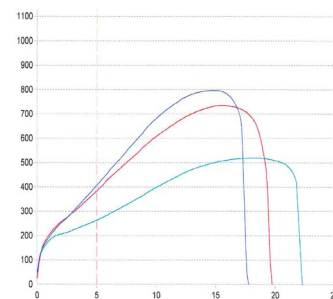
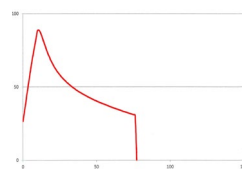
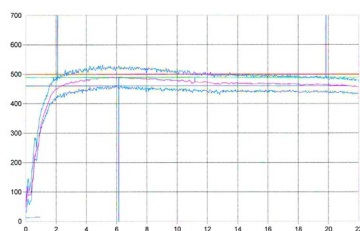
## DOUGH PROPERTIES

### FARINOGRAMS

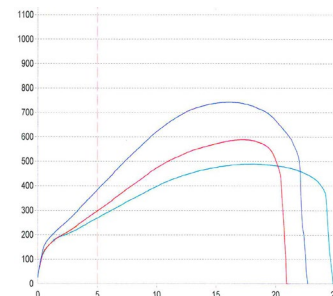
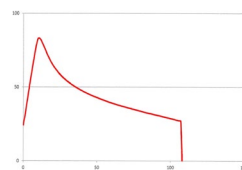
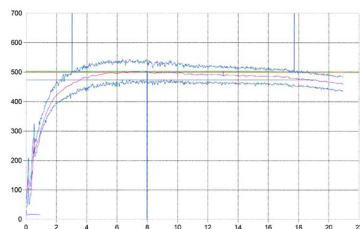
### ALVEOGRAMS

### EXTENSOGRAMS

#### CALIFORNIA LOW



#### CALIFORNIA HIGH



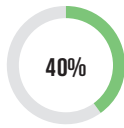


5 STATES  
SAMPLED

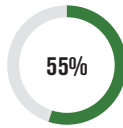
97%

OF TOTAL HW PRODUCTION  
REPRESENTED

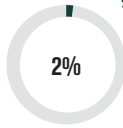
Percentage of total  
U.S. HW production  
by region.



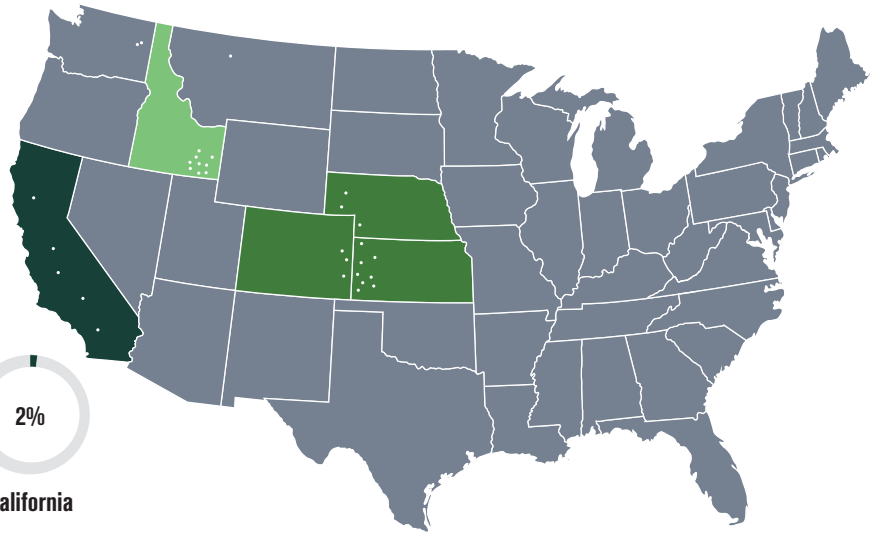
PNW



Southern  
Plains



California

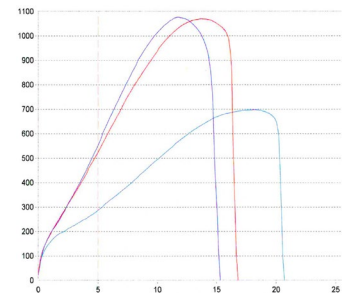
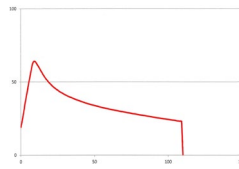
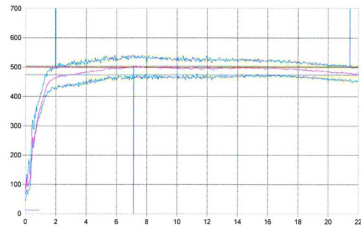


## FARINOGRAMS

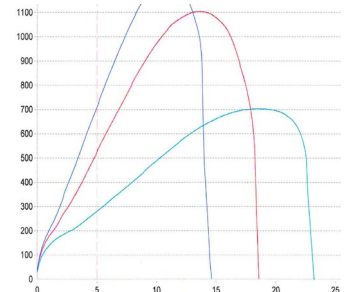
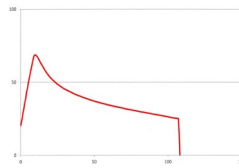
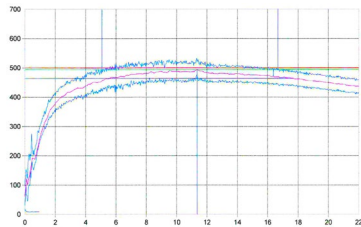
## ALVEOGRAMS

## EXTENSOGRAMS

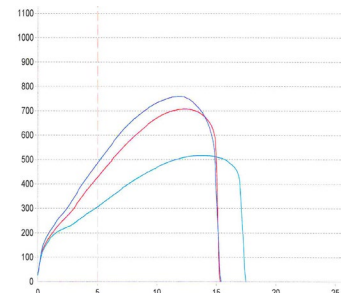
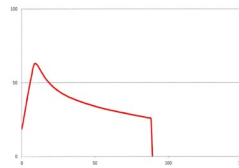
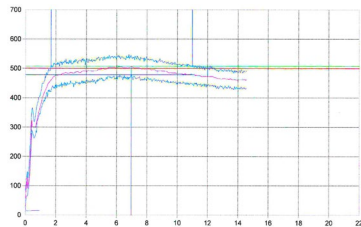
PNW  
LOW



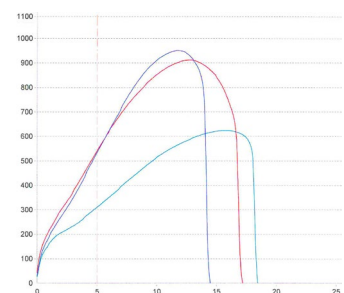
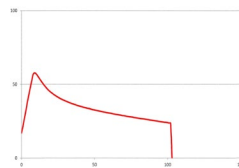
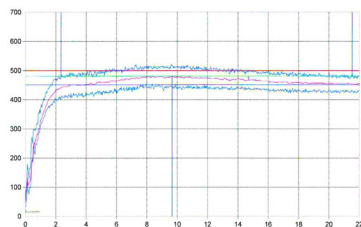
PNW  
HIGH



SOUTHERN  
PLAINS MEDIUM



SOUTHERN  
PLAINS HIGH



## HARVEST DATA

### PACIFIC NORTHWEST

2018 BY PROTEIN<sup>1</sup>

Low High

### CALIFORNIA

2018 BY PROTEIN<sup>1</sup>

Low High

### SOUTHERN PLAINS

2018 BY PROTEIN<sup>1</sup>

Low Med

WHEAT GRADE DATA:						
Test Weight (lb/bu)	63.6	61.6	62.7	64.2	60.9	60.5
(kg/hl)	83.6	81.0	82.4	84.4	80.1	79.6
Damaged Kernels (%)	0.3	0.0	0.0	0.0	0.0	0.0
Foreign Material (%)	0.0	0.1	0.0	0.0	0.0	0.0
Shrunken & Broken (%)	0.7	0.9	1.4	0.3	0.8	1.2
Total Defects (%)	1.0	1.0	1.4	0.3	0.8	1.2
Grade	1 HW	1 HW	1 HW	1 HW	1 HW	1 HW
WHEAT NON-GRADE DATA:						
Dockage (%)	0.6	0.5	0.3	0.2	0.6	0.0
Moisture (%)	9.7	10.1	8.9	8.4	9.9	11.2
Protein (%) 12%/0% moisture basis	11.4/13.0	13.3/15.1	11.1/12.6	12.7/14.4	12.0/13.6	12.8/14.5
Ash (%) 14%/0% moisture basis	1.52/1.77	1.51/1.76	1.47/1.71	1.37/1.59	1.59/1.85	1.55/1.80
1000 Kernel Weight (g)	34.9	35.1	31.8	38.8	34.7	29.7
Kernel Size (%) lg/md/sm	87/12/1	83/16/1	72/27/1	85/15/0	80/20/0	63/37/0
Single Kernel: Hardness	65.5	65.5	78.2	69.3	53.3	58.1
Weight (mg)	39.4	38.4	35.7	43.1	37.8	33.0
Diameter (mm)	2.81	2.77	2.77	2.99	2.76	2.61
Sedimentation (cc)	31.5	34.1	22.5	31.9	30.9	34.0
Falling Number (sec)	360	369	383	392	368	411
FLOUR DATA:						
Lab Mill Extraction (%)	74.4	73.8	71.1	74.2	74.3	73.2
Color: L*	91.3	90.7	91.4	90.4	91.8	91.9
a*	-1.9	-1.7	-1.9	-1.7	-2.1	-2.0
b*	9.1	8.5	9.8	8.5	10.0	9.6
Protein (%) 14%/0% moisture basis	10.4/12.1	13.0/15.1	10.3/12.0	11.6/13.5	10.9/12.7	11.4/13.3
Ash (%) 14%/0% moisture basis	0.42/0.49	0.43/0.50	0.45/0.52	0.45/0.52	0.48/0.56	0.43/0.50
Wet Gluten (%)	27.3	35.2	28.1	32.3	27.2	28.9
Gluten Index	94	82	96	78	87	87
Falling Number (sec)	391	400	423	405	417	446
Amylograph Viscosity 65 g (BU)	878	904	910	946	873	907
Starch Damage (%)	5.2	4.0	7.8	6.4	4.5	3.6
SRC: GPI	0.72	0.80	0.67	0.76	0.83	0.96
Water / 50% Sucrose	62/116	62/113	72/102	70/101	72/91	58/87
5% Lactic Acid / 5% Na <sub>2</sub> CO <sub>3</sub>	147/88	151/76	139/105	149/94	143/82	160/79
DOUGH PROPERTIES:						
Farinograph: Peak Time (min)	7.2	11.4	6.2	8.0	7.0	9.7
Stability (min)	19.5	11.6	17.7	14.7	9.3	19.2
Absorption (%)	60.1	61.4	62.1	63.3	57.8	56.9
Alveograph: P (mm)	70	76	98	91	69	64
L (mm)	109	107	76	107	88	102
P/L Ratio	0.64	0.71	1.29	0.85	0.78	0.63
W (10 <sup>-4</sup> J)	254	273	251	317	220	230
Extensograph: Resistance (BU)	697/1076	702/1237	518/796	488/741	516/759	623/950
(45/135 min) Extensibility (cm)	20.7/15.3	23.4/14.6	22.4/17.8	25.0/22.7	17.5/15.4	18.5/14.5
Area (cm <sup>2</sup> )	171/189	196/207	151/172	165/218	118/147	141/161
BAKING EVALUATION:						
Pan Bread: Bake Absorption (%)	65.0	66.4	66.9	68.5	62.7	61.8
Crumb Grain and Texture (1-10)	7.0	7.0	6.8	6.8	7.0	7.0
Loaf Volume (cc)	837	883	754	819	817	872

<sup>1</sup>Protein Range: Low, <11.5%; Med, 11.5 to 12.5%; High, 12.6 to 13.5%.



## HARVEST DATA

PACIFIC NORTHWEST  
2018 BY PROTEIN<sup>1</sup>  
Low High

CALIFORNIA  
2018 BY PROTEIN<sup>1</sup>  
Low High

SOUTHERN PLAINS  
2018 BY PROTEIN<sup>1</sup>  
Low Med

CHINESE RAW NOODLE-MAKING QUALITY:						
Color at 0/24 hour: L*	84.5/75.0	81.9/71.9	85.2/73.7	83.2/70.5	83.3/72.5	82.7/71.5
a*	-0.1/0.4	0.6/1.6	0.0/0.2	0.4/0.7	-0.1/0.6	0.0/0.5
b*	18.7/24.9	19.8/24.0	17.8/22.8	18.7/22.1	19.5/24.2	20.4/24.1
Change in L* (0-24 hr)	9.5	10.0	11.5	12.7	10.9	11.2
Cooking Yield (5 min, %)	112	104	117	112	114	112
Sensory Color Stability Score	6.8	6.3	6.7	6.1	6.5	6.3
Instrumental Texture:						
Firmness (g)	1086	1213	1069	1109	1225	1246
Springiness (%)	95.8	96.3	96.8	96.2	95.7	96.0
Cohesiveness	0.65	0.66	0.70	0.70	0.65	0.66
Chewiness (g)	676	767	721	743	760	787
CHINESE WET NOODLE-MAKING QUALITY:						
Uncooked Color at 0/24 hour: L*	80.6/71.0	79.3/70.3	79.4/68.6	78.4/67.9	80.2/71.8	79.3/68.6
a*	-1.8/-0.9	-1.2/-0.5	-2.0/-0.9	-1.4/-0.5	-1.7/-0.7	-1.5/-0.4
b*	22.5/23.6	23.8/24.8	23.5/23.3	22.4/22.6	23.1/24.1	23.5/24.3
Change in L* (0-24 hr)	9.6	8.9	10.8	10.5	8.4	10.7
Parboiled Color at 0/24 hour: L*	77.9/76.8	76.2/75.2	77.7/76.6	76.3/74.9	77.8/78.0	77.1/77.4
a*	-1.3/-2.3	-0.8/-1.7	-2.0/-2.7	-1.1/-1.8	-2.6/-3.0	-2.3/-2.9
b*	28.3/26.3	27.1/25.3	29.3/26.9	26.0/24.1	29.8/28.7	29.6/28.8
Cooking Yield (1.5 min, %)	68	65	68	67	77	75
Uncooked Color Stability Score	6.6	6.5	6.1	6.0	6.8	6.3
Parboiled Color Stability Score	6.1	6.1	6.1	6.0	7.0	6.2
Instrumental Texture:						
Firmness (g)	1231	1382	1203	1411	1172	1171
Springiness (%)	94.6	97.8	98.3	94.6	89.2	94.9
Cohesiveness	0.57	0.60	0.60	0.63	0.60	0.58
Chewiness (g)	668	806	707	836	630	649
ASIAN-TYPE STEAMED BREAD EVALUATION:						
Specific Volume (ml/g)	2.5	2.6	2.4	2.7	2.7	2.7
Total Score	68.7	67.6	70.0	74.7	75.0	75.1

<sup>1</sup>Protein Range: Low, <11.5%; Med, 11.5 to 12.5%; High, 12.6 to 13.5%.



Flat Bread

Hardest of all wheats, durum has a rich amber color and high gluten content. Hard Amber Durum (HAD) sets the “gold standard” for premium pasta products, couscous and some Mediterranean breads.



Couscous



## 241 SAMPLES

Collected from fields, farm bins and local elevators by the National Agricultural Statistics Service.

The Durum Quality Lab, North Dakota State University, Fargo, ND, conducted the quality analyses.

Official grade, test weight, vitreous kernel, thousand kernel weight, protein and falling number were determined on each sample. The remaining tests were conducted on 6 composite samples categorized by growing region for Northern Durum. Northern Durum production area is highlighted on the map on page 29. The methods are described in the Analysis Methods section of this booklet.

## NORTHERN PLAINS

**OVERVIEW:** Buyers will find a larger supply of durum from the northern part of the United States in 2018. This sound crop has high protein and excellent kernel characteristics, including high vitreous kernel counts and above-average kernel size. Quality is balanced across the region as shown by the distribution data, but some variability does exist due to the delayed harvest in isolated areas. As with most years, buyers should remain diligent in their contract specifications.

**WEATHER AND HARVEST:** Durum production in the U.S. Northern Plains is up nearly 60% from 2017 on lower acreage, as a favorable growing season pushed yields to near record levels. Planting began in late April with slow initial progress, but rapidly accelerated in the last half of May on dry, hot conditions and was finished by early June.

Crop emergence was hindered in parts of the region by overly dry top soils, but frequent and plentiful rains brought relief to stressed areas and boosted crop conditions and yield potential. Beneficial moisture for much of the growing season and limited disease pressure allowed the crop to hold above average yield potential as it matured.

Harvest began in early August and progressed steadily through the month on favorable weather. Some rain and slow crop maturity led to delays, but most areas were finished by late September.

**WHEAT AND GRADE DATA:** The crop average grade is U.S. No. 1 Hard Amber Durum (HAD) and 78% of the crop grades U.S. No. 1 HAD. Average test weight of 61.4 lbs/bu (79.9 kg/hl) and

average total kernel defects of 1% are both improvements over last year and the 5-year averages. In some northern areas of the region, the percentage of contrasting classes in samples is higher than normal.

The average vitreous kernel content is 90%, up from both last year and the 5-year average, with more than half of the crop above 90% vitreous compared to 45% in 2017. Scattered, isolated rains after maturity reduced vitreous kernel levels in some areas. Regional average protein is 14.5% (12% mb), equal to 2017 and slightly above the 5-year average.

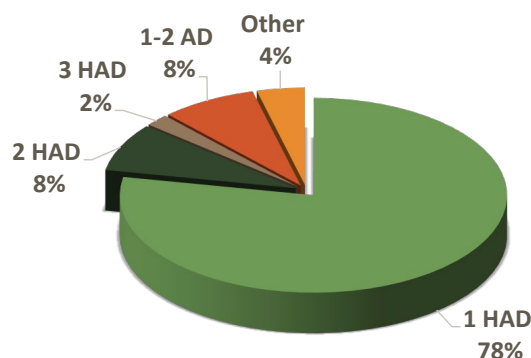
Limited disease pressure, low stress during kernel fill and minimal rains during harvest are reflected in other non-grade kernel features, including thousand kernel weight (TKW), kernel size distribution, falling number and DON. The crop average TKW is 41.2 g, the heaviest in six crop years, and the percent of large kernels is notably higher than a year ago. The average falling number is 425 sec, with only 2% of the crop falling below 300 sec. Although disease pressure was slightly higher in 2018 compared to 2017, DON was undetectable or <0.5 ppm in the samples analyzed.

**SEMOLINA AND PROCESSING DATA:** The Buhler laboratory mill average total extraction is 74%, above last year and the 5-year average. Semolina extraction of 69.3% is higher than last year and the 5-year average. The milled product ash and speck counts are also higher than last year and the 5-year averages. The gluten index average is 57.1% compared to 86.3% in 2017. Last year's drought conditions supported exceptionally high gluten index values, while the 2018 crop values are more typical.



Semolina and cooked spaghetti evaluations show similar semolina color values to a year ago, but lower dry pasta color. Mixing properties are slightly weaker, and cooked firmness values are also lower than last year but similar to the 5-year averages. The higher extraction levels and higher ash levels on the Buhler laboratory mill may have contributed in part to the lower color scores on the dry pasta. Evaluation of the cooked spaghetti shows slightly lower firmness than 2017, but higher than the 5-year average.

## NORTHERN DURUM GRADE DISTRIBUTION



## DURUM PRODUCTION

for the major producing states (million metric tons)

	2018	2017	2016	2015	2014
Arizona	0.2	0.2	0.3	0.4	0.2
California	0.1	0.1	0.1	0.2	0.1
Montana	0.6	0.3	0.9	0.5	0.4
North Dakota	1.2	0.8	1.6	1.2	0.8
<b>Total Durum Production</b>	<b>2.1</b>	<b>1.5</b>	<b>2.8</b>	<b>2.3</b>	<b>1.5</b>

Based on USDA crop estimates as of September 28, 2018.

## DESERT DURUM®

Desert Durum® is a registered certification mark of the Arizona Grain Research and Promotion Council and the California Wheat Commission, which authorize its use only to designate durum grown under irrigation in the desert valleys and lowlands of Arizona and California.

Desert Durum® can be produced and delivered "identity preserved" to domestic and export markets, which allows customers to purchase grain with quality traits specific to their processing needs. Annual requirements can be pre-contracted with grain merchandisers ahead of the fall-winter planting season for harvest in late May through early July. Varietal identity is maintained by experienced growers planting certified seed and merchandisers who store and ship according to customers' preferred delivery schedules.

2018 Desert Durum® production acreage was less than in 2017, largely due to lower prices available at planting time. Yields were average, and quality was uniformly good.

**WHEAT AND GRADE DATA:** In 2018, the average grade is U.S. No. 1 Hard Amber Durum (HAD). Test weight average is 62.8 lbs/bu (81.8 kg/hl). The average vitreous kernel content (DHV) is 98%, a high average typical of Desert Durum®. Average damaged kernels are 0.2% and total defects are 0.6%. Desert Durum® is characterized by its kernel low moisture content, and this year's average is 6.7%. Protein content average is 13.4% (12% mb)

**SEMOLINA AND PROCESSING DATA:** The semolina b\* value is 30.5, similar to the 2017 b\* value of 30.9. Wet gluten is 32.3% and gluten index is 75%. Semolina mixograph score is 8 and alveograph W value is 231 (10<sup>-4</sup> J), both of which indicate high strength. Pasta color b\* value is 44 and score is 9.6. Pasta cooked firmness was 6.9, significantly higher than 2017.

**SUMMARY:** Desert Durum® exhibits consistently large kernels and low moisture, traits that contribute to efficient transportation costs and high extraction rates. The 2018 crop will deliver the valuable milling, semolina and



# 22

SAMPLES

Collected by a Federal Grain Inspection Service (FGIS) licensed inspection agency or submitted by handlers to a licensed agency.

**California Wheat Commission Laboratory conducted the quality analyses. Milling of Desert Durum® samples is done by the Durum Quality Lab, North Dakota State University, Fargo, ND.**

All tests were conducted on each sample. Production-weighted results are reported. The Desert Durum® production area is highlighted on the map on page 29. The methods are described in the Analysis Methods section of this booklet.

pasta quality traits that customers have learned to expect and appreciate.



## EXPORT CARGO SURVEY

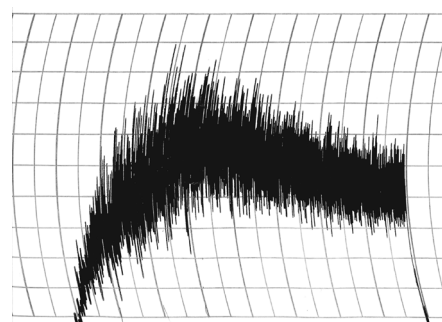
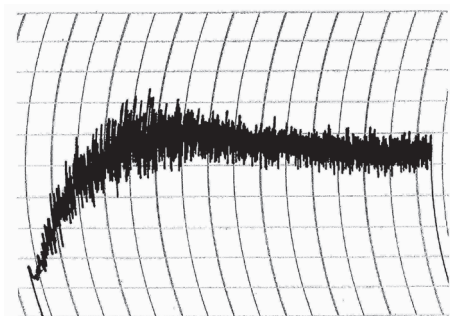
The export cargo data represent 25 individual subplot samples provided by USDA's Federal Grain Inspection Service for crop year 2017 (collected from October 2017 through June 2018) and 24 samples for 2016. Grade data are the official grades on the individual sublots. North Dakota State University conducted the milling and processing analyses.

## REGIONAL SEMOLINA PROPERTIES

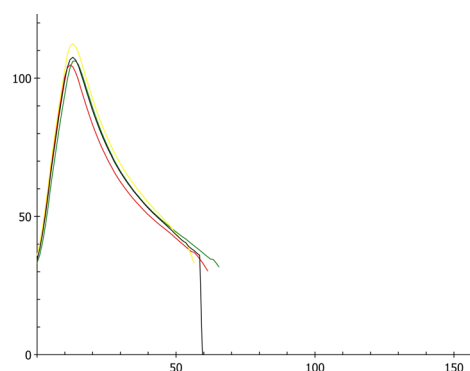
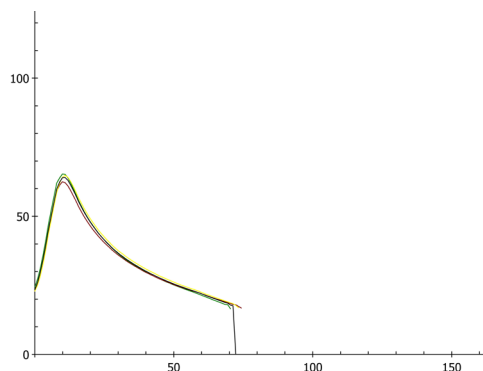
### NORTHERN DURUM REGIONAL AVERAGE

### DESERT DURUM® REGIONAL AVERAGE

#### MIXOGRAMS



#### ALVEOGRAMS

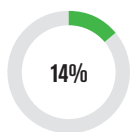
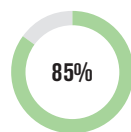


Penne

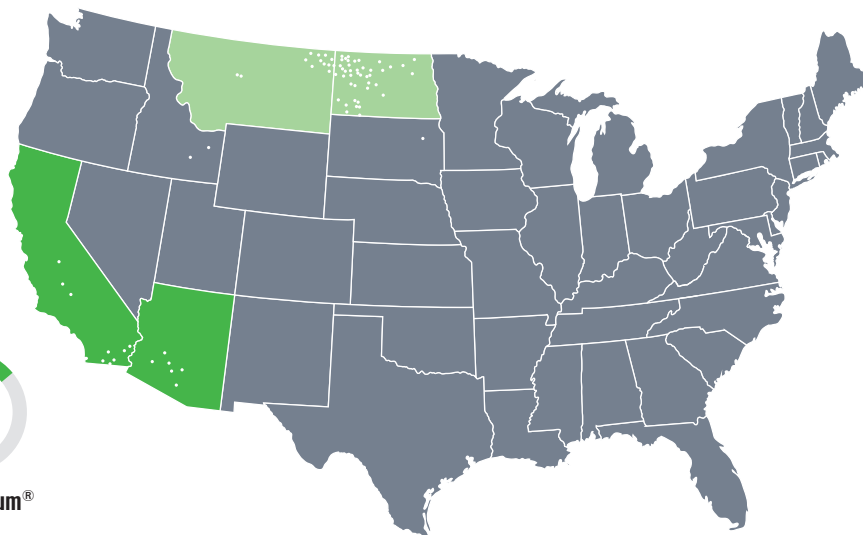


**4 STATES SURVEYED**  
**99%**  
**OF TOTAL DURUM PRODUCTION REPRESENTED**

Percentage of total U.S. durum production by region.



Northern Durum Desert Durum®

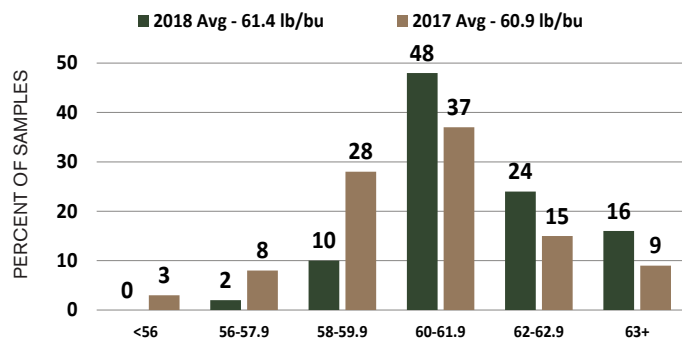


## NORTHERN DURUM DISTRIBUTIONS



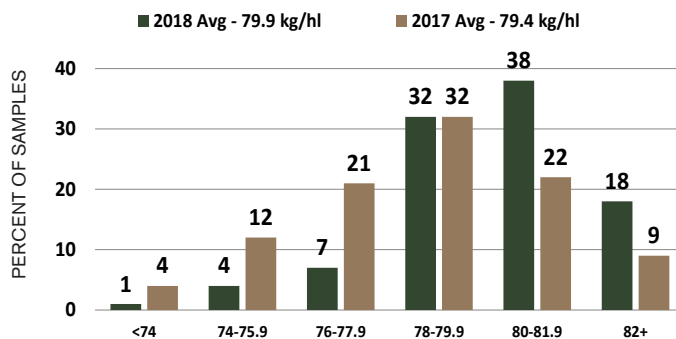
### TEST WEIGHT

Pounds/Bushel



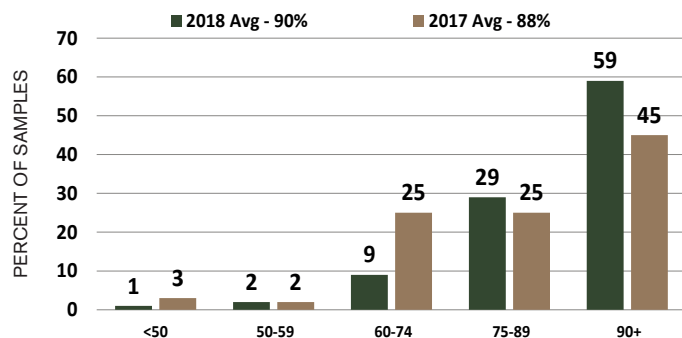
### HECTOLITER WEIGHT

Kilograms/Hectoliter



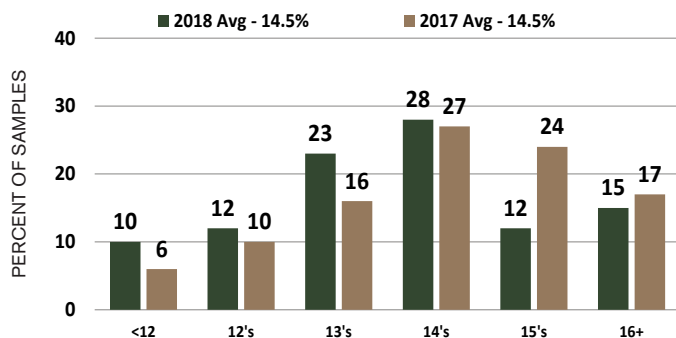
### VITREOUS KERNELS

Percent



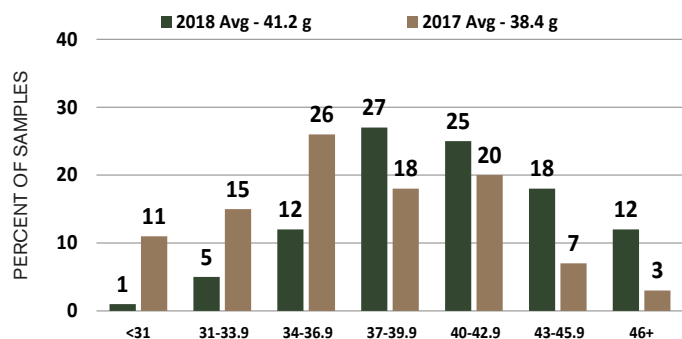
### PROTEIN (12% MB)

Percent



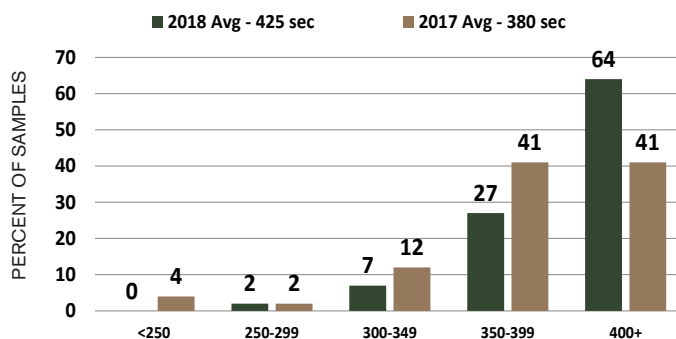
### 1000 KERNEL WEIGHT

Grams



### FALLING NUMBER

Seconds



## HARVEST DATA

## EXPORT CARGO DATA

	NORTHERN DURUM			DESERT DURUM®			NORTHERN DURUM		DESERT DURUM®	
	2018	2017	5-Year Avg	2018	2017	5-Year Avg	2017	2016	2017	2016
<b>WHEAT GRADE DATA:</b>										
Test Weight (lb/bu)	61.4	60.9	60.4	62.8	62.2	62.7	61.1	61.1	62.0	62.9
(kg/hl)	79.9	79.4	78.6	81.8	81.0	81.6	79.5	79.6	80.7	81.9
Damaged Kernels (%)	0.3	0.1	0.3	0.2	0.2	0.2	2.5	2.3	0.5	0.4
Foreign Material (%)	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.2
Shrunken and Broken (%)	0.7	1.1	1.0	0.4	0.7	0.6	1.3	1.1	0.6	1.0
Total Defects (%)	1.0	1.2	1.3	0.6	1.0	0.9	3.9	3.6	1.3	1.6
Contrasting Classes (%)	0.4	0.0	0.2	0.0	0.0	0.0	0.9	1.1	0.1	0.4
Vitreous Kernels (%)	90	88	86	98	98	96	69	69	97	89
Grade	1 HAD	1 HAD	1 HAD	1 HAD	1 HAD	1 HAD	2 AD	2 AD	1 HAD	1 HAD
<b>WHEAT NON-GRADE DATA:</b>										
Dockage (%)	0.7	1.1	0.8	0.3	0.5	0.5	0.5	0.4	0.5	0.7
Moisture (%)	11.2	11.3	11.7	6.7	6.6	6.8	11.8	11.8	6.8	6.6
Protein (%) 12%/0% moisture basis	14.5/16.4	14.5/16.5	13.6/15.4	13.4/15.2	13.5/15.3	13.6/15.4	13.7/15.6	13.1/14.8	14.1/16.0	13.0/14.7
Ash (%) 14%/0% moisture basis	1.54/1.79	1.46/1.70	1.57/1.83	1.70/1.93	1.66/1.93	1.71/1.95	1.58/1.84	1.59/1.85	1.64/1.90	1.55/1.80
1000 Kernel Weight (g)	41.2	38.4	39.9	46.3	49.0	49.2	40.9	40.2	45.5	44.7
Kernel Size (%) lg/md/sm	54/43/3	40/55/5	50/47/3	91/9/0	91/9/0	91/9/0	50/46/4	58/39/3	68/30/2	69/28/3
Falling Number (sec)	425	380	374	615	717	557	439	404	2196	1585
Sedimentation (cc)	61	87	62	60	61	64				
DON (ppm)	<0.5	<0.5	1.0				2.6	1.5	<0.5	<0.5
<b>SEMOLINA DATA:<sup>1</sup></b>										
Lab Mill Extraction (%)	74.0	72.2	71.5	77.0	75.0	75.1	74.9	72.3	76.3	71.8
Semolina Extraction (%)	69.3	68.5	66.3	71.0	70.0	63.7	68.4	66.5	70.4	66.2
Color: L*	83.6	83.3	84.2	86.3	86.9	87.1	83.3	83.9	82.9	84.2
a*	-2.5	-2.3	-3.1	-3.8	-2.8	-2.3	-2.2	-2.6	-2.1	-2.2
b*	29.9	29.4	29.1	30.5	30.9	27.4	27.7	28.3	27.8	25.9
Protein (%) 14%/0% moisture basis	13.4/15.6	13.8/16.0	12.6/14.7	12.6/14.7	12.4/14.4	12.6/14.6	12.7/14.7	11.9/13.8	13.0/15.1	12.0/14.0
Ash (%) 14%/0% moisture basis	0.73/0.85	0.69/0.80	0.69/0.80	0.80/0.93	0.80/0.93	0.84/0.98	0.78/0.90	0.70/0.81	0.84/0.98	0.71/0.82
Specks (no/10 sq in)	29	26	27	21	27	24	34	29	33	28
Wet Gluten (%)	37.4	34.5	33.8	32.3	33.0	33.7				
Gluten Index	57	86	59	75	76	78	64	50	87	76
Mixograph: Classification	5.3	5.7	5.4	8.0	7.0		5.7	5.5	7.8	7.0
Peak Time (min)	2.9	2.6		3.5	3.2		3.0	3.2	3.5	3.0
Peak Height (MU)	5.8	6.2		5.6	5.1		5.4	5.2	5.9	5.4
Alveograph: P (mm)	73	60	50	112	101	107				
L (mm)	66	99	107	61	76	63				
P/L Ratio	1.2	0.6	0.5	2.0	1.3	1.7				
W (10 <sup>-4</sup> J)	162	180	143	231	266	240				
<b>SPAGHETTI PROCESSING DATA:</b>										
Color Score	8.3	9.0	8.8	9.6	9.8	8.6	7.7	8.5	8.2	8.5
Cooked Weight (g)	30.5	31.0	31.2	29.7	29.1	29.3	30.6	30.8	29.8	30.7
Cooking Loss (%)	5.7	5.9	6.3	5.3	5.0	5.8	6.1	6.1	6.0	6.1
Cooked Firmness (g cm)	4.5	4.9	4.3	6.9	5.5	6.5	4.5	4.3	5.3	4.6
<b>SAMPLE COUNT:</b>							15	21	10	3

<sup>1</sup> The lab mill used for Desert Durum® changed in 2016.



Sponge Cake

Low moisture wheat with excellent milling results, SW provides a whiter and brighter product for Asian-style noodles and is ideal for exquisite cakes, pastries and other confectionary products.

**SUMMARY:** The 2018 Pacific Northwest (PNW) soft white (SW) wheat crop generally has similar kernel characteristics to last year with good test weight, lower moisture content, lower protein content and acceptable finished product characteristics. This year's white club (WC) quality characteristics trend the same as SW. The high-protein segment of the SW crop provides opportunities in blends for Asian noodles, steamed breads, flat breads and pan breads.


**WEATHER AND HARVEST:** The PNW had good growing conditions for the 2018 SW wheat crop. There was adequate soil moisture at planting and, in most of the area, also through winter and spring. Late spring through harvest was generally warm and dry. Yields were higher in all three states. USDA estimates total 2018 PNW SW production at 6.04 million metric tons (MMT), up from 2017's 5.64 MMT. Of that, the Washington Grain Commission estimates WC accounts for 373,300 metric tons (MT).

**WHEAT AND GRADE DATA:** The Overall average grade of the 2018 SW and WC crops is U.S. No. 1. The average SW test weight of 61.7 lb/bu (81.1 kg/hl) is higher than last year's 60.9 lb/bu (80.1 kg/hl); WC test weight of 60.4 lb/bu (79.5 kg/hl) is slightly higher than 2017's 60.2 lb/bu (79.2 kg/hl). SW has more damaged kernels but fewer shrunken and broken kernels than the 5-year average; all other grade factors and dockage are similar to last year and the 5-year average. WC shrunken and broken kernel percentage is slightly lower than last year and the 5-year average. WC dockage is the same as last year and slightly lower than the 5-year average. Other WC grade factors are similar

to past averages. Wheat moisture for both SW and WC is below last year and the 5-year averages, reflecting the dry harvest conditions.

The Overall SW and WC wheat protein content (12% mb) of 9.3% and 9.0%, respectively, are 0.3 and 0.4 percentage points below the respective 2017 values and well below the wheat protein 5-year averages. SW wheat ash content (14% mb) is slightly higher than last year and the 5-year average; WC wheat ash is higher than last year and the 5-year average. Thousand kernel weights for SW and WC are slightly above 2017 and 5-year average levels. Both SW and WC kernel diameters are slightly larger than last year and the 5-year averages. Falling number values of 315 sec for SW and 316 sec for WC are both below last year and the 5-year averages.

**FLOUR, DOUGH, AND BAKE DATA:** The 2018 SW crop Buhler laboratory mill flour extraction average of 72.5% is lower than last year and the 5-year average; the WC average of 76.9% is higher than last year and the 5-year average. Flour protein content (14% mb) is 8.3% and 8.0% for SW and WC, respectively. Flour ash content (14% mb) for both SW and WC is slightly higher than last year, but lower than the 5-year averages. Amylograph peak viscosity value for SW is 497 BU, slightly higher than last year and for WC is 415 BU, lower than last year. Starch damage values are slightly higher for SW and WC than last year, but lower than the 5-year averages. SW and WC solvent retention capacity (SRC) water values are similar to last year and the 5-year averages. SW sucrose and sodium carbonate values are similar to last year, but lower than the 5-year average. SW and WC lactic



**473**  
SOFT WHITE AND  
**128**  
CLUB SAMPLES

Collected from state, private grain inspection agencies and commercial wheat handling operations.

**Wheat Marketing Center (WMC) conducted wheat and flour quality testing and analyses. Federal Grain Inspection Service (FGIS) graded and tested wheat protein content.**

Official grade, protein, moisture, thousand kernel weight and falling number tests were determined on each sample. The remaining tests were conducted on 3 composite samples categorized by protein ranges of <9.0%, 9.0 to 10.5%, >10.5% and one composite of all WC samples. The methods are described in the Analysis Methods section of this booklet.

acid values are higher than last year, but lower than the 5-year averages. SW gluten performance index (GPI) is higher than last year and the 5-year average, and WC GPI is slightly lower than last year and the 5-year average. SW and WC farinograph peak and stability times are similar to last year and the 5-year averages, while water absorption is higher than last year for SW and the same as last year for WC. The SW and WC alveograph L values

are considerably longer than last year and the 5-year averages. SW and WC extensograph resistance is similar to last year and higher than the 5-year averages. SW extensibility value is longer than last year and the 5-year average and WC extensibility is similar to last year and shorter than the 5-year average. Sponge cake volume for SW at 1066 cc is smaller than last year and the 5-year averages, and the total score

is slightly higher than last year and the 5-year average. The sponge cake volume for WC at 1115 cc is smaller than last year and the 5-year average, and total score is higher than last year and the 5-year average. SW and WC cookie diameter values are larger than last year and the 5-year averages. SW and WC cookie spread factors are less than last year and the 5-year averages.

**CHINESE SOUTHERN-TYPE STEAMED BREAD:** Each flour was made into southern-type steamed bread and compared to a control flour. SW specific volume is the same as last year and the 5-year average. WC specific volume is slightly higher than last year, but slightly lower than the 5-year average. The SW and WC total scores are lower than last year and the 5-year averages.

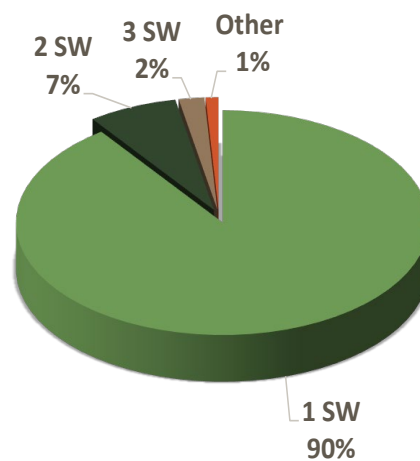


## EXPORT CARGO SURVEY

The export cargo data represent 60 individual subplot samples provided by USDA's Federal Grain Inspection Service for crop year 2017 (August 2017 through May 2018) and 90 samples for 2016 all from PNW ports. Grade data are

the official grades on the individual subplots. Wheat Marketing Center conducted the milling and processing analyses.

## SW GRADE DISTRIBUTION



## PACIFIC NORTHWEST SOFT WHITE WHEAT PRODUCTION

for the major producing states (million metric tons)

	2018		2017		2016		2015		2014	
	SW	CLUB	SW	CLUB	SW	CLUB	SW	CLUB	SW	CLUB
Washington	3.0	0.3	2.8	0.3	3.1	0.4	2.3	0.2	2.2	0.2
Oregon	1.2	0.0	1.1	0.0	1.0	0.0	1.0	0.0	1.1	0.0
Idaho	1.5	0.0	1.4	0.0	1.7	0.0	1.5	0.0	1.6	0.0
<b>Three-State Total</b>	<b>5.7</b>	<b>0.4</b>	<b>5.3</b>	<b>0.4</b>	<b>5.8</b>	<b>0.5</b>	<b>4.7</b>	<b>0.2</b>	<b>4.9</b>	<b>0.2</b>
<b>Three-State Total Soft White Wheat</b>	<b>6.0</b>		<b>5.6</b>		<b>6.2</b>		<b>4.9</b>		<b>5.1</b>	
<b>Total US Soft White Wheat</b>	<b>6.5</b>		<b>6.1</b>		<b>6.9</b>		<b>5.4</b>		<b>5.5</b>	

Based on USDA crop estimates as of September 28, 2018.

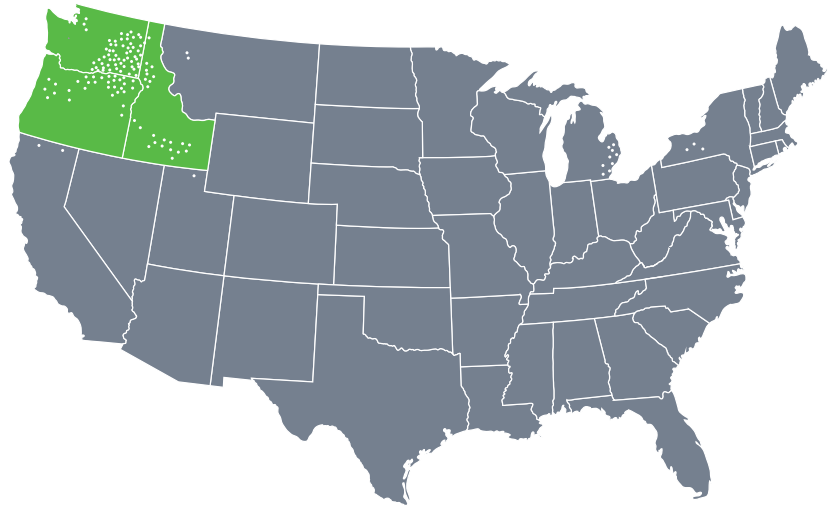
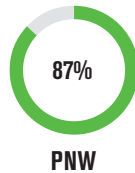
Crackers

**3** STATES  
SURVEYED

**87%**

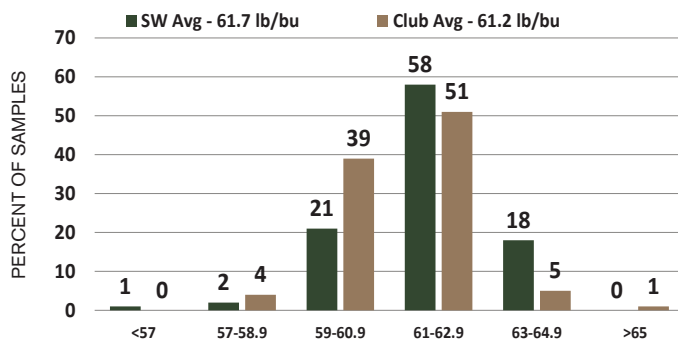
OF TOTAL SW PRODUCTION  
REPRESENTED

Percentage of total U.S. SW  
production by export tributary region.



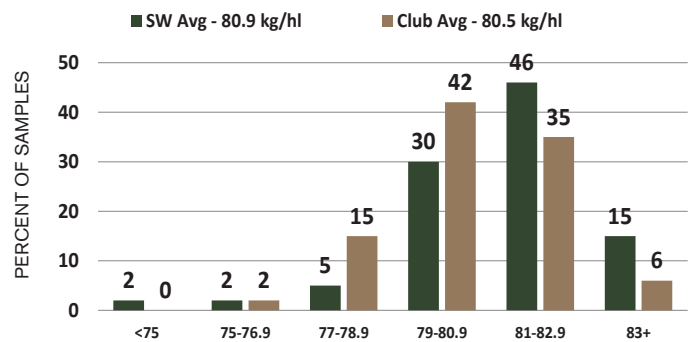
## TEST WEIGHT

Pounds/Bushel



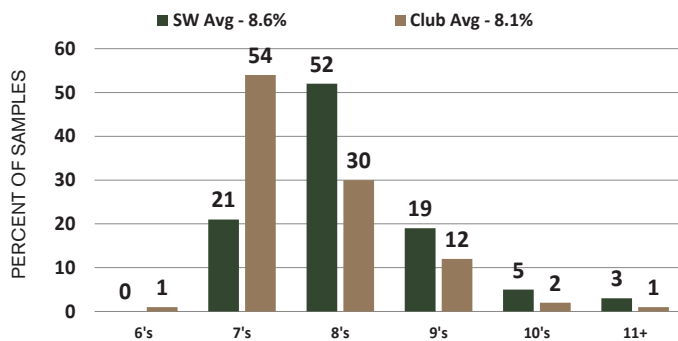
## HECTOLITER WEIGHT

Kilograms/Hectoliter



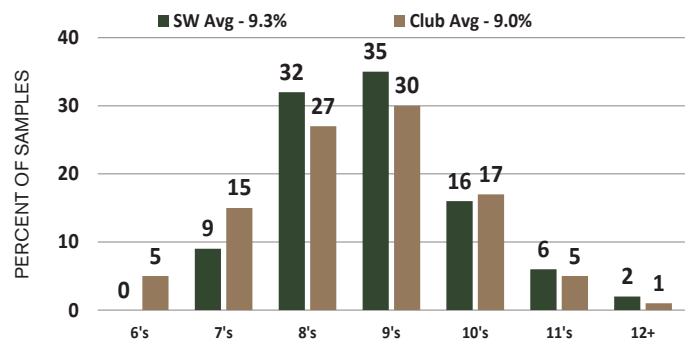
## WHEAT MOISTURE

Percent



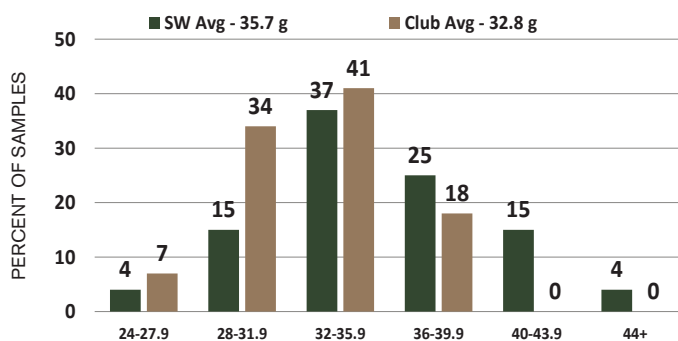
## PROTEIN (12% MB)

Percent



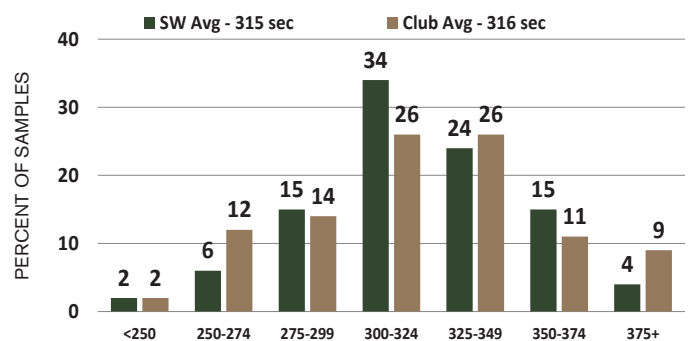
## 1000 KERNEL WEIGHT

Grams



## FALLING NUMBER

Seconds





## HARVEST DATA

	2018					2017		5-YEAR AVERAGE	
	SOFT WHITE BY PROTEIN <sup>1</sup>					CLUB			
	Low	Med	High	Overall	AVERAGE	SW	Club	SW	Club
<b>WHEAT GRADE DATA:</b>									
Test Weight (lb/bu)	61.7	62.1	60.9	61.7	60.4	60.9	60.2	60.5	60.3
(kg/hl)	81.1	81.7	80.1	81.1	79.5	80.1	79.2	79.6	79.4
Damaged Kernels (%)	0.0	0.4	0.0	0.2	0.0	0.0	0.0	0.0	0.0
Foreign Material (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Shrunken & Broken (%)	0.5	0.4	0.5	0.5	0.7	0.5	1.0	0.7	1.3
Total Defects (%)	0.5	0.8	0.5	0.6	0.7	0.6	1.1	0.7	1.4
Grade	1 SW	1 SW	1 SW	1 SW	1 WC	1 SW	1 WC	1 SW	1 WC
<b>WHEAT NON-GRADE DATA:</b>									
Dockage (%)	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.6
Moisture (%)	8.6	8.6	8.6	8.6	8.1	8.9	8.3	9.2	8.8
Protein (%) 12%/0% moisture basis	8.3/9.4	9.5/10.8	11.4/13.0	9.3/10.6	9.0/10.2	9.6/10.9	9.4/10.7	10.3/11.8	10.6/12.1
Ash (%) 14%/0% moisture basis	1.34/1.56	1.36/1.58	1.44/1.67	1.36/1.58	1.29/1.50	1.32/1.54	1.27/1.48	1.35/1.57	1.29/1.50
1000 Kernel Weight (g)	36.1	36.2	32.8	35.7	32.8	35.5	32.5	34.4	31.1
Kernel Size (%) lg/md/sm	91/9/0	89/11/0	77/22/1	87/12/1	80/20/0	87/12/1	79/21/0	83/16/1	74/26/0
Single Kernel: Hardness	25.7	27.9	29.8	27.2	27.9	30.1	30.6	30.7	33.4
Weight (mg)	39.7	39.7	36.4	39.1	35.2	38.5	34.4	37.0	33.3
Diameter (mm)	2.78	2.78	2.69	2.77	2.62	2.75	2.56	2.71	2.54
Sedimentation (cc)	14.3	17.6	20.4	17.0	10.8	13.6	11.3	15.8	11.7
Falling Number (sec)	310	323	357	315	316	337	348	341	344
<b>FLOUR DATA:</b>									
Lab Mill Extraction (%)	72.4	72.7	71.9	72.5	76.9	73.5	74.0	74.5	74.5
Color: L*	92.8	93.2	92.8	93.0	92.3	92.3	92.1	92.2	91.9
a*	-2.3	-2.2	-2.0	-2.2	-2.1	-2.1	-2.0	-2.2	-2.2
b*	8.6	8.5	8.4	8.5	8.9	8.2	7.9	7.8	7.6
Protein (%) 14%/0% moisture basis	7.3/8.5	8.3/9.7	10.2/11.9	8.3/9.7	8.0/9.3	8.4/9.8	8.0/9.3	9.2/10.7	9.4/10.9
Ash (%) 14%/0% moisture basis	0.42/0.49	0.41/0.48	0.42/0.49	0.42/0.49	0.41/0.48	0.40/0.47	0.39/0.45	0.46/0.54	0.47/0.55
Wet Gluten (%)	17.5	24.1	30.9	23.2	17.5	21.7	20.8	24.9	24.6
Gluten Index	85	84	71	82	55	69	9	62	34
Falling Number (sec)	340	338	375	346	349	359	388	370	378
Amylograph Viscosity 65 g (BU)	474	491	557	497	415	487	546	512	514
Starch Damage (%)	3.6	3.5	3.3	3.5	3.4	3.2	2.8	4.3	3.8
SRC: GPI	0.60	0.64	0.60	0.62	0.46	0.56	0.48	0.57	0.48
Water/50% Sucrose	54/89	53/88	53/103	53/91	52/94	53/91	53/88	56/105	54/98
5% Lactic Acid / 5% Na <sub>2</sub> CO <sub>3</sub>	99/76	103/74	107/77	102/75	77/76	95/74	76/66	105/79	82/74
<b>DOUGH PROPERTIES:</b>									
Farinograph: Peak Time (min)	1.5	2.0	2.4	2.7	1.5	2.2	1.5	2.5	1.7
Stability (min)	3.9	3.3	2.1	2.9	1.4	2.8	1.2	2.7	1.3
Absorption (%)	50.8	51.9	52.8	52.2	49.9	51.5	49.9	53.6	52.5
Alveograph: P (mm)	35	32	31	32	21	42	31	40	30
L (mm)	76	100	134	121	79	70	54	93	75
P/L Ratio	0.46	0.32	0.23	0.26	0.27	0.60	0.57	0.44	0.42
W (10 <sup>-4</sup> J)	74	81	85	83	31	84	45	96	50
Extensograph: Resistance (BU)	232	214	183	221	118	225	128	183	98
(45 min) Extensibility (cm)	16.4	18.2	20.9	18.9	14.2	14.1	14.3	17.8	17.5
Area (cm <sup>2</sup> )	58	60	59	62	20	49	28	49	25
<b>BAKING EVALUATION:</b>									
Sponge Cake: Volume (cc)	1095	1054	1047	1066	1115	1114	1176	1198	1217
Score	49	46	45	47	53	46	50	45	46
Cookie: Diameter (cm)	9.2	9.2	9.1	9.2	9.6	9.0	9.5	8.6	9.0
Spread Ratio (width/height)	9.9	9.4	8.6	9.4	11.1	10.4	12.2	9.7	11.1
Pan Bread: Bake Absorption (%) <sup>2</sup>			57.8						
Crumb Grain and Texture (1-10)			4.7						
Loaf Volume (cc)			690						
<b>CHINESE SOUTHERN-TYPE STEAMED BREAD EVALUATION:</b>									
Specific Volume (ml/g)	2.0	2.1	2.2	2.1	2.2	2.1	2.1	2.1	2.3
Total Score	64.0	63.0	63.0	63.3	62.0	67.1	66.0	68.1	65.6
PRODUCTION OF 3 STATES (%)	41	47	12	100	100	100	100	100	100

<sup>1</sup>Protein Range: Low, <9.0%; Medium, 9.0 - 10.5%; High, >10.5%.

<sup>2</sup>Bread Bake for High Protein SW only

## EXPORT CARGO DATA

	2017	2016
<b>WHEAT GRADE DATA:</b>		
Test Weight (lb/bu)	62.5	62.1
(kg/hl)	82.1	81.7
Damaged Kernels (%)	0.1	0.1
Foreign Material (%)	0.0	0.0
Shrunken & Broken (%)	0.8	0.7
Total Defects (%)	1.0	0.8
Grade	1 SW	1 SW
<b>WHEAT NON-GRADE DATA:</b>		
Dockage (%)	0.3	0.3
Moisture (%)	8.4	9.3
Protein (%) 12%/0% moisture basis	9.8/11.2	10.0/11.3
Ash (%) 14%/0% moisture basis	1.34/1.56	1.24/1.44
1000 Kernel Weight (g)	37.7	39.5
Kernel Size (%) lg/md/sm	84/16/0	88/12/0
Single Kernel: Hardness	32.4	29.9
Weight (mg)	38.0	41.4
Diameter (mm)	2.70	2.78
Sedimentation (cc)	16.0	15.4
Falling Number (sec)	366	319
<b>FLOUR DATA:</b>		
Lab Mill Extraction (%)	74.7	74.6
Color: L*	92.5	91.9
a*	-1.9	-1.8
b*	8.0	7.2
Protein (%) 14%/0% moisture basis	8.6/10.0	8.7/10.1
Ash (%) 14%/0% moisture basis	0.46/0.54	0.45/0.53
Wet Gluten (%)	20.6	21.4
Gluten Index	62	67
Falling Number (sec)	393	357
Amylograph Viscosity 65 g (BU)	523	391
Starch Damage (%)		
SRC: GPI		
Water/50% Sucrose		
5% Lactic Acid / 5% Na <sub>2</sub> CO <sub>3</sub>		
<b>DOUGH PROPERTIES:</b>		
Farinograph: Peak Time (min)	1.9	2.3
Stability (min)	3.1	3.3
Absorption (%)	51.5	53.0
Alveograph: P (mm)	40	43
L (mm)	84	84
P/L Ratio	0.47	0.51
W (10 <sup>-4</sup> J)	87	97
Extensograph: Resistance (BU)		
(45 min) Extensibility (cm)		
Area (cm <sup>2</sup> )		
<b>BAKING EVALUATION:</b>		
Sponge Cake: Volume (cc)	1098	1139
Score	44	44
Cookie: Diameter (cm)	8.7	8.4
Spread Factor (width/height)		
Pan Bread: Bake Absorption (%) <sup>2</sup>		
Crumb Grain and Texture (1-10)		
Loaf Volume (cc)		
<b>CHINESE SOUTHERN-TYPE STEAMED BREAD EVALUATION:</b>		
Specific Volume (ml/g)		
Total Score		
<b>SAMPLE COUNT:</b>	<b>60</b>	<b>90</b>

<sup>2</sup>Bread Bake for High Protein SW only



Pastries

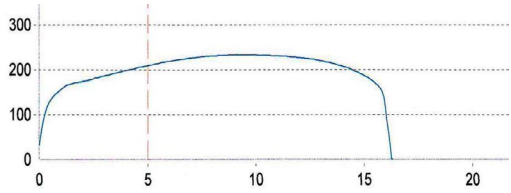
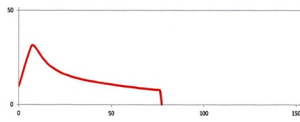
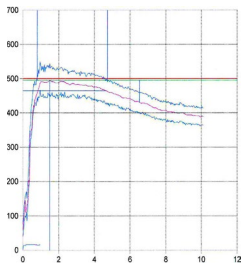
# SOFT WHITE DOUGH PROPERTIES

FARINOGRAMS

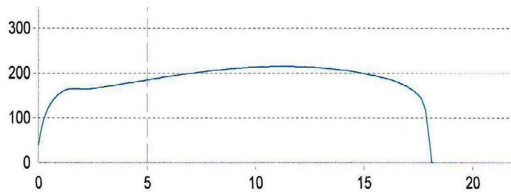
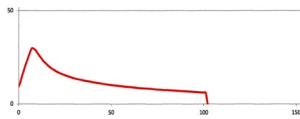
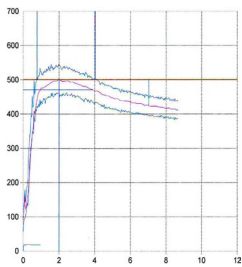
ALVEOGRAMS

EXTENSOGRAMS

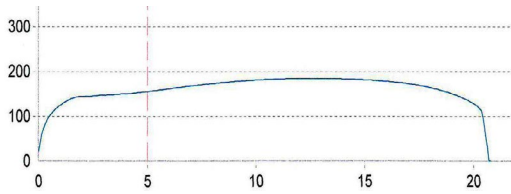
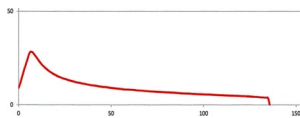
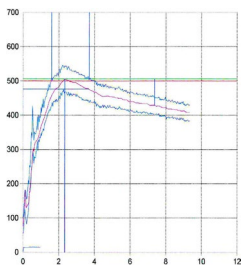
LOW  
PROTEIN



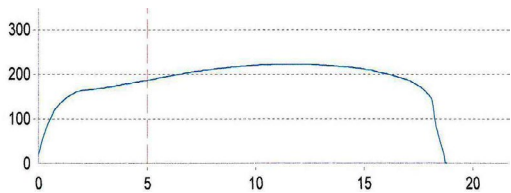
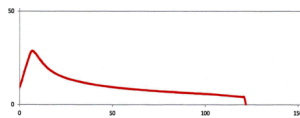
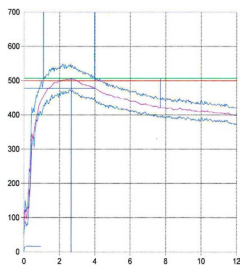
MEDIUM  
PROTEIN



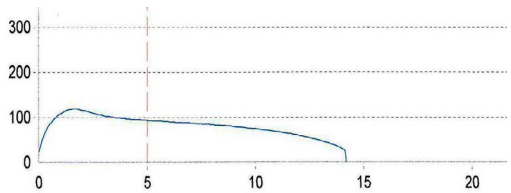
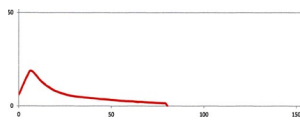
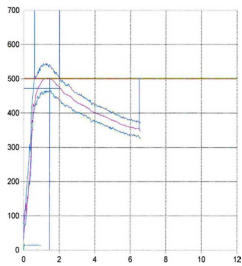
HIGH  
PROTEIN



AVERAGE  
PROTEIN



CLUB





Cookies (Biscuits)

SRW is a profitable choice for producing a wide range of confectionary products like cookies, crackers and cakes and for blending for baguettes and other bread products.

**OVERVIEW:** Some soft red winter (SRW) production areas, especially in the East Coast states, experienced difficult 2018 growing conditions with excessive moisture affecting test weight, falling number and DON values. While test weight is somewhat below the 5-year average, other grade factors are better than the 5-year averages, protein is above average, and DON is slightly below average. Processors should find good qualities for crackers and segments of the crop with good cookie and cake qualities. With higher protein and good extensibility, the crop should also be valuable in blending for baking applications. Buyers are encouraged to review their quality specifications to ensure purchases meet expectations.

**WEATHER AND HARVEST:** SRW is grown widely in the eastern United States. The SRW area seeded in fall 2017 for the 2018 harvest is estimated by USDA at 5.89 million acres (2.38 million hectares), up from 5.61 million acres (2.27 million hectares) seeded in 2016 but still below the 5-year average. The 2018 SRW production, estimated at 8.25 million metric tons (MMT), is up from 7.95 MMT in 2017 but also below the 5-year average. USDA estimates the total SRW supply (excluding imports) for the 2018/19 marketing year is similar to the 2017/18 supply.

Planting was slightly slower than normal in fall 2017; however, by mid-November emergence was close to the 5-year average. Although parts of the Southeast were abnormally dry in early winter, persistent rain began in February in the Ohio River Valley and spread throughout most of the SRW survey states during the following

months. This adversely affected quality by reducing test weight and increasing DON values in some areas. After some rain delays, the 2018 SRW harvest ended in late July.

**WHEAT AND GRADE DATA:** Weighted by estimated state production, the average grade of all 2018 SRW harvest survey samples collected is U.S. No. 3. The weighted average test weight is 57.9 lb/bu (76.2 kg/hl), slightly below the 5-year average of 58.2 lb/bu (76.6 kg/hl) and below the 59.1 lb/bu (77.1 kg/hl) 2017 average. The Gulf Port average of 58.2 lb/bu is close to the 58.4 lb/bu (76.8 kg/hl) 5-year average. The East Coast test weight average of 56.6 lb/bu (74.5 kg/hl) is below both last year and the 5-year average. All other grade factors, dockage and moisture are similar to or less than 2017 and 5-year average values. The Gulf Port total defects average of 0.8% indicates unusually low damaged and shrunken and broken kernels in that portion of the crop. The Composite average wheat protein content of 9.9% (12% mb) is higher than 2017's 9.5% and the 9.7% 5-year average. The 9.9% Gulf Port protein average and 10.2% East Coast average are above the respective 2017 and 5-year averages.

The Composite average falling number of 322 sec is similar to 2017 and above the 5-year average of 304 sec. The Gulf Port average of 327 sec is slightly above last year and the 5-year average, while the East Coast average of 301 sec is slightly below last year and the 5-year average of 310 sec. Less than 10% of samples had a falling number below 250 sec in 2018. The Composite DON average of 0.7 ppm

is above the very low 2017 value of 0.2 ppm but below the 5-year average of 1.3 ppm. The East Coast value of 1.1 ppm is similar to the 5-year average while the Gulf Port value of 0.7 ppm is below the 5-year average. Of the samples tested for DON, 75% of the Gulf Port results and 65% of the East Coast results were less than 1.0 ppm.

**FLOUR AND BAKING DATA:** The Composite, East Coast and Gulf Port Buhler laboratory mill flour extraction averages are below 2017 and 5-year averages. The farinograph peak values are similar to 5-year averages, but



## 265

SAMPLES

Collected from elevators in 18 reporting areas.

**Great Plains Analytical Laboratory in Kansas City, MO, collected the samples and conducted the quality analyses.**

Test weight, moisture, protein, thousand kernel weight, wheat ash and falling number were determined on each sample, and DON on a portion of the samples. The remaining tests were determined on 18 composite samples. Results were weighted by estimated production for each reporting area and combined into Composite, East Coast and Gulf Port averages. Gulf Port States and East Coast states are highlighted on the map on page 39. The methods are described in the Analysis Methods section of this booklet.

stability and absorption values are all below last year and 5-year averages. The SRC values generally indicate acceptable quality for crackers; some Gulf Port areas also have acceptable SRC values for cookies. The Composite and Gulf Port alveograph L averages of 97 and 98 are higher

than last year and 5-year averages, indicating good extensibility. All other alveograph averages are similar to the respective 5-year averages given the variability of alveograph analysis. The Gulf amylograph average of 614 BU indicates good quality for cakes. The Composite and Gulf Port

cookie spread ratios are all higher than last year and similar to the 5-year averages, again indicating good extensibility. Average loaf volumes are also higher than last year and the 5-year averages.

## SOFT RED WINTER PRODUCTION

for the major producing states (million metric tons)

	2018	2017	2016	2015	2014
<i>Alabama</i>	0.2	0.2	0.3	0.4	0.4
<i>Arkansas</i>	0.1	0.2	0.2	0.4	0.7
<i>Georgia</i>	0.1	0.1	0.1	0.2	0.3
<i>Illinois</i>	1.0	1.0	0.9	0.9	1.2
<i>Indiana</i>	0.5	0.5	0.6	0.5	0.7
<i>Kentucky</i>	0.5	0.6	0.9	0.9	1.0
<i>Maryland</i>	0.3	0.4	0.5	0.5	0.5
<i>Michigan</i>	0.6	0.5	0.8	0.7	0.7
<i>Missouri</i>	0.8	1.0	1.1	0.9	1.2
<i>North Carolina</i>	0.6	0.6	0.4	0.8	1.2
<i>New York</i>	0.2	0.2	0.2	0.2	0.1
<i>Ohio</i>	0.9	0.9	1.2	0.9	1.1
<i>Pennsylvania</i>	0.3	0.3	0.3	0.3	0.3
<i>Tennessee</i>	0.5	0.5	0.7	0.7	0.9
<i>Virginia</i>	0.3	0.3	0.3	0.4	0.5
<i>Wisconsin</i>	0.4	0.3	0.5	0.4	0.4
<b>Surveyed-States Total*</b>	<b>5.8</b>	<b>6.1</b>	<b>7.0</b>	<b>7.2</b>	<b>9.3</b>
<b>Sixteen-State Total</b>	<b>7.3</b>	<b>7.5</b>	<b>9.0</b>	<b>8.9</b>	<b>11.1</b>
<b>Total SRW Production</b>	<b>7.7</b>	<b>7.9</b>	<b>9.4</b>	<b>9.8</b>	<b>12.4</b>

Based on USDA crop estimates as of September 28, 2018.

\*Eleven states denoted by italics were surveyed accounting for 76% of 2018 SRW production.



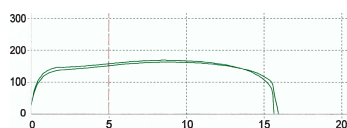
### EXPORT CARGO SURVEY

The export cargo data represent 110 sublot samples provided by USDA's Federal Grain Inspection Service for Export for crop years 2017 and 2018 from Gulf of Mexico and East Coast ports. Grade data are the official grades on the individual sublots. Great Plains Analytical Laboratory conducted the milling and baking analyses.

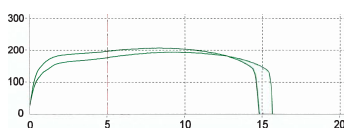
## REGIONAL DOUGH PROPERTIES

### EXTENSOGRAMS

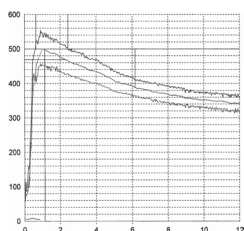
#### EAST COAST



#### GULF

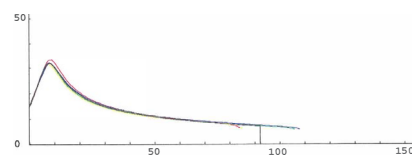


### FARINOGRAMS



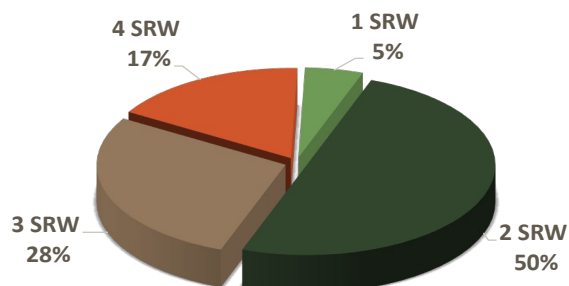
### ALVEOGRAMS

#### EAST COAST & GULF



## GRADE DISTRIBUTION

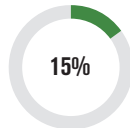
(Based on 18 composite samples)



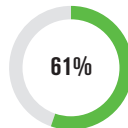
**11** STATES  
SURVEYED

**76%**  
OF TOTAL SRW PRODUCTION  
REPRESENTED

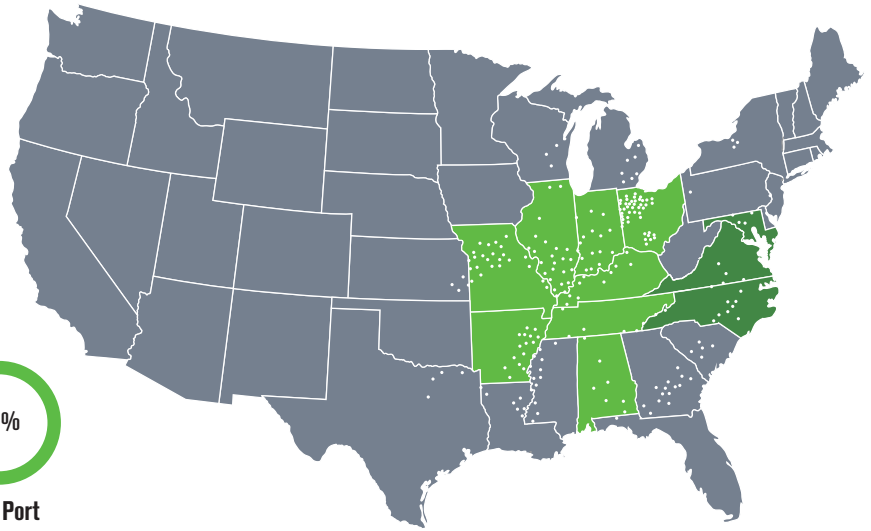
Percentage of total U.S.  
SRW production by export  
tributary region.



East Coast

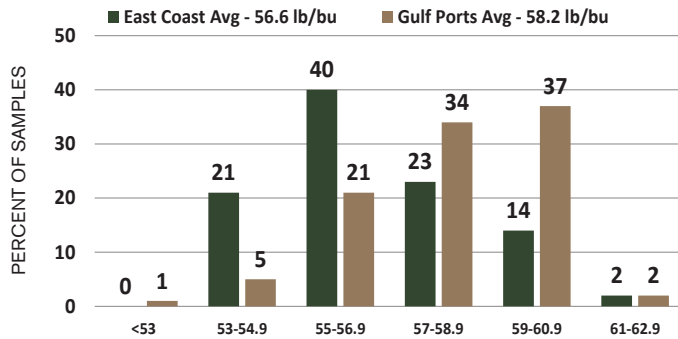


Gulf Port



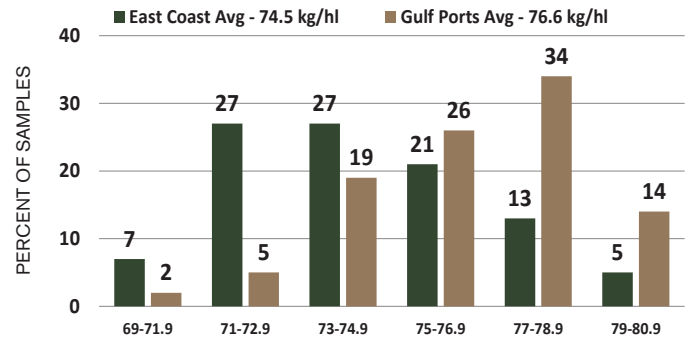
## TEST WEIGHT

Pounds/Bushel



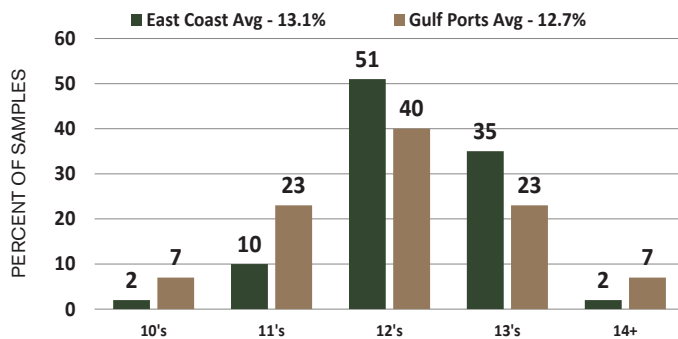
## HECTOLITER WEIGHT

Kilograms/Hectoliter



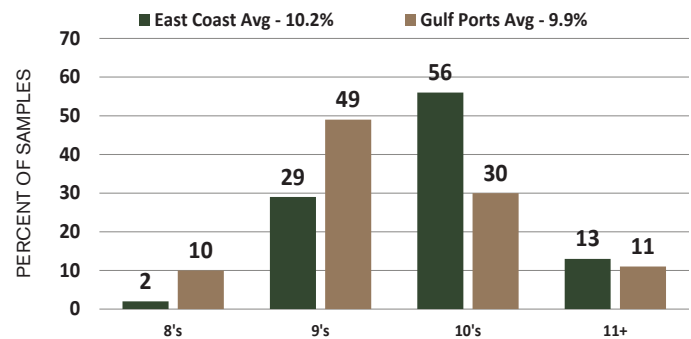
## WHEAT MOISTURE

Percent



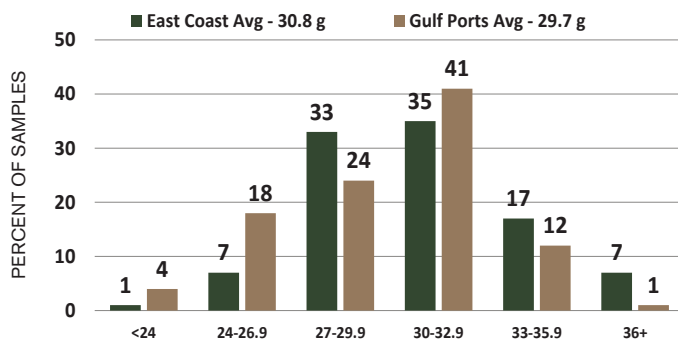
## PROTEIN (12% MB)

Percent



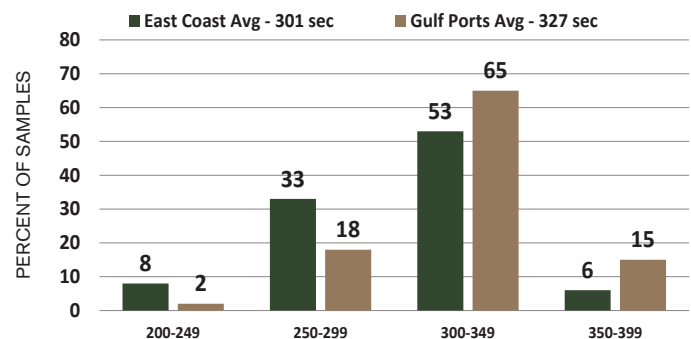
## 1000 KERNEL WEIGHT

Grams



## FALLING NUMBER

Seconds





# SOFT RED WINTER

## HARVEST DATA

### COMPOSITE AVERAGE

### EAST COAST<sup>1</sup>

### GULF PORTS<sup>1</sup>

	2018	2017	5-YEAR AVERAGE	2018	2017	5-YEAR AVERAGE	2018	2017	5-YEAR AVERAGE
<b>WHEAT GRADE DATA:</b>									
Test Weight (lb/bu)	57.9	59.1	58.2	56.6	58.6	57.6	58.2	59.2	58.4
(kg/hl)	76.2	77.7	76.6	74.5	77.1	75.8	76.6	77.9	76.8
Damaged Kernels (%)	0.5	1.1	1.7	1.3	1.6	1.7	0.4	1.0	1.7
Foreign Material (%)	0.0	0.1	0.1	0.1	0.0	0.2	0.0	0.1	0.1
Shrunken & Broken (%)	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.4	0.5
Total Defects (%)	1.1	1.6	2.4	2.0	2.1	2.4	0.8	1.5	2.4
Grade	3 SRW	2 SRW	2 SRW	3 SRW	2 SRW	3 SRW	2 SRW	2 SRW	2 SRW
<b>WHEAT NON-GRADE DATA:</b>									
Dockage (%)	0.4	0.4	0.5	0.3	0.4	0.5	0.4	0.3	0.5
Moisture (%)	12.8	13.0	13.0	13.1	12.9	12.8	12.7	13.0	13.0
Protein (%) 12%/0% moisture basis	9.9/11.3	9.5/10.8	9.7/11.0	10.2/11.5	9.4/10.7	9.9/11.3	9.9/11.2	9.5/10.8	9.7/11.0
Ash (%) 14%/0% moisture basis	1.45/1.69	1.45/1.69	1.47/1.71	1.43/1.67	1.44/1.67	1.47/1.71	1.45/1.69	1.45/1.69	1.47/1.71
1000 Kernel Weight (g)	29.9	34.0	32.6	30.8	34.1	33.1	29.7	33.9	32.5
Kernel Size (%) lg/md/sm	77/21/02	88/12/00	84/15/01	74/22/04	88/11/01	85/14/01	78/21/01	87/13/00	84/15/01
Single Kernel: Hardness	17.3	23.7	21.2	15.0	21.8	18.3	17.8	24.2	21.9
Weight (mg)	33.2	35.7	33.8	34.0	36.4	34.2	33.0	35.5	33.7
Diameter (mm)	2.59	2.63	2.63	2.59	2.65	2.63	2.59	2.63	2.63
Sedimentation (cc)	11.4	12.2	12.2	11.7	11.2	12.8	11.3	12.4	12.1
Falling Number (sec)	322	319	304	301	305	310	327	323	302
DON (ppm)	0.7	<0.5	1.3	1.1	0.8	1.1	0.7	<0.5	1.4
<b>FLOUR DATA:</b>									
Lab Mill Extraction (%)	68.0	68.9	70.0	67.9	68.2	69.9	68.0	69.1	70.0
Color: L*	91.0	92.2	91.8	90.7	92.2	92.1	91.1	92.2	91.7
a*	-2.2	-2.3	-2.6	-2.2	-2.4	-2.7	-2.2	-2.3	-2.6
b*	8.8	8.4	8.4	8.8	8.6	8.6	8.8	8.4	8.3
Protein (%) 14%/0% moisture basis	8.5/9.9	7.7/9.0	8.1/9.4	8.4/9.8	8.1/9.4	8.3/9.7	8.5/9.9	7.6/8.8	8.0/9.3
Ash (%) 14%/0% moisture basis	0.47/0.55	0.44/0.51	0.44/0.52	0.46/0.54	0.44/0.51	0.44/0.51	0.47/0.55	0.44/0.51	0.45/0.52
Wet Gluten (%)	23.6	21.3	21.6	23.0	22.4	22.3	23.7	21.0	21.4
Gluten Index	80	76	84	74	78	83	82	75	84
Falling Number (sec)	321	319	300	288	305	310	329	323	298
Amylograph Viscosity 65 g (BU)	568	536	428	371	445	409	614	561	434
Starch Damage (%)	5.5	5.1	4.8	5.0	5.3	4.6	5.6	5.0	4.8
SRC: GPI	0.59	0.60	0.59	0.60	0.54	0.57	0.59	0.58	0.58
Water / 50% Sucrose	57/109	63/129	56/110	56/113	69/125	58/110	57/108	61/130	56/108
5% Lactic Acid / 5% Na <sub>2</sub> CO <sub>3</sub>	113/81	130/89	112/81	118/83	119/97	110/84	111/81	128/89	110/81
<b>DOUGH PROPERTIES:</b>									
Farinograph: Peak Time (min)	1.2	1.3	1.3	1.2	1.2	1.4	1.2	1.3	1.3
Stability (min)	1.8	2.2	2.5	1.7	1.7	2.4	1.8	2.4	2.5
Absorption (%)	51.9	53.2	52.9	52.6	53.6	53.3	51.7	53.1	52.8
Alveograph: P (mm)	34	41	36	35	41	37	34	41	36
L (mm)	97	89	89	93	83	90	98	90	89
P/L Ratio	0.35	0.46	0.40	0.38	0.49	0.41	0.34	0.45	0.40
W (10 <sup>-4</sup> J)	81	92	82	79	87	83	81	93	81
Extensograph: Resistance (BU)	182	179	NA	152	166	NA	188	183	NA
(45 min) Extensibility (cm)	15.3	15.7	NA	15.9	16.0	NA	15.2	15.6	NA
Area (cm <sup>2</sup> )	48	50	NA	42	46	NA	49	51	NA
<b>BAKING EVALUATION:</b>									
Cookie: Diameter (cm)	8.7	8.7	NA	8.4	8.6	NA	8.8	8.7	NA
Spread Ratio (width/height)	9.3	8.8	9.2	8.5	7.7	8.7	9.5	9.1	9.4
Pan Bread: Bake Absorption (%)	53.7	54.9	NA	54.4	55.4	NA	53.5	54.8	NA
Crumb Grain and Texture (1-10)	4.8	5.1	5.1	4.8	5.3	5.1	4.8	5.1	5.1
Loaf Volume (cc)	735	720	712	738	731	730	734	718	708
<b>PRODUCTION OF 11 STATES (%):</b>	<b>100</b>			<b>19</b>			<b>81</b>		

<sup>1</sup>East Coast - Maryland, Virginia and North Carolina; Gulf Ports - Alabama, Arkansas, Illinois, Indiana, Kentucky, Missouri, Ohio and Tennessee

## EXPORT CARGO DATA

2018

2017

WHEAT GRADE DATA:		
Test Weight (lb/bu)	58.6	59.2
(kg/hl)	77.2	77.9
Damaged Kernels (%)	1.3	1.9
Foreign Material (%)	0.1	0.1
Shrunken & Broken (%)	1.0	0.9
Total Defects (%)	2.4	2.9
Grade	2 SRW	2 SRW
WHEAT NON-GRADE DATA:		
Dockage (%)	0.8	0.8
Moisture (%)	12.3	12.4
Protein (%) 12%/0% moisture basis	10.1/11.5	9.8/11.1
Ash (%) 14%/0% moisture basis	1.46/1.70	1.45/1.68
1000 Kernel Weight (g)	28.6	30.8
Kernel Size (%) lg/md/sm	78/21/1	83/16/1
Single Kernel: Hardness		24.7
Weight (mg)		34.0
Diameter (mm)		2.6
Sedimentation (cc)	10.6	11.3
Falling Number (sec)	326	332
DON (ppm)		<0.5
FLOUR DATA:		
Lab Mill Extraction (%)	68.7	68.9
Color: L*	91.0	91.1
a*	-2.1	-2.0
b*	8.7	8.3
Protein (%) 14%/0% moisture basis	8.0/9.3	7.8/9.1
Ash (%) 14%/0% moisture basis	0.45/0.52	0.45/0.52
Wet Gluten (%)	21.2	20.4
Gluten Index	92	91
Falling Number (sec)	341	335
Amylograph Viscosity 65 g (BU)	734	531
Starch Damage (%)		
SRC: GPI		
Water / 50% Sucrose		
5% Lactic Acid/5% Na <sub>2</sub> CO <sub>3</sub>		
DOUGH PROPERTIES:		
Farinograph: Peak Time (min)	1.2	1.3
Stability (min)	2.1	2.2
Absorption (%)	52.3	54.5
Alveograph: P (mm)	39	53
L (mm)	94	76
P/L Ratio	0.41	0.69
W (10 <sup>-4</sup> J)	96	116
Extensograph: Resistance (BU)		
(45 min) Extensibility (cm)		
Area (cm <sup>2</sup> )		
BAKING EVALUATION:		
Cookie: Diameter (cm)		
Spread Ratio (width/height)	9.4	8.4
Pan Bread: Bake Absorption (%)	54.0	56.2
Crumb Grain and Texture (1-10)	4.8	5.3
Loaf Volume (cc)	745	721
SAMPLE COUNT:	29	81



Pastries

# ANALYSIS METHODS

The harvest and cargo samples for each class are evaluated using the following methods. Flour or semolina produced as described in “Laboratory Milling Extraction” is analyzed to provide flour, semolina and end-use product data.

## WHEAT AND GRADE DATA

**GRADE:** Official U.S. Standards for Grain.

**DOCKAGE:** Official USDA procedure using the Carter Dockage Tester.

**MOISTURE:** HRW, HRS, SW, HW – Official USDA NIR method; Durum – AACC 44-11.01 (Motomco Moisture Meter) and AACC 44-15.02 (air oven method); SRW – AACC 44-15.02.

**TEST WEIGHT:** AACC 55-10.01; test weight is converted to hectoliter weight: for durum –  $\text{kg/hl} = \text{lb/bu} \times 1.292 + 0.630$ , for other classes –  $\text{kg/hl} = \text{lb/bu} \times 1.292 + 1.419$ .

**PROTEIN:** HRW, HRS, SW, HW – AACC 39-25.01 (NIR method); all other classes – AACC 46-30.01 (Dumas combustion nitrogen analysis or CNA method).

**SINGLE KERNEL CHARACTERIZATION:** AACC 54-31.01 using Perten SKCS 4100.

**SEDIMENTATION:** HRS, HRW (Midwestern), SRW, SW, HW – AACC 56-61.02; Durum – AACC 56-70.01; HRW California (CA) – AACC 56-63.01.

**1000 KERNEL WEIGHT:** HRS, Durum, SRW – based on a 10 gram (g) clean wheat sample counted by an electronic counter; SW, HW – based on the average weight of three 100-kernel samples expressed on a 14% moisture basis (mb); HRW – average of SKCS kernel weight times 1000.

**ASH:** AACC 08-01.01 expressed on a 14% mb.

**FALLING NUMBER:** AACC 56-81.03; average value is a simple mean of sample results.

**DON:** All analysis is on ground wheat. HRS, Durum – gas chromatograph with electron capture detector as described in the Journal of the Association of Official Analytical Chemists 79,472 (1996). SRW, HRW (CA) – Neogen ELISA; HRW (Midwestern) – Charm ROSA DonQ2 Quantitative Test.

**VITREOUS KERNELS:** HRS and Durum – percentage by vitreous kernels weight handpicked from a 15 g clean wheat sample.

**KERNEL SIZE DISTRIBUTION:** HRS, Durum (Northern) – Cereal Foods World (Cereal Science Today) 5:(3), 71 (1960). HRW (Midwestern), SW, HW, SRW – Wheat is sifted with a RoTap sifter using Tyler No. 7 (2.82 mm) and No. 9 (2.00 mm) screens. HRW (CA), Durum (Pacific Southwest) – uses U.S. Standard Sieves No. 7 (2.80 mm) and No. 10 (2.00 mm). Kernels remaining on the No. 7 screen are “Large,” passing through the No. 7 screen but not the No. 9 or No. 10 (HRW (CA), Pacific Southwest Durum) are “Medium,” and passing through the No. 9 or No. 10 screen are “Small.”

## FLOUR DATA

### LABORATORY MILLING EXTRACTION:

Samples are cleaned and tempered according to AACC 26-10.02. All samples other than HRW (CA) are milled with standardized mill settings on a Buhler laboratory mill using these methods: SW – AACC 26-31.01; HRW (Midwestern), SRW, HRS and HW – AACC 26-21.02. SRW – uses a 183 micron sieve. HRW (CA) is milled on a Brabender® Quadrumat Senior mill using the Brabender® procedure. All extraction rates are calculated against total products on an “as is” moisture basis.

**ASH:** AACC 08-01.01, reported on 14% mb.

**COLOR:** HRW (Midwestern) – Minolta method using Minolta Chroma Meter CR-110 with Granular-Materials Attachment; HRW (CA) – CR-210; HRS, SW, SRW, HW – CR-410 with Granular-Materials Attachment CR-A50. CIE 1976 L\*a\*b\* color system: L\* indicates white-black, a\* – red-green and b\* – yellow-blue.

**PROTEIN:** HRW, HRS – AACC 39-10.01 (NIR method); all other classes – AACC 46-30.01 (Dumas CNA method).

**WET GLUTEN AND GLUTEN INDEX:** HRW, HRS, SRW, HW – AACC 38-12.02; SW – AACC 38-12.02 (water reduced from 4.8 to 4.2 ml).

**FALLING NUMBER:** AACC 56-81.03; average value is a simple mean of sample results.

**FARINOGRAPH:** AACC 54-21.02 (Constant Flour Method) with 50 g bowl. Absorption is reported on 14% mb.

**ALVEOGRAPH:** AACC 54-30.02. SW, HW – Alveolab.

**AMYLOGRAPH:** AACC 22-10.01 modified to use 65 g flour (14% mb) and 450 ml distilled water with paddle (HRS) or pins (other classes).

**EXTENSOGRAPH:** AACC 54-10.01, modified 45-min and 135-min rest for HRS, HRW, HW; 45-min rest for SW and SRW.

**STARCH DAMAGE:** SRW – AACC 76-30.02; all other classes – AACC 76-33.01 (SDmatic method).

**SOLVENT RETENTION CAPACITY (SRC):** SW, HW – SRC machine (Chopin); all other classes – AACC 56-11.02.

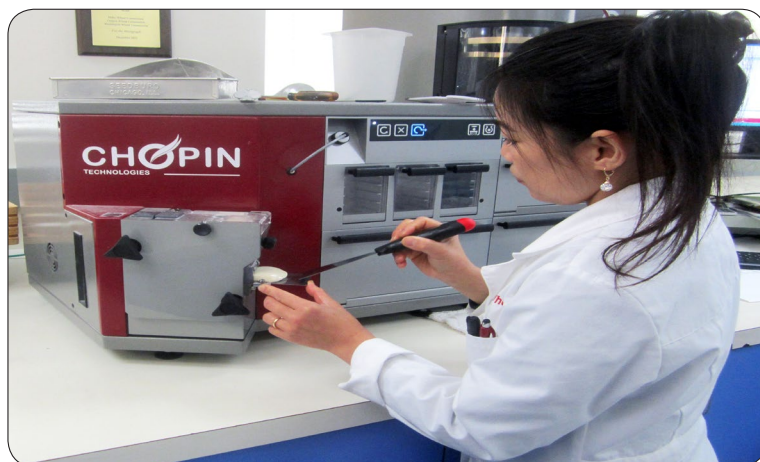


Photo courtesy of Wheat Marketing Center



## SEMOLINA DATA

**LABORATORY MILLING EXTRACTION:** Samples are milled using a modified Buhler laboratory mill with identical settings and equipped with Miag laboratory purifiers, as described by Vasiljevic and Banasik 1980: Quality Testing Methods for Durum Wheat and Its Products, pp. 64-72, Dept. of Cereal Chemistry and Technology, NDSU, Fargo, ND. Roll gaps are modified to (in mm): B1-0.762; B2-0.305; B3-0.254; R1-0.102; B4-0.076; B5-0.038. Extraction rates are calculated against total products on an "as is" moisture basis. Procedure is derived from AACC 26-41.02 based on research showing improved correlation between laboratory and commercially milled semolina quality.

**ASH:** AACC 08-01.01 on 14.0% mb.

**COLOR:** Minolta Method using Minolta Chroma Meter CR-410 (Northern) or CR-210 (Pacific Southwest) with Granular-Materials Attachment.

**PROTEIN:** AACC 46-30.01 (Dumas CNA method).

**WET GLUTEN AND GLUTEN INDEX:** AACC 38-12.02 (Glutomatic procedure).

**SPECKS:** Sample is pressed under a 3-inch by 4-inch glass plate and the specks within a one-inch square marked on the plate are counted. Average of three determinations is expressed as specks per 10 square centimeters.

**MIXOGRAPH:** Northern – 10 g of semolina are mixed in a 10 g bowl with 5.8 ml of distilled water to give maximum dough consistency. Pacific Southwest – 35 g of semolina are mixed in a 35 g bowl with optimum water absorption using the formula  $y=1.5 \times X+43.6$ .  $X$ =semolina protein (14% mb). The spring setting is 8 (Northern) and 10 (Pacific Southwest). A classification incorporating peak height and general curve characteristics is assigned based on comparison with eight reference mixograms; the higher the classification number, the stronger the curve type.

## END-USE PRODUCT DATA

**MIDWESTERN HRW:** AACC 10-10.03 (pup loaf method). 100 g flour at 14% mb with optimized water absorption is mixed to optimum development with other ingredients (6% sugar, 3% shortening, 1.5% salt, 1.0% instant dry yeast, 50 ppm ascorbic acid and 0.25% malted barley flour) in a 100g pin mixer with head speed of 100 to 125 rpm. The dough is fermented for 60 min with two punches, then molded, panned and proofed for 60 min before baking at 425 F for 18 min. Loaf volume is measured immediately after baking by rapeseed displacement. Crumb grain and texture are evaluated on a 0 to 6 scale, which for this booklet is converted to a 1 to 10 scale.

**CA HRW:** AACC 10-10.03 producing two loaves per batch using 6% sugar, 3% shortening, 1.5% salt, 1.5% active dry yeast, 50 ppm ascorbic acid, 0.10% malted barley flour in a 200 g Swanson pin mixer with head speed of 100 to 120 rpm and 120-min fermentation. Loaf volume is measured 1 hour after baking. Grain and texture are scored on a scale of 1 to 10 with higher numbers indicating preferred quality.

**SRW:** AACC 10-10.03 producing two loaves per batch using dry yeast and ascorbic acid. After mixing, the dough is divided into two equal portions, fermented for 160 min, molded and panned in "pup loaf" pans before proofing and baking. Loaf volume is measured immediately after baking by rapeseed displacement. SRW Cookie Spread Ratio - AACC 10-50.05.

**HRS:** AACC 10-09.01 (long fermentation method) modified: 15 SKB units fungal amylase/100 g flour; 1% instant dry yeast; 10 ppm ammonium phosphate; 2% added shortening. Dough is mechanically punched, molded and baked in "Shogren-type" pans. Scoring is based on a 1 to 10 scale with higher numbers indicating preferred quality attributes.

**SW:** Cookie diameter – AACC 10-52.02. Sponge cake volume\* and score - Japanese standard

method described by Nagao in Cereal Chemistry 53:977-988, 1976. Sponge cake control flour is western white. SW High Protein – AACC 10-10.03 with 180-min fermentation for bread.\*

**DURUM:** Pasta is made using the laboratory procedure described by Walsh, Ebeling and Dick, Cereal Foods World: 16: (11) 385 (1971). Water (Pacific Southwest – adjusted to optimum hydration based on P-value from Alveograph test; Northern – 32%) is added to semolina and mixed in a Hobart mixing bowl for 5 min. Semolina-water mixture is extruded using a DeMaco laboratory pasta extruder. Northern – Spaghetti is dried using modified Buhler high-temperature drying cycle as described by Debouz, Pitz, Moore and D'Appolonia, Cereal Chemistry: 72 (1):128-131. Pacific Southwest – Spaghetti is dried using modified Buhler low-temperature drying cycle as described by P. Yue, P. Rayas-Duarte, and E. Elias, Cereal Chemistry 76(4):541-547. Color scores are determined by the procedure described by Walsh, Macaroni Journal 52: (4) 20 (1970), using a Minolta Color Difference Meter (Northern CR-410, Pacific Southwest CR-210). Higher values (scale 1 to 12) are preferred. Cooked weight, cooking loss and firmness are determined by AACC 16-50.01.

**HW BAKING:** AACC 10-10.03 with 180-min fermentation.\*

**HW NOODLE:** Two noodle types are prepared from each HW flour: Chinese raw noodles and Chinese wet noodles. Raw noodle formula: flour 100%, salt 1.2% and distilled water 28%; wet noodle formula: flour 100%, salt 2%,  $K_2CO_3$  0.45%,  $Na_2CO_3$  0.45% and distilled water 32%. Noodle sheet color is measured twice on each side of a dough sheet that is resting atop a two other dough sheets to ensure color consistency. This is done for two dough sheets (eight readings total) using a Minolta CR-410 Chroma Meter; the mean value is reported.

For wet noodles, noodle sheet color is measured on both uncooked and parboiled (for 1.5 min) sheets. Cooking yield is percent of weight gain

after cooking for 5 min for raw noodles and 1.5 min for wet noodles, rinsing in 26°-27° C water and draining. Sensory noodle color stability score is a total score of noodle color rated at 2 and 24 hours against a control sample (an assigned score of 7) and is reported based on a 1 to 10 scale; higher scores indicate better color stability. Noodle texture is determined on five strands of cooked noodles with a strand cross-cut dimension of 2.5 x 1.2 mm for raw noodles, W x T; 1.7 x 1.6 mm for wet noodles, W x T using a Stable Micro Systems TA.XT2 Texture Analyzer. Firmness indicates noodle bite; springiness indicates the degree of recovery after first bite; cohesiveness is a measure of noodle structure disruption during first bite; and chewiness is a product of firmness, cohesiveness and springiness (firmness x cohesiveness x springiness) and thus is a single parameter that incorporates the three textural parameters. Higher textural parameter values are generally more desirable for Chinese-style noodles.

**CHINESE STEAMED BREAD:** Two types of steamed breads are prepared: Chinese southern-type steamed breads from each of the SW and WC flours; and Asian-type steamed breads from each of the HW flours. Chinese southern-type formula: flour 100%, sugar 15%, shortening 4%, baking powder 1.2%, instant yeast 0.8%, nonfat dry milk powder 3% and water 39 to 43%; Asian-type formula: flour 100%, instant yeast 1.5%, sugar 12%, shortening 2% and water 42.5 to 45%. Yeast is dissolved in water before use. All steamed breads are prepared using no-time dough methods (Wheat Marketing Center protocols). The total product score comprises volume\*, external characteristics, internal characteristics, eating quality and flavor. Each property is rated compared with a control sample. The control flour is scored 70.

\*Finished Product Volume for SW bread, sponge cake and steamed bread and HW bread and steamed bread: Laser light using a Tex Vol Instrument (BVM-L370).

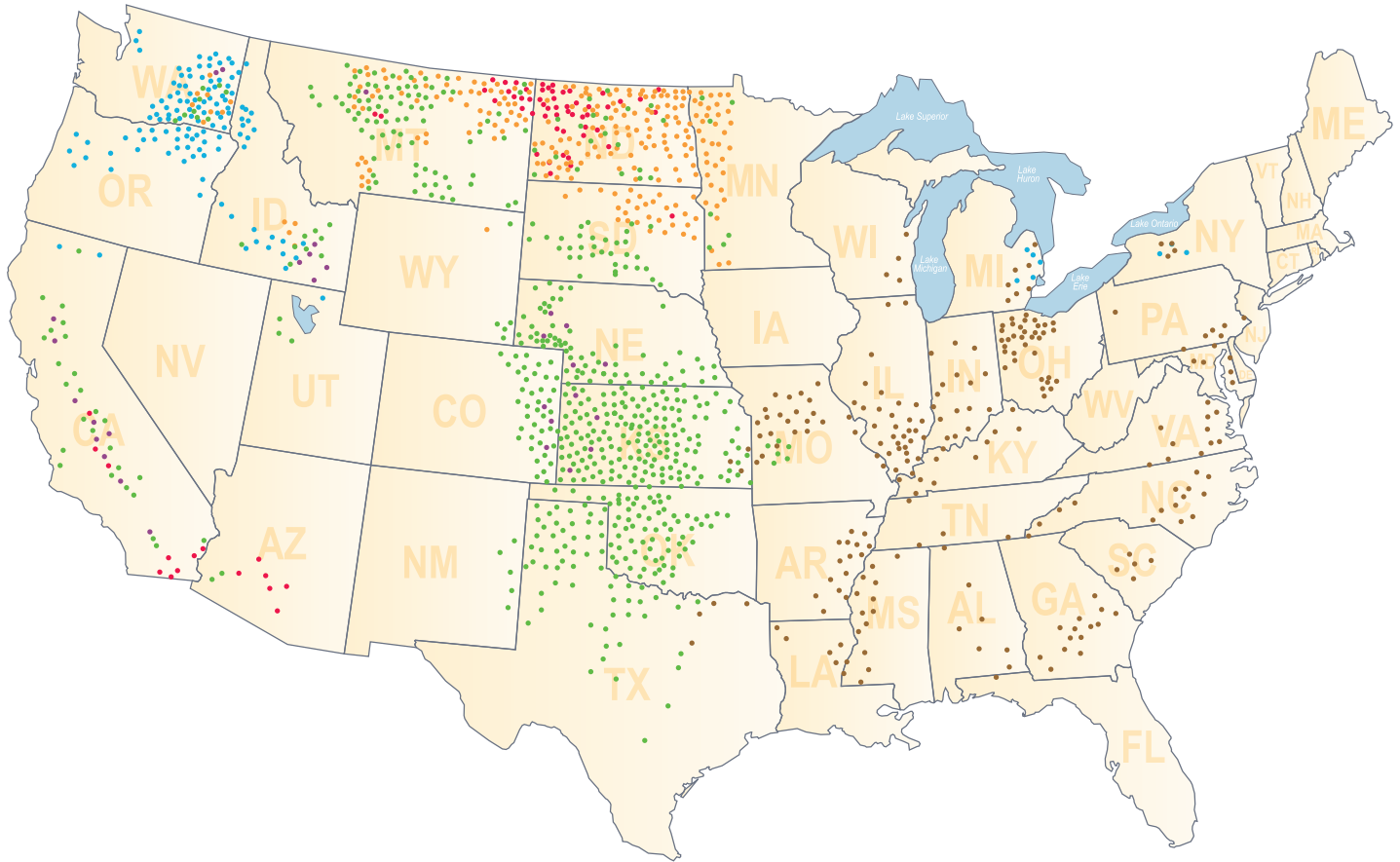
# U.S. WHEAT GRADES AND GRADE REQUIREMENTS

U.S. GRADING FACTORS	GRADES U.S. NO.				
	1	2	3	4	5
	MINIMUM LIMITS:				
Test Weight (lb/bu)					
Hard Red Spring or White Club	58.0	57.0	55.0	53.0	50.0
All other classes and subclasses	60.0	58.0	56.0	54.0	51.0
Test Weight (kg/hl)					
Hard Red Spring or White Club	76.4	75.1	72.5	69.9	66.0
Durum	78.2	75.6	73.0	70.4	66.5
All other classes and subclasses	78.9	76.4	73.8	71.2	67.3
	MAXIMUM PERCENT LIMITS:				
Defects					
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 and broken kernels	3.0	5.0	8.0	12.0	20.0
Total <sup>1</sup>	3.0	5.0	8.0	12.0	20.0
Wheat of Other Classes <sup>2</sup>					
Contrasting classes	1.0	2.0	3.0	10.0	10.0
Total <sup>3</sup>	3.0	5.0	10.0	10.0	10.0
Stones	0.1	0.1	0.1	0.1	0.1
	MAXIMUM COUNT LIMITS (ALL GRADES):				
Other material (1000 gram sample)					
Animal filth			1		
Castor beans			1		
Crotalaria seeds			2		
Glass			0		
Stones			3		
Unknown foreign substance			3		
Total <sup>4</sup>			4		
Insect-damaged kernels in 100 grams			31		
U.S. Sample grade:					
Wheat that:					
(a) Does not meet the requirements for U.S. Nos. 1, 2, 3, 4, 5; or					
(b) Has a musty, sour or commercially objectionable foreign odor (except smut or garlic odor); or					
(c) Is heating or of distinctly low quality.					
Notes:					
1. Includes damaged kernels (total), foreign material, and shrunken and broken kernels.					
2. Unclassed wheat of any grade may contain not more than 10.0% of wheat of other classes.					
3. Includes contrasting classes.					
4. Includes any combination of animal filth, castor beans, crotalaria seeds, glass, stones, or unknown foreign substance.					
Wheat Equivalents:			Metric Equivalents:		
1 bushel* =	60 pounds (27.2 kg)	1 pound =	0.4536 kg		
36.74 bushels =	1 metric ton	1 metric ton (MT) =	2204.6 lbs		
37.33 bushels =	1 long ton	1 short ton (2000 lbs) =	0.9072 MT, or 907.2 kg		
33.33 bushels =	1 short ton	1 long ton (2240 lbs) =	1.0160 MT, or 1016.0 kg		
3.67 bushels =	1 quintal	1 metric ton =	10 quintals		
tons/ha =	0.06725 bu/acre	1 hectare =	2.47 acres		
durum kg/hl =	lbs/bu x 1.292 + 0.630	1 acre =	0.40 hectare		
other wheat kg/hl =	lbs/bu x 1.292 + 1.419	1 hundredweight =	100 pounds or 45.36 kg		
*Winchester bushel					



# U.S. WHEAT...

## THE WORLD'S MOST RELIABLE CHOICE



### HARD RED WINTER



Versatile, with excellent milling and baking characteristics for wheat foods like hearth breads, hard rolls, croissants and flat breads. HRW is also an ideal wheat choice for some types of Asian noodles, general purpose flour and as an improver for blending.

### HARD RED SPRING



The aristocrat of wheat when it comes to “designer” wheat foods like hearth breads, rolls, croissants, bagels and pizza crust. HRS is also a valued improver in flour blends.

### HARD WHITE



HW receives enthusiastic reviews when used for Asian noodles, whole wheat or high extraction applications, pan breads or flat breads.

### DURUM



Hardest of all wheats, durum has a rich amber color and high gluten content. Hard amber durum (HAD) sets the “gold standard” for premium pasta products, couscous and some Mediterranean breads.

### SOFT WHITE



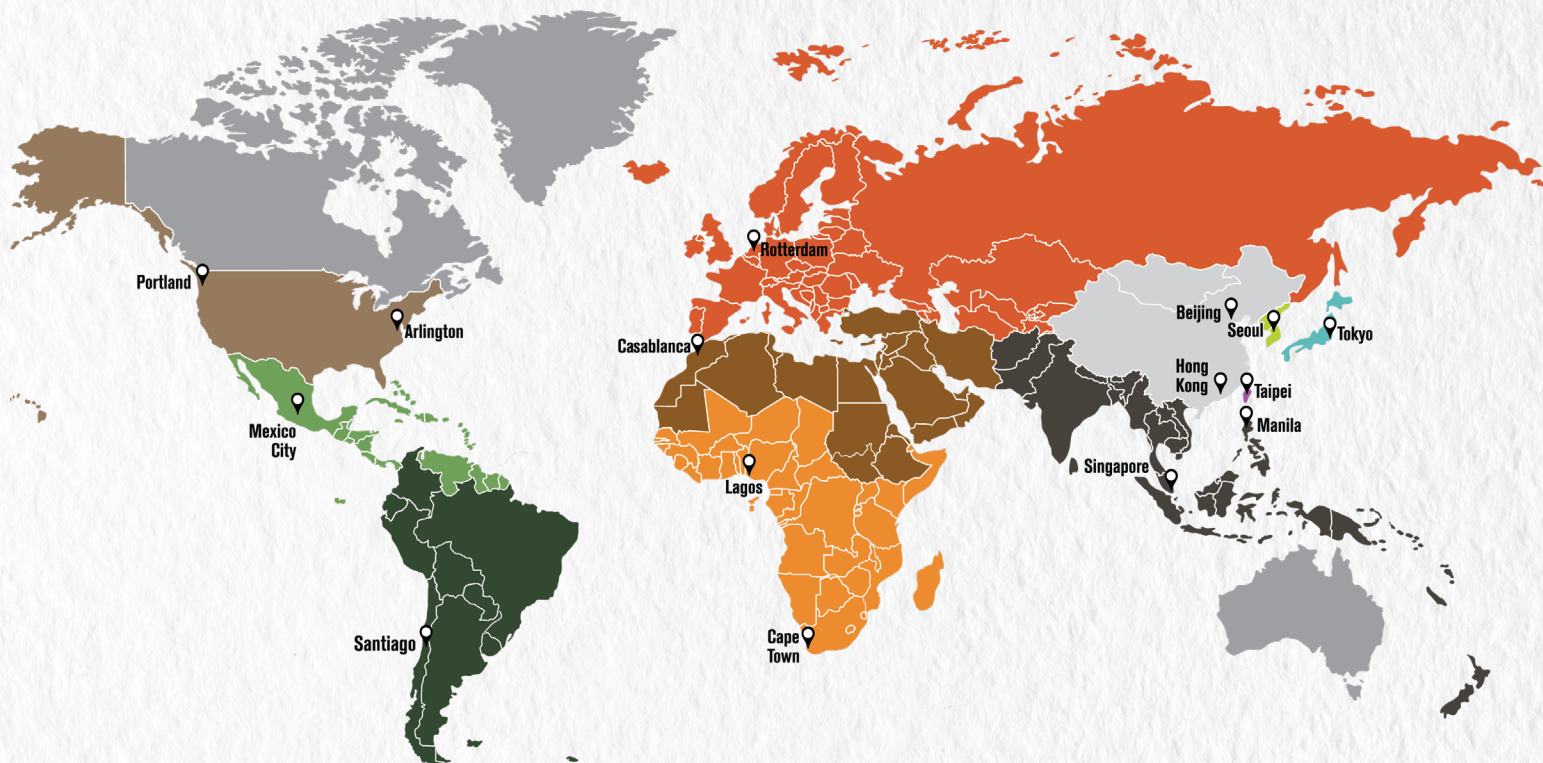
Low moisture wheat with excellent milling results, SW provides a whiter and brighter product for Asian-style noodles and is ideal for exquisite cakes, pastries and other confectionary products.

### SOFT RED WINTER



SRW is a profitable choice for producing a wide range of confectionary products like cookies, crackers and cakes, and for blending for baguettes and other bread products.





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