U.S. WHEAT ASSOCIATES

The World's Most Reliable Choice

2016 CROP QUALITY REPORT

U.S. WHEAT ASSOCIATES

To Our Valued Customers:

An interesting blend of market factors have joined together to create an unusually good buying opportunity for U.S. wheat in marketing year 2016/17. You can take maximum advantage of this situation with the comprehensive data on the quality of all six U.S. wheat classes in this report, compiled again, as we have done for many decades, by U.S. Wheat Associates (USW).

The story of world wheat production and trade continues to be about an abundant supply. All indications point to a fourth consecutive year of record world production, with USDA projecting production will increase in six of the eight major exporting countries. Record-large world carry-in stocks add to the global surplus, resulting in the largest estimated world wheat supply on record. The result, as expected, is lower costs for the world's flour millers and wheat food processors.

U.S. wheat prices have not been this low for about 10 years. We recognize that a few alternative supplies may be offered at even lower prices. Yet considering price alone overlooks the range of characteristics available within several U.S. wheat classes – the reliability of the U.S. wheat supply chain – the trade service and technical support my USW colleagues provide – and the unique, objective inspection and certification from the Federal Grain Inspection Service. Considered together with price, these advantages make U.S. wheat the most valuable and reliable supply in the world.

This report and the experienced support from my colleagues in your country or region will be particularly valuable this marketing year. As I have pledged before, you can also be confident that USW provides service and technical support with your best interests in mind because our mission directs us to "develop, maintain and expand international markets to enhance the profitability of U.S. wheat producers and their customers."

I want to thank our 19 state wheat commission member organizations and USDA's Foreign Agricultural Service for the resources that support our activities, including this important information. Thanks also to the many public and private service partners who analyzed thousands of samples and tabulated the data.

Finally, I want to thank our customers for continuing to choose U.S. wheat this year, and in the future. It is a pleasure to work with all of you. We wish you a successful year ahead.

Sincerely,

Alan T. Tracy, 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

Arkansas Wheat Promotion Board

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

Virginia Small Grains Board

Washington Grain Commission

Wyoming Wheat Marketing Commission

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2016 CROP QUALITY REPORT OVERVIEW

SUMMARY OF CLASSES

	Hard Red Winter[1]		Hard Red Spring		Northern Durum[2]		Desert Durum®		Soft White		Soft Red Winter	
	2016	5-Year Avg	2016	5-Year Avg	2016	5-Year Avg	2016	5-Year Avg	2016	5-Year Avg	2016	5-Year Avg
Test Weight (lb/bu)	60.5	60.3	61.6	61.4	61.2	60.2	62.9	62.7	60.8	60.6	58.6	58.5
(kg/hl)	79.6	79.3	81.0	80.8	79.7	78.3	81.9	81.8	80.0	79.7	77.2	76.9
Grade	1 HRW	1 HRW	1 DNS	1 NS	1 HAD	1 HAD	1 HAD	1 HAD	1 SW	1 SW	2 SRW	2 SRW
Dockage (%)	0.5	0.5	0.5	0.6	0.2	1.0	0.5	0.4	0.6	0.5	0.5	0.6
Wheat Moisture (%)	11.2	11.1	12.0	12.1	11.4	11.6	6.8	6.7	9.8	9.3	12.4	13.0
Wheat Protein (%) [3]	11.5	12.8	14.1	14.2	13.4	13.6	13.9	13.6	10.1	10.2	9.4	10.0
Wheat Ash (%) [3]	1.49	1.54	1.50	1.56	1.61	1.61	1.76	1.74	1.34	1.36	1.46	1.49
1000 Kernel Weight (g)	31.7	29.1	30.9	30.2	40.0	38.9	49.6	48.4	36.3	34.6	32.3	32.6
Wheat Falling Number (sec)	392	404	378	379	423	370	612	517	314	336	330	305
Flour/Semolina Extraction (%)	76.6	73.9	66.8	68.1	67.9	64.5	61.9	62.1	75.0	75.1	67.3	71.7
Flour/Semolina Ash (%)[3]	0.56	0.53	0.49	0.51	0.71	0.67	0.87	0.88	0.39	0.51	0.43	0.45
Wet Gluten (%)	24.8	29.9	33.6	34.8	32.4	35.4	33.2	33.6	23.6	23.4	21.3	22.3
Farinograph:												
Peak Time (min)	4.0	5.4	8.1	7.0	n/a	n/a	n/a	n/a	2.4	2.2	1.4	1.5
Stability (min)	6.7	10.9	12.2	11.2	n/a	n/a	n/a	n/a	2.8	2.8	2.7	2.7
Absorption (%)	59.2	59.1	63.0	63.4	n/a	n/a	n/a	n/a	53.8	53.9	52.6	52.9
Alveograph W (10^{-4} joules)	211	246	394	348	136	129	230	228	85	100	86	80
Loaf Volume (cm^3)	821	836	986	971	n/a	n/a	n/a	n/a	n/a	n/a	718	708
Production (MMT)	29.4	22.3	13.4	13.7	2.5	1.3	0.3	0.5	6.9	6.2	9.4	10.9
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[1]Hard red winter data does not include California.
[2]Durum extraction and ash values are for semolina.
[3]Protein - 12% moisture basis; ash - 14% moisture basis.

2016 PRODUCTION, SUPPLY AND DEMAND

U.S. PRODUCTION BY CLASS

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

	2016	2015	2014	2013	2012
Hard Red Winter	29.4	22.6	20.1	20.3	27.2
Hard Red Spring	13.4	15.4	15.1	13.4	13.7
Hard White	0.9	0.6	0.6	0.6	0.6
Durum	2.8	2.3	1.5	1.7	2.3
Soft White	6.9	5.4	5.5	6.8	6.5
Soft Red Winter	9.4	9.8	12.4	15.5	11.4
Total	**62.9**	**56.1**	**55.1**	**58.1**	**61.7**

Based on USDA crop estimates as of September 30, 2016.

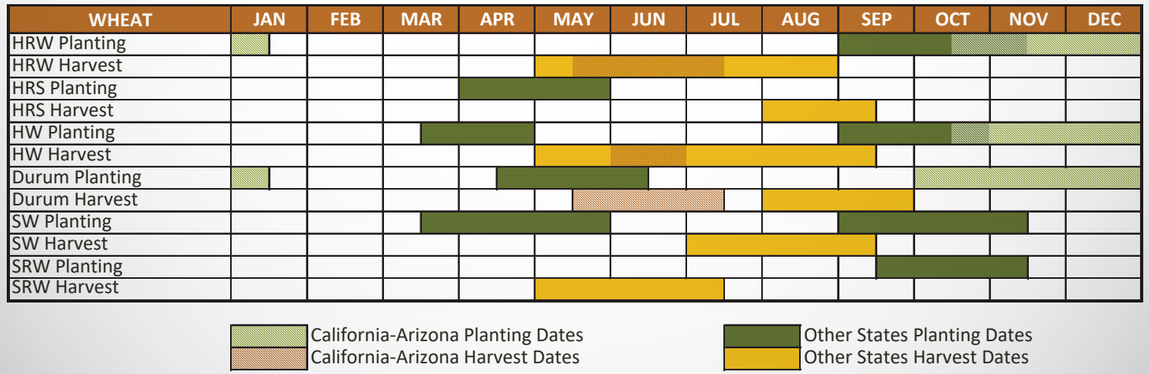
U.S. SUPPLY AND DEMAND

Estimated for 2016/17 (year beginning June 1)

	HRW	HRS	Durum	White	SRW	TOTAL
Beginning Stocks	12.1	7.4	0.8	2.0	4.3	26.6
Production	29.4	13.4	2.8	7.8	9.4	62.9
Imports	0.1	1.2	1.0	0.2	0.8	3.4
Total Supply	**41.7**	**22.0**	**4.6**	**10.0**	**14.5**	**92.8**
Domestic Use	14.9	8.5	2.4	2.8	6.8	35.3
Exports	10.5	7.9	1.0	4.6	2.6	26.5
Total Demand	**25.3**	**16.4**	**3.3**	**7.4**	**9.4**	**61.8**
Ending Stocks	**16.4**	**5.6**	**1.3**	**2.6**	**5.1**	**31.0**
Stocks Five-year Average	**8.9**	**5.3**	**0.7**	**1.7**	**4.0**	**20.6**

Based on USDA Supply/Demand estimates as of October 12, 2016.

PLANTING AND HARVEST DATES



WHAT THE TESTS MEAN

WHEAT GRADES reflect the physical quality and condition of a sample and thus may indicate the general suitability for milling. The U.S. grade of 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 that occur during the 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 which either were insufficiently filled during growing and have a shrunken or shriveled appearance or have been 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.

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 effect 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 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 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 particularly white flour call for low ash content while whole wheat flour has higher ash content.

1000 KERNEL WEIGHT is the weight in grams of one thousand kernels of wheat and may indicate grain size and expected milling yield.

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

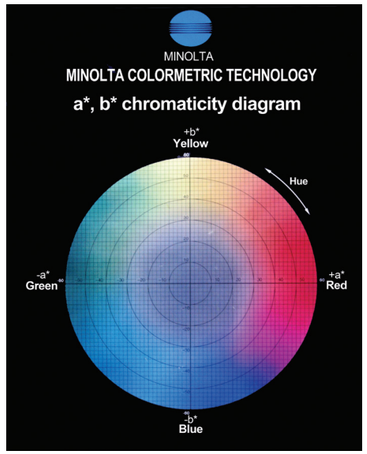
SEDIMENTATION value is a measure of the sediment that results when lactic acid is added to a sifted ground wheat sample and can be used as an indicator of gluten quality and thus the baking quality of wheat flour.

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 is difficult to blend to lower alpha-amylase content, and 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.

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

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.

COLOR is a numerical system to measure a sample's lightness (L*) on a scale of 0 to 100 and "chromaticity" or hue on two scales each running 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 the wheat's endosperm color particle size and the ash content of the flour and often affects the color of the finished product. Durum semolina color is heavily influenced by particle size.



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 some end products such as sheeted Asian noodles. Amylograph also measures enzyme (alpha-amylase) activity which results from sprout damage. Amylograph results usually correlate very closely with falling number results.

STARCH DAMAGE, the percentage by weight of damaged starch in a flour sample, 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.

FARINOGRAPH

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 such products as yeast-raised breads while short stability times indicate weaker gluten useful in many confectionary products.
- **ABSORPTION RESISTANCE** 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.

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. For example, low P value (indicating weak gluten) and long L value (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.

EXTENSOGRAPH 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.

MIXOGRAPH generates a graph that records the force needed to mix flour or semolina and water into dough. The mixograph is similar to farinograph but is quicker, uses a pin mixer and uses a smaller amount of 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.

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 glutenin, especially for bread wheat flour.

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 visually counted in a semolina sample and reported as the number in 10 square inches. Specks, which can detract from pasta appearance and desirability, 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.

SUGAR SNAP COOKIE, SPONGE CAKE, CHINESE SOUTHERN-TYPE STEAMED BREAD, SPAGHETTI, and the hard white (HW) 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.

ALVEOGRAPH

Photo courtesy of Wheat Marketing Center

HARD RED WINTER

OVERVIEW

MIDWEST AND PNW HARVEST SURVEY

WEATHER AND HARVEST:

Early growing conditions for the 2016 hard red winter (HRW) crop were generally good across the entire region with adequate moisture in the late fall and early winter. The exception was north Texas where excessive fall rains reduced planted acres.

The U.S. central and southern plains were very dry during the late winter and early spring, but had excessive moisture during the later stages of crop development. Late spring rains fell on mature wheat in Texas and southern Oklahoma and adversely affected test weight. However, the rains were in time to generate record high yields in many parts of northwest Texas, northern Oklahoma, Kansas, Colorado and Nebraska. Because producers fertilized for normal yields, the 50% to 70% higher than average yields resulted in below normal protein values.

Washington, Oregon, Idaho and Montana had unseasonably warm temperatures during the late spring and very erratic rainfall throughout the later stages of crop development. These conditions resulted in a wide range of kernel characteristics and protein levels in the crop in these states.

SURVEY METHODS:

USDA/ARS Hard Winter Wheat Quality Lab, Manhattan, KS and Plains Grains, Inc., collected and analyzed 499 samples from grain elevators when at least 30% of the local harvest was complete in Texas, Oklahoma, Kansas, Colorado, Nebraska, Wyoming, South Dakota, North Dakota, Montana, Washington, Oregon and Idaho. The area sampled accounts for about 80% of total HRW production.

Official grade and nongrade factors were determined on each sample. Functionality tests were conducted on 122 composites representing 44 growing areas and protein ranges of <11.5%, 11.5% to 12.5% and >12.5%. Production-weighted results are presented as Gulf-tributary (about 77% of production), Pacific Northwest (PNW)-tributary (23%) and Overall averages. The methods are described in the Analysis Methods section of this booklet.

WHEAT AND GRADE DATA:

Overall kernel characteristics were outstanding in the 2016 crop though protein content is relatively low. Overall 93% of samples were U.S. No. 2 or better; 91% of Gulf-Tributary and 96% of PNW-tributary samples were U.S. No. 2 or better. Overall test weight averaged 60.5 lb/bu (79.6 kg/hl), which is above the 5-year average of 60.3 lb/bu (79.3 kg/hl) and significantly above last year's average of 59.0 lb/bu (77.6 kg/hl). The overall dockage of 0.5% is significantly below last year's 0.8% and equal to the 5-year average of 0.5%. Shrunken and broken (0.9%) and total defects (1.3%) are also significantly below the 5-year averages. Wheat ash is well below and thousand kernel weight and kernel diameter are well above last year and the 5-year averages, values which reflect the very healthy kernel characteristics of the 2016 crop. The average 2016 wheat falling number is 392 sec, comparable to the 2015 average of 400 sec and the 5-year average of 404 sec, and is indicative of sound wheat.

The average protein of 11.5% is more than a full percentage point lower than the 5-year average of 12.8%. Protein content distribution varied by growing region. Overall approximately 50% of samples were less than 11.5% protein, 35% between 11.5% and 12.5% and 15% greater than 12.5%.

FLOUR AND BAKING DATA:

The Buhler Laboratory mill flour yield overall averaged 76.6% and significantly exceeds the 2015 average of 74.1% and the 5-year average of 73.9%. Flour ash (14% mb) of 0.56% is comparable to 2015 (0.59%) and the 5-year average of 0.53%. Gluten index values averaged 93%, which is comparable to last year and equal to the 5-year average. The W value of 211 is slightly lower than last year's average of 214 and well below the 5-year average of 246. Overall average bake absorption is 62.9%, slightly above the 2015 absorption of 62.5% and the 5-year average of 62.5%. Farinograph development and stability times were 4.0 min and 6.7 min, respectively, both of which are lower than last year and significantly below the 5-year averages of 5.4 min and 10.9 min, respectively. Overall loaf volume averaged 821cm^3 and is well below 2015 (870 cm^3), but comparable to the 5-year average of 836 cm^3.

SUMMARY:

Growing conditions greatly influenced the 2016 HRW in all production areas. The result is a crop that has generally outstanding kernel characteristics and will potentially provide the miller with increased flour yield compared with the HRW crops of recent years. There is lower than normal protein in the 2016 HRW crop. Most producers fertilized at a rate intended for average yields, but in many locations yields were 50% to 70% above normal. The combination of normal fertilizer rates and record yields meant there was inadequate nitrogen present to achieve normal protein levels. Even though mixing times are shorter than the 5-year averages, the loaf volumes achieved indicate there is adequate protein quality to make good quality bread. This crop meets or exceeds typical HRW contract specifications and should provide high value to customers.

CALIFORNIA HARVEST SURVEY

California's wheat growing regions are defined by climate, value of alternative crops and distinct differences in variety selection. HRW is the most prevalent class grown in the state. Consistent with prior years, the 2016 crop has high protein, low moisture, high flour extraction and strong baking performance, all of which make California wheat very good for blending. Compared to recent years of extreme drought, growing regions received more precipitation during the 2015/16 season. However, rainfall was still below historical averages and was insufficient to alleviate what USDA categorizes as "extreme" drought throughout much of the San Joaquin Valley. Harvest takes place in June and July. With the strong domestic demand for new crop wheat, importers are encouraged to express their purchasing interest in early spring or even at planting time.

Survey methods: Grade information is provided by FGIS. Milling and end-use quality analysis are conducted by the California Wheat Commission laboratory.

EXPORT CARGO SURVEY

The export cargo data represent 423 sublot samples provided by USDA's Federal Grain Inspection Service for marketing years 2016 and 2015. Of 122 2016-crop samples collected in July and August, 93 are from Gulf and 29 from PNW ports. Of the 301 2015-crop samples, 180 are from Gulf and 121 from PNW ports. Grade data are the official grades on the individual sublots. Milling and baking analyses were tested by Great Plains Analytical Laboratory, Kansas City, MO.

HARD RED WINTER

MIDWEST AND PNW HARVEST DATA

Instant Noodles

HARD RED WINTER	COMPOSITE AVERAGE					
	2016 BY PROTEIN*				2015	5-YEAR
	Low	Med	High	Overall	OVERALL	AVERAGE
WHEAT GRADE DATA:						
Test Weight (lb/bu)	60.7	60.5	60.3	60.5	59.0	60.3
(kg/hl)	79.8	79.6	79.3	79.6	77.6	79.3
Damaged Kernels (%)	0.3	0.2	0.3	0.3	0.5	0.3
Foreign Material (%)	0.2	0.2	0.1	0.2	0.2	0.1
Shrunken & Broken (%)	0.8	1.0	0.9	0.9	1.2	1.2
Total Defects (%)	1.3	1.4	1.3	1.4	1.9	1.6
Grade	1 HRW	1 HRW	1 HRW	1 HRW	2 HRW	1 HRW
WHEAT NON-GRADE DATA:						
Dockage (%)	0.5	0.6	0.7	0.5	0.8	0.5
Moisture (%)	11.3	11.2	10.7	11.2	11.4	11.1
Protein (%) 12%/0% moisture basis	10.7/12.2	11.9/13.5	13.1/14.8	11.5/13.1	12.4/14.1	12.8/14.5
Ash (%) 14%/0% moisture basis	1.46/1.70	1.53/1.78	1.46/1.70	1.49/1.73	1.59/1.85	1.54/1.79
1000 Kernel Weight (g)	32.1	31.6	30.6	31.7	29.6	29.1
Kernel Size (%) lg/md/sm	73/26/1	69/30/1	62/37/1	70/29/1	63/36/1	55/43/2
Single Kernel: Hardness	53.1	56.8	58.8	55.2	60.8	66.7
Weight (mg)	32.1	31.6	30.6	31.7	29.6	29.1
Diameter (mm)	2.66	2.71	2.58	2.66	2.59	2.58
Sedimentation (cc)	40.1	46.0	54.6	43.8	50.2	52.9
Falling Number (sec)	385	396	421	392	400	404
DON (ppm)	<0.5	<0.5	<0.5	<0.5	0.6	
FLOUR DATA:						
Lab Mill Extraction (%)	76.6	77.1	75.8	76.6	74.1	73.9
Color: L*	90.2	90.1	90.1	90.0	87.6	90.7
a*	-1.2	-1.1	-1.0	-1.2	-1.1	-1.7
b*	10.4	10.4	10.1	10.3	9.7	10.2
Protein (%) 14%/0% moisture basis	9.7/11.3	10.9/12.6	12.0/14.0	10.4/12.0	11.4/13.3	11.7/13.6
Ash (%) 14%/0% moisture basis	0.56/0.65	0.57/0.66	0.55/0.64	0.56/0.65	0.59/0.69	0.53/0.62
Wet Gluten (%)	22.7	26.7	30.3	24.8	29.2	29.9
Gluten Index	94	92	92	93	92	93
Falling Number (sec)	421	444	462	431	425	419
Amylograph Viscosity 65 g (BU)	480	518	488	491	441	540
Starch Damage (%)	6.5	6.4	6.3	6.4	6.6	6.2
SRC: GPI	0.61	0.67	0.72	0.66	0.59	
Water / 50% Sucrose	72/112	72/114	72/116	72/114	71/125	
5% Lactic Acid / 5% Na_2CO_3	137/103	146/105	156/101	146/103	136/104	
DOUGH PROPERTIES:						
Farinograph: Peak Time (min)	3.1	5.0	5.6	4.0	4.8	5.4
Stability (min)	5.9	7.6	7.8	6.7	6.9	10.9
Absorption (%)	58.5	59.8	61.4	59.2	59.6	59.1
Alveograph: P (mm)	89	91	99	91	75	77
L (mm)	63	73	86	69	94	100
P/L Ratio	1.43	1.25	1.16	1.32	0.80	0.77
W (10^{-4} J)	193	221	273	211	214	246
Extensograph: Resistance (BU)	315/508	326/498	345/492	324/503	315/440	331/493
(45/135 min) Extensibility (cm)	13.1/12.2	13.9/13.0	15.5/14.9	13.6/12.8	14.6/14.5	14.9/14.3
Area (cm^2)	68/92	76/102	93/123	74/100	78/107	87/120
BAKING EVALUATION:						
Pan Bread: Bake Absorption (%)	62.0	63.9	65.7	62.9	62.5	62.5
Crumb Grain and Texture (1-10)	5.3	5.7	5.9	5.5	6.4	6.2
Loaf Volume (cc)	791	856	892	821	870	836
PRODUCTION OF 12 STATES (%):	**50**	**35**	**15**	**100**		

*Protein Range: Low, <11.5%; Med, 11.5 - 12.5%; High, >12.5%.

HARD RED WINTER

MIDWEST AND PNW HARVEST DATA

	GULF EXPORTABLE AVERAGE						PNW EXPORTABLE AVERAGE					
	2016 BY PROTEIN*				2015	5-YEAR	2016 BY PROTEIN*				2015	5-YEAR
	Low	Med	High	Overall	OVERALL	AVERAGE	Low	Med	High	Overall	OVERALL	AVERAGE
	60.5	60.3	60.2	60.4	58.7	60.1	61.6	61.0	60.0	60.8	60.1	61.0
	79.6	79.3	79.2	79.5	77.3	79.1	81.0	80.2	78.9	80.0	79.1	80.2
	0.3	0.2	0.4	0.3	0.6	0.3	0.1	0.4	0.1	0.2	0.1	0.2
	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.4	0.1	0.2	0.1	0.1
	0.8	0.9	1.0	0.9	1.3	1.3	0.7	1.2	0.7	0.9	1.1	1.1
	1.3	1.3	1.6	1.4	2.1	1.7	1.0	2.0	0.9	1.3	1.3	1.4
	1 HRW	1 HRW	1 HRW	1 HRW	2 HRW	1 HRW	1 HRW	1 HRW	1 HRW	1 HRW	1 HRW	1 HRW
	0.5	0.5	0.7	0.5	0.8	0.5	0.5	1.0	0.6	0.7	0.7	0.6
	11.4	11.4	11.0	11.4	11.7	11.2	10.8	10.7	10.4	10.6	10.3	10.8
	10.7/12.2	11.9/13.5	13.3/15.1	11.4/13.0	12.5/14.2	13.0/14.7	10.5/11.9	11.9/13.5	12.7/14.4	11.7/13.3	12.0/13.7	12.2/13.9
	1.46/1.70	1.48/1.72	1.51/1.76	1.48/1.72	1.61/1.87	1.56/1.81	1.46/1.70	1.69/1.96	1.40/1.63	1.52/1.76	1.52/1.77	1.50/1.73
	31.9	31.7	30.4	31.7	29.3	28.4	33.0	31.3	30.6	31.6	30.6	31.1
	73/26/1	70/29/1	64/35/1	71/28/1	63/36/1	52/46/2	71/28/1	67/32/1	60/39/1	66/33/1	65/34/1	64/35/1
	52.7	55.7	57.6	54.3	60.8	67.0	55.4	60.0	59.8	58.4	62.4	65.8
	31.9	31.7	30.4	31.7	29.3	28.4	33.0	31.3	30.6	31.6	30.6	31.1
	2.66	2.65	2.59	2.65	2.58	2.56	2.68	2.89	2.55	2.71	2.61	2.65
	39.3	43.8	49.7	41.4	49.2	52.6	44.5	52.9	59.8	51.8	53.3	54.3
	388	405	438	396	400	404	371	365	398	378	399	403
	<0.5	<0.5	<0.5	<0.5	0.7		<0.5	<0.5	<0.5	<0.5	0.5	
	77.0	77.1	76.4	77.0	74.1	73.8	74.5	76.4	74.6	75.2	74.0	74.1
	90.1	89.8	89.6	89.9	87.4	90.6	90.6	90.4	90.0	90.3	88.1	91.0
	-1.2	-1.1	-1.0	-1.2	-1.1	-1.7	-1.2	-1.1	-1.1	-1.1	-1.2	-1.8
	10.5	10.6	10.1	10.5	9.8	10.2	9.8	10.0	10.0	9.9	9.4	10.1
	9.7/11.3	10.9/12.6	12.1/14.0	10.4/12.1	11.6/13.4	12.0/13.9	9.6/11.1	10.7/12.5	11.9/13.8	10.6/12.4	10.9/12.7	11.0/12.8
	0.57/0.66	0.58/0.68	0.61/0.71	0.58/0.67	0.61/0.72	0.55/0.64	0.51/0.59	0.52/0.60	0.48/0.56	0.50/0.59	0.53/0.62	0.49/0.57
	22.9	27.1	30.8	24.7	30.1	30.9	21.6	25.0	29.5	25.0	26.4	27.3
	93	91	89	92	92	92	98	97	95	97	96	96
	425	448	490	436	426	426	397	431	427	417	425	417
	483	516	466	489	430	535	467	521	509	497	474	554
	6.4	6.4	6.4	6.4	6.6	6.1	6.7	6.5	6.1	6.5	6.5	6.2
	0.63	0.65	0.70	0.64	0.58		0.48	0.71	0.73	0.72	0.66	
	71/114	71/115	73/117	72/115	72/127		77/104	73/109	70/115	73/109	66/117	
	138/104	143/104	153/101	141/104	135/106		134/100	154/107	158/100	149/102	140/96	
	3.2	5.0	5.2	3.9	4.8	5.6	2.4	4.8	5.9	4.3	4.7	5.0
	6.0	7.4	6.8	6.5	6.6	10.9	5.2	8.2	8.8	7.3	8.0	10.8
	58.5	59.9	61.7	59.2	60.1	59.7	58.3	59.0	60.7	59.2	58.0	58.2
	88	89	103	89	75	77	95	98	94	96	76	77
	63	73	80	67	94	100	60	74	92	74	93	100
	1.40	1.22	1.29	1.33	0.80	0.77	1.58	1.32	1.02	1.29	0.82	0.77
	189	209	255	199	206	241	213	260	292	252	238	261
	302/496	300/477	319/480	304/489	291/393	317/467	384/570	410/564	373/503	390/549	390/591	369/565
	13.0/12.2	13.8/13.0	15.0/14.3	13.4/12.6	14.8/15.0	14.9/14.6	13.4/12.0	14.1/13.0	16.0/15.4	14.4/13.3	14.0/13.1	14.8/13.7
	64/90	69/97	80/111	67/94	74/102	83/117	86/105	99/120	107/135	97/119	94/124	97/131
	62.1	63.6	64.9	62.6	62.7	62.7	61.4	64.5	66.1	63.9	62.0	62.0
	5.3	5.6	5.6	5.4	6.4	6.2	5.2	6.0	6.1	5.7	6.4	6.3
	796	858	885	819	876	844	764	843	894	829	850	818
	42	**27**	**8**	**77**			**8**	**8**	**7**	**23**		

*Protein Range: Low, <11.5%; Med, 11.5 - 12.5%; High, >12.5%.

HARD RED WINTER

CALIFORNIA AND EXPORT DATA

HARD RED WINTER	CALIFORNIA HARVEST DATA				EXPORT CARGO DATA			
	MEDIUM PROTEIN*		HIGH PROTEIN*		GULF		PNW	
	2016	2015	2016	2015	2016	2015	2016	2015
WHEAT GRADE DATA:								
Test Weight (lb/bu)	63.4	63.9	64.1	63.2	59.8	59.7	61.6	61.5
(kg/hl)	83.4	84.0	84.3	83.0	78.7	78.5	81.0	80.9
Damaged Kernels (%)	0.1	0.2	0.2	0.2	0.9	1.2	0.1	0.2
Foreign Material (%)	0.4	0.2	0.4	0.1	0.2	0.2	0.0	0.1
Shrunken & Broken (%)	0.6	0.5	1.0	0.6	1.4	1.5	1.5	1.5
Total Defects (%)	1.1	0.9	1.6	0.9	2.5	2.9	1.6	1.8
Grade	1 HRW	1 HRW	1 HRW	1 HRW	2 HRW	2 HRW	1 HRW	1 HRW
WHEAT NON-GRADE DATA:								
Dockage (%)	1.0	0.8	1.3	0.8	0.6	0.6	0.3	0.3
Moisture (%)	8.3	9.0	8.2	8.2	11.2	11.5	10.4	10.4
Protein (%) 12%/0% moisture basis	11.9/13.5	11.9/13.5	13.5/15.3	13.2/15.0	11.7/13.3	12.4/14.1	12.2/13.9	12.0/13.7
Ash (%) 14%/0% moisture basis	1.39/1.61	1.42/1.65	1.46/1.70	1.41/1.64	1.50/1.75	1.59/1.85	1.38/1.60	1.43/1.66
1000 Kernel Weight (g)	40.9	41.1	40.0	39.8	27.9	26.6	27.0	27.9
Kernel Size (%) lg/md/sm	89/11/0	88/12/0	86/13/1	84/15/1	68/30/2	63/35/2	57/42/2	63/36/2
Single Kernel: Hardness	63.0	73.0	67.7	74.3				
Weight (mg)	40.9	41.4	40.0	39.8				
Diameter (mm)	2.96	3.00	2.97	2.90				
Sedimentation (cc)	51.0		61.9		32.3	32.3	46.7	38.8
Falling Number (sec)	370	374	421	399	384	375	402	409
DON (ppm)	<0.5		<0.5					
FLOUR DATA:								
Lab Mill Extraction (%)	70.5	69.7	70.2	69.6	69.1	67.8	69.6	68.8
Color: L*	93.1	95.4	93.0	95.3	89.9	89.7	90.1	89.9
a*	-0.8	0.1	-0.7	0.1	-2	-2	-2	-2
b*	7.2	7.2	7.8	7.4	9.2	9.3	9.1	9.1
Protein (%) 14%/0% moisture basis	10.8/12.6	10.6/12.3	12.3/14.3	11.8/13.7	10.2/11.8	10.8/12.6	10.9/12.6	10.8/12.5
Ash (%) 14%/0% moisture basis	0.41/0.48	0.38/0.45	0.37/0.43	0.37/0.43	0.48/0.56	0.48/0.56	0.48/0.55	0.47/0.54
Wet Gluten (%)	30.0	29.0	35.2	32.7	27.1	29.7	28.4	28.6
Gluten Index	92	97	89	92	97	96	97	97
Falling Number (sec)	383	396	379	420	407	397	429	417
Amylograph Viscosity 65 g (BU)	672		809		571	501	679	596
Starch Damage (%)	8.7		8.3					
SRC: GPI	0.69		0.74					
Water / 50% Sucrose	71/114		75/118					
5% Lactic Acid / 5% Na_2CO_3	144/96		158/97					
DOUGH PROPERTIES:								
Farinograph: Peak Time (min)	7.0	11.1	15.0	15.1	6.3	6.4	6.9	6.5
Stability (min)	12.2	21.9	17.0	22.9	11.6	11.7	13.7	11.7
Absorption (%)	63.3	64.5	67.5	65.4	59.1	59.2	60.0	59.7
Alveograph: P (mm)	108	110	123	113	99	96	101	103
L (mm)	93	87	100	93	92	99	98	89
P/L Ratio	1.26	1.27	1.27	1.21	1.08	0.97	1.03	1.16
W (10^{-4} J)	310	378	399	394	292	300	331	307
Extensograph: Resistance (BU)	266/329		310/502					
(45/135 min) Extensibility (cm)	17.7/18.0		16.8/15.0					
Area (cm^2)	107/133		114/139					
BAKING EVALUATION:								
Pan Bread: Bake Absorption (%)	64.6	65.0	69.0	66.0				
Crumb Grain and Texture (1-10)	8.0	8.0	9.0	9.0	6.6	6.7	6.6	6.7
Loaf Volume (cc)	900	915	986	960	855	900	866	854
SAMPLE COUNT:					93	180	29	121

*California HRW Protein Range: Med, 11.0 - 12.5%; High, >12.5%.

HARD RED WINTER PRODUCTION

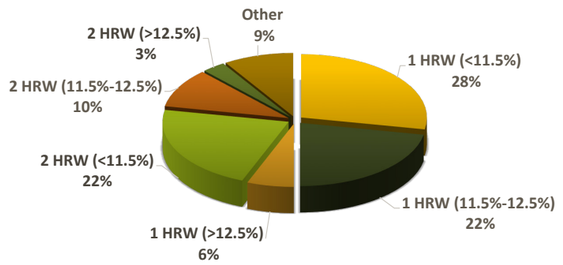
for the major producing states (million metric tons)

	2016	2015	2014	2013	2012
California	0.3	0.3	0.3	0.7	0.6
Colorado	2.7	2.1	2.3	1.1	2.0
Idaho	0.4	0.4	0.3	0.4	0.4
Kansas	12.3	8.5	6.5	8.6	10.2
Montana	2.9	2.5	2.5	2.2	2.3
Nebraska	1.8	1.2	1.9	1.1	1.5
North Dakota	0.2	0.2	0.7	0.2	1.1
Oklahoma	3.7	2.7	1.3	2.8	4.2
Oregon	0.1	0.0	0.1	0.1	0.1
South Dakota	1.7	1.2	1.6	0.7	1.6
Texas	2.4	2.7	1.7	1.7	2.4
Washington	0.5	0.3	0.3	0.4	0.6
Wyoming	0.1	0.1	0.1	0.1	0.1
Thirteen-State Total	**29.1**	**22.2**	**19.8**	**20.0**	**27.0**
Total HRW Production	**29.4**	**22.6**	**20.1**	**20.3**	**27.2**

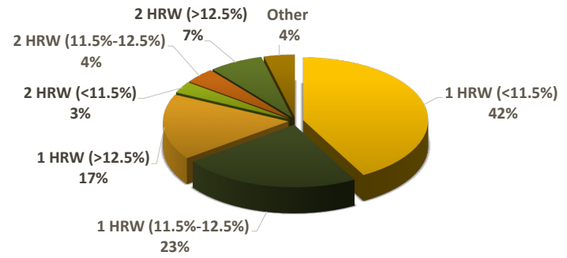
Based on USDA crop estimates as of September 30, 2016.

HRW GRADE DISTRIBUTIONS

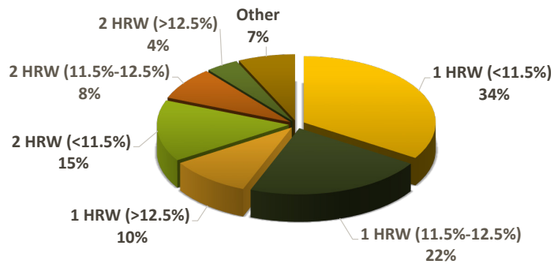
GULF EXPORTABLE HRW



PNW EXPORTABLE HRW



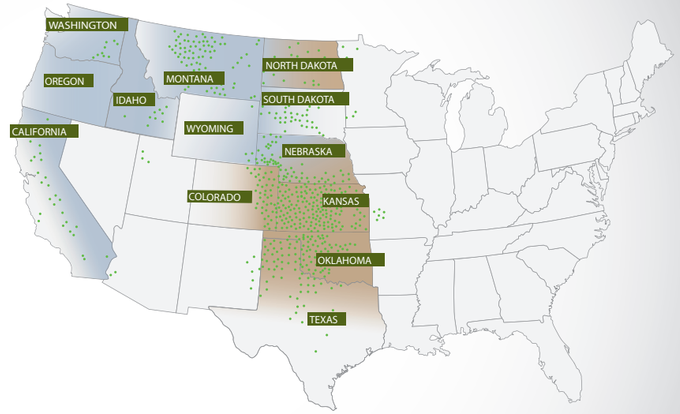
OVERALL



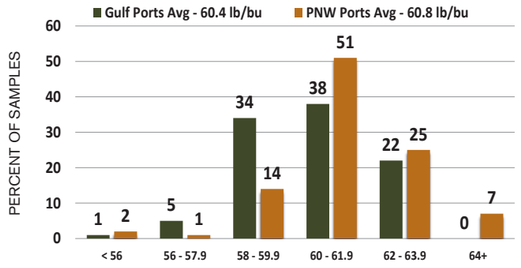
*Values in parentheses denote protein level.

THIRTEEN STATES SURVEYED

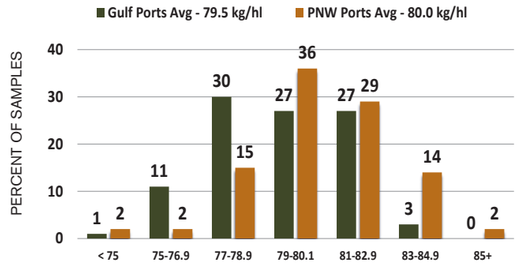
California • Colorado • Idaho • Kansas
Montana • Nebraska • North Dakota
Oklahoma • Oregon • South Dakota
Texas • Washington • Wyoming



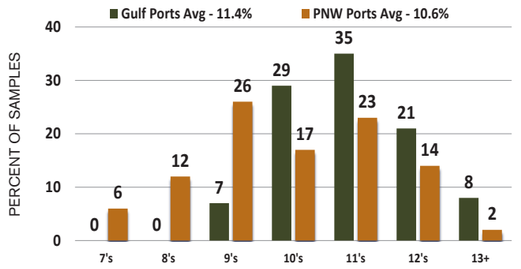
TEST WEIGHT | Pounds/Bushel



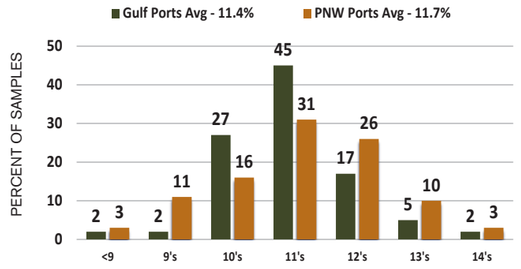
HECTOLITER WEIGHT | Kilograms/Hectoliter



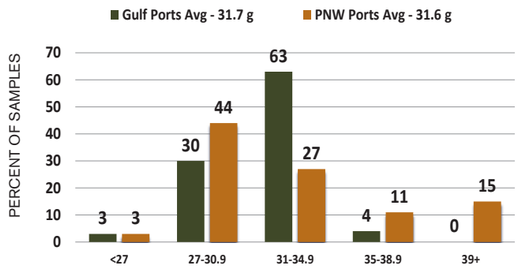
WHEAT MOISTURE | Percent



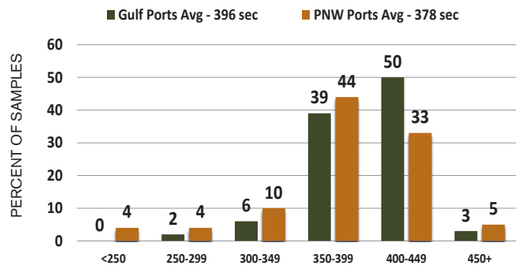
PROTEIN (12% MB) | Percent



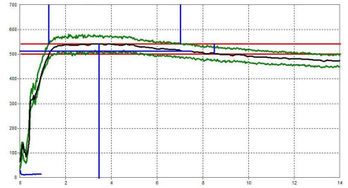
1000 KERNEL WEIGHT | Grams

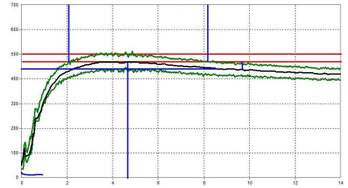


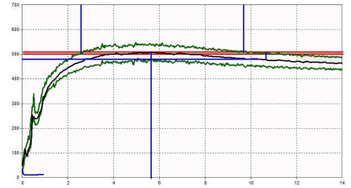
FALLING NUMBER | Seconds



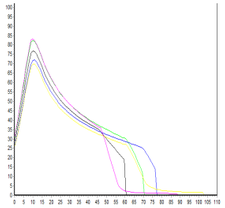
FARINOGRAMS*

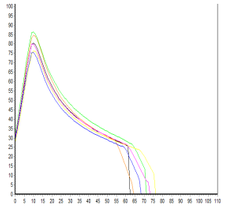


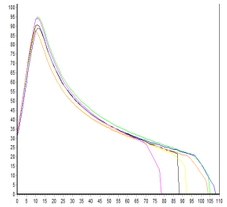




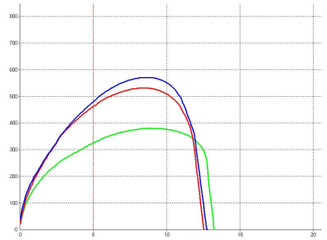
ALVEOGRAMS



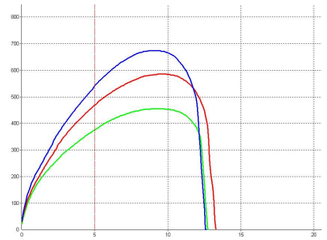




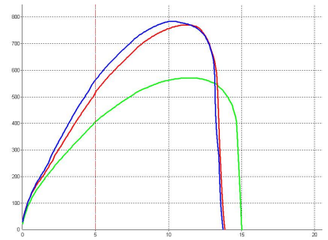
EXTENSOGRAMS



LOW PROTEIN



MEDIUM PROTEIN



HIGH PROTEIN

*Representing 2016 Composite Average

ABOUT HARD RED WINTER WHEAT

U.S. hard red winter wheat has medium to high protein, medium hard endosperm, red bran, medium gluten content and mellow gluten. Used in pan breads, Asian noodles, hearth breads, hard rolls, flatbreads, croissants and general-purpose flour.

Hard Rolls

HARD RED SPRING

OVERVIEW

HARVEST SURVEY

WEATHER AND HARVEST:

Early planting and excellent growing conditions resulted in a record national yield average but hard red spring wheat (HRS) production slipped 13% from last year as planted area declined. Planting started in late March with warm, dry conditions and was mostly complete by May, well ahead of the average pace. Crop development was two to three weeks ahead of average for most of the growing season with adequate moisture from timely precipitation. Northern and northwestern North Dakota and northern Montana experienced more plentiful rain than areas further south and east. Disease pressure was minimal except for isolated fusarium infection near the Canadian border. Growing conditions in the three Pacific Northwest (PNW) states were also excellent and much improved from 2015 drought conditions. Harvest began in late July and made steady progress with mostly dry conditions. The majority of the crop was harvested by mid-September with good quality and few problems, although heavy rain delayed a small portion in early September.

SURVEY METHODS:

Sample collection and analysis were conducted by the HRS Wheat Quality Lab, Department of Plant Sciences, North Dakota State University (NDSU), Fargo, ND. 799 samples were collected from fields, on-farm bin sites or elevators during harvest in Minnesota (124), Montana (152), North Dakota (384), South Dakota (85) and Washington, Idaho and Oregon (54). The samples represent approximately 99% of the 2016 HRS crop. Samples were segregated by export region (Eastern and Western) and composited by protein range (<13.5%, 13.5% to 14.5% and >14.5%). The methods are described in the Analysis Methods section of this booklet.

WHEAT AND GRADE DATA:

The 2016 HRS features a high grade profile, high protein content, sound kernel traits and improved functional performance, including very good values for absorption, dough strength, loaf volume and bake properties.

Many grade factor averages are very similar to those of the 2015 crop, and the average grade is U.S. No. 1 Dark Northern Spring (DNS). Of Eastern and Western samples, 95% and 89%, respectively, are U.S. No. 1. The crop averages 61.6 lb/bu (81 kg/hl) test weight, 0.1% damage and 85% vitreous kernels (DHV). More than 78% of the crop exceeds 60 lb/bu (78.9 kg/hl) test weight. The Western crop averages 90% DHV, well above recent levels, but the Eastern crop has a slightly lower average of 79%. Of Western samples, 80% have sufficient DHV for the DNS subclass, compared to 51% of Eastern.

Protein averages 14.1% overall (12% mb), equal to 2015 and near the 5-year average of 14.2%. Protein averages 14.1% in both regions, but the Western average is slightly below 2015 and the 5-year average, while Eastern is slightly above. Protein distributions show 55% of the Western crop and 50% of the Eastern is above 14%. Just 17% of the Western crop and 7% of the Eastern fall below 13% protein (12% mb).

Kernel moisture is low, averaging 12.1%, as most areas benefited from dry harvest conditions. Western moisture averaged 11.2% and Eastern 12.9%. Mostly dry harvest conditions also secured a sound crop, with an average falling number of 378 sec. More than 90% of the samples were above 300 sec. Late, heavy rains in the north reduced falling numbers in isolated areas.

The crop's overall DON average is less than 0.5 ppm. Only 2% of samples, mainly from far northern areas, had DON values exceeding 1.0 ppm.

FLOUR, DOUGH AND BAKING DATA:

Buhler Laboratory milling yield averaged 66.8%, slightly below 2015 and the 5-year average. Western flour yields are slightly higher compared to 2015, but Eastern are slightly lower. Flour ash of 0.49% is slightly lower than 2015 and the 5-year average. Wet gluten averaged 33.6%, slightly lower than 2015 and the 5-year average with a more significant decline in the Western region. Amylograph values average 667 BU for 65 g of flour, slightly lower than 685 in 2015, but higher than 618 for the 5-year average.

Overall, 2016 HRS exhibits stronger dough properties and greater water absorption compared with recent crops, with somewhat stronger values across the Eastern region. Average farinograph stability is 12.2 min, up from 9.5 in 2015 and 11.2 for the 5-year average. Western averages 10.3 min, higher than 9.7 in 2015, but slightly lower than the 5-year average of 11.2. The average Eastern stability is 14.2 min, much stronger than 9.3 in 2015 and 5-year average. Growing season environment and variety shifts are both contributing factors. Average farinograph absorption value is 63%, up from 62.2% in 2015, but slightly lower than the 5-year average. Western absorption averages 63.4% and Eastern 62.4%. Across both regions, stability and absorption value increase with protein content.

Dough properties as measured by the extensograph show greater resistance and less extensibility compared with 2015 and the 5-year average. The average alveograph W-value is 394 (10^{-4} J), compared with 312 in 2015 and the 5-year average of 348. The P/L ratio fell to 0.6, compared to 0.7 in 2015.

Baking evaluation indicates average bake absorption of 69.3%, higher than 2015 and the 5-year average. The overall average loaf volume of 986 cm^3 is also higher than the 974 cm^3 of 2015. Western loaf volume averages 1010 cm^3 compared with the Eastern average of 959 cm^3. Overall crop shows better functionality, making for a stronger dough that will require adjustments for end users. Western bread scores are slightly improved, compared to 2015, but Eastern are slightly lower.

SUMMARY:

The 2016 crop provides buyers with many positive attributes including high grades and protein levels, minimal DON, and good functional performance overall, especially for dough strength, absorption and bake quality. Differences in growing season environments created some variance in protein levels and functional performance among growing regions, but key parameters such as dough stability, absorption and loaf volume all tend to improve with protein content in 2016. Buyers can buy with confidence, but diligent contract specifications are still the best way to get the quality demanded.

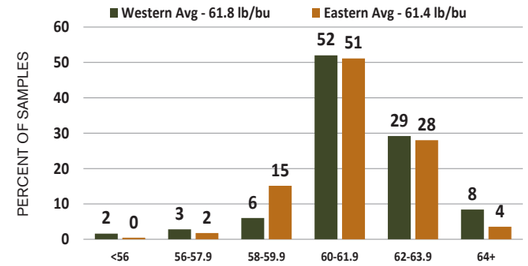
EXPORT CARGO SURVEY

The export cargo data represents 469 individual sublot samples provided by USDA's FGIS for crop years 2015 (collected from October 2015 through June 2016) and 2014. Of 249 2015-crop samples, 154 were from the PNW, 51 from Gulf ports and 44 from Great Lakes ports. Grade data are the official grades on the individual sublots. NDSU conducted the milling and baking analyses.

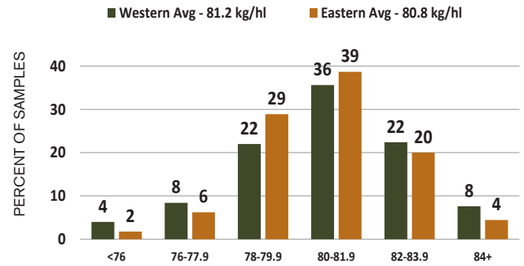
SEVEN STATES SURVEYED

Idaho • Minnesota • Montana
North Dakota • Oregon
South Dakota • Washington

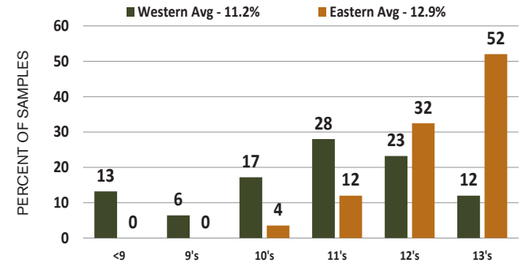
TEST WEIGHT | Pounds/Bushel



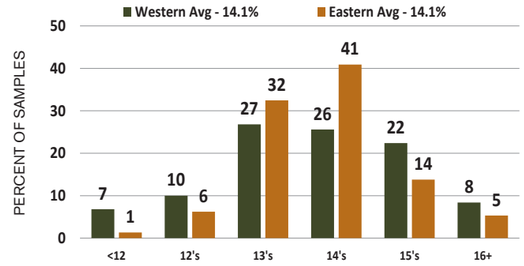
HECTOLITER WEIGHT | Kilograms/Hectoliter



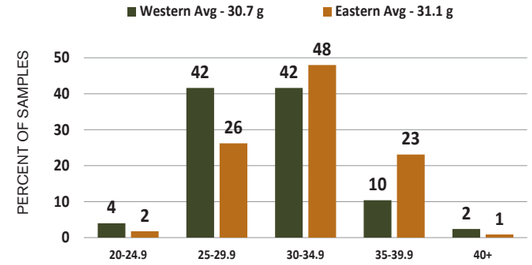
WHEAT MOISTURE | Percent



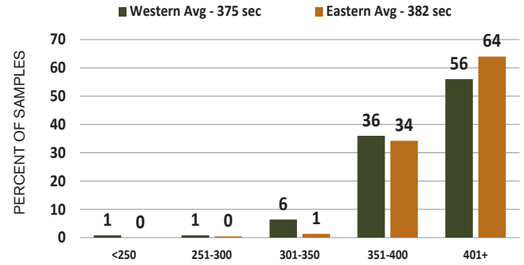
PROTEIN (12% MB) | Percent



1000 KERNEL WEIGHT | Grams



FALLING NUMBER | Seconds



HARD RED SPRING

HARVEST DATA

HARD RED SPRING	COMPOSITE AVERAGE					
	2016 BY PROTEIN*				2015	5-YEAR
	Low	Med	High	Overall	Overall	Average
WHEAT GRADE DATA:						
Test Weight (lb/bu)	62.1	61.6	61.3	61.6	61.6	61.4
(kg/hl)	81.7	81.0	80.6	81.0	81.1	80.8
Damaged Kernels (%)	0.0	0.2	0.1	0.1	0.3	0.2
Foreign Material (%)	0.0	0.0	0.0	0.0	0.0	0.0
Shrunken & Broken (%)	0.9	0.7	0.9	0.8	1.0	1.1
Total Defects (%)	0.9	0.9	1.1	1.0	1.4	1.3
Vitreous Kernels (%)	77	83	92	85	77	70
Grade	1 DNS	1 DNS	1 DNS	1 DNS	1 DNS	1 NS
WHEAT NON-GRADE DATA:						
Dockage (%)	0.5	0.4	0.6	0.5	0.6	0.6
Moisture (%)	12.0	12.2	11.9	12.0	12.0	12.1
Protein (%) 12%/0% moisture basis	12.7/14.4	14.0/15.9	15.3/17.4	14.1/16.0	14.1/16.0	14.2/16.1
Ash (%) 14%/0% moisture basis	1.48/1.73	1.52/1.77	1.51/1.75	1.50/1.75	1.51/1.75	1.56/1.81
1000 Kernel Weight (g)	31.3	31.6	29.8	30.9	31.7	30.2
Kernel Size (%) lg/md/sm	47/50/3	45/52/3	37/59/4	43/54/3	48/50/2	44/52/4
Single Kernel: Hardness	77	80	77	78	83	84
Weight (mg)	33.7	32.8	30.3	32.1	32.8	32.4
Diameter (mm)	2.40	2.39	2.23	2.34	2.36	2.36
Sedimentation (cc)	59.8	65.1	66.8	64.3	62.2	61.5
Falling Number (sec)	370	380	382	378	371	379
DON (ppm)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
FLOUR DATA:						
Lab Mill Extraction (%)	67.9	66.9	65.9	66.8	67.5	68.1
Color: L*	91.1	90.9	90.8	90.9	90.4	90.7
a*	-1.1	-1.1	-1.1	-1.1	-1.2	-1.1
b*	9.3	9.5	9.9	9.6	9.8	9.4
Protein (%) 14%/0% moisture basis	11.7/13.7	12.9/15.0	14.1/16.4	13.0/15.1	13.0/15.1	13.0/15.1
Ash (%) 14%/0% moisture basis	0.48/0.56	0.49/0.57	0.51/0.59	0.49/0.57	0.52/0.60	0.51/0.60
Wet Gluten (%)	29.1	32.8	37.7	33.6	34.3	34.8
Gluten Index	96	96	92	94	88	91
Falling Number (sec)	386	391	397	392	384	395
Amylograph Viscosity: 65g (BU)	693	694	619	667	685	618
Starch Damage (%)	7.5	7.3	6.6	7.1	6.9	7.4
SRC: GPI	0.64	0.67	0.68	0.66	0.69	0.66
Water / 50% Sucrose	68/117	69/118	69/118	69/118	69/119	75/128
5% Lactic Acid / 5% Na_2CO_3	137/100	145/99	147/97	144/98	135/93	150/103
DOUGH PROPERTIES:						
Farinograph: Peak Time (min)	7.2	8.1	8.7	8.1	7.1	7.0
Stability (min)	10.5	12.3	13.3	12.2	9.5	11.2
Absorption (%)	61.7	62.8	64.1	63.0	62.2	63.4
Alveograph: P (mm)	82	83	84	83	81	91
L (mm)	131	143	144	140	113	115
P/L Ratio	0.63	0.58	0.58	0.59	0.71	0.79
W (10^{-4} joules)	361	397	414	394	312	348
Extensograph: Resistance (BU)	506/920	531/981	529/1087	524/1003	442/783	432/662
(45/135 min) Extensibility (cm)	15.7/11.5	17.0/12.2	16.6/12.0	16.5/11.9	16.9/13.5	17.0/15.0
Area (cm^2)	103/141	118/155	111/168	112/156	97/140	96/127
BAKING EVALUATION:						
Pan Bread: Bake Absorption (%)	67.6	69.5	70.2	69.3	67.7	65.8
Crumb Grain and Texture (1-10)	7.7	7.7	8.2	7.9	7.9	8.0
Loaf Volume (cc)	890	1002	1040	986	974	971
PRODUCTION OF 7 STATES (%):	**26**	**38**	**36**	**100**		

*Protein Range: Low, <13.5%; Med, 13.5 - 14.5%; High, >14.5%.

HARD RED SPRING

HARVEST DATA

	WESTERN REGIONAL AVERAGE						EASTERN REGIONAL AVERAGE					
	2016 BY PROTEIN*				2015	5-YEAR	2016 BY PROTEIN*				2015	5-YEAR
	Low	Med	High	Overall	Overall	Average	Low	Med	High	Overall	Overall	Average
	62.3	61.9	61.3	61.8	61.4	61.2	61.9	61.3	61.3	61.4	61.9	61.6
	81.9	81.4	80.6	81.2	80.7	80.5	81.4	80.6	80.6	80.8	81.4	81.0
	0.0	0.2	0.0	0.1	0.3	0.1	0.1	0.2	0.3	0.2	0.4	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
	1.1	1.0	1.2	1.1	1.5	1.5	0.6	0.5	0.6	0.6	0.6	0.8
	1.1	1.2	1.2	1.2	1.8	1.6	0.7	0.7	0.9	0.8	1.0	1.1
	87	88	94	90	79	74	64	79	90	79	74	67
	1 DNS	1 DNS	1 DNS	1 DNS	1 DNS	1 NS	1 NS	1 DNS	1 DNS	1 DNS	1 NS	1 NS
	0.7	0.6	0.7	0.7	0.6	0.7	0.3	0.3	0.5	0.4	0.5	0.5
	11.2	11.3	11.2	11.2	11.5	11.3	13.0	13.0	12.7	12.9	12.5	12.8
	12.4/14.0	14.1/16.0	15.5/17.6	14.1/16.0	14.3/16.2	14.3/16.3	13.1/14.8	14.0/15.9	15.1/17.1	14.1/16.1	13.9/15.8	14.0/15.9
	1.48/1.73	1.53/1.78	1.51/1.76	1.51/1.75	1.51/1.76	1.55/1.80	1.49/1.73	1.51/1.76	1.50/1.74	1.50/1.75	1.50/1.75	1.57/1.82
	30.9	31.8	29.6	30.7	31.7	29.8	31.8	31.5	30.0	31.1	31.6	30.7
	42/55/3	39/57/4	34/62/4	38/58/4	41/57/2	38/59/4	55/43/2	50/48/2	41/55/4	48/49/3	55/43/2	50/47/3
	77	80	74	77	82	83	77	80	82	80	83	84
	32.7	32.5	29.9	31.6	32.4	32.3	35.0	33.0	30.9	32.8	33.2	32.4
	2.35	2.33	2.19	2.28	2.32	2.35	2.48	2.44	2.29	2.40	2.41	2.37
	61.4	65.8	67.9	65.3	64.3	63.4	57.7	64.5	65.5	63.3	60.0	59.7
	368	383	373	375	370	374	373	378	394	382	371	384
	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	68.2	67.4	66.1	67.1	66.6	67.2	67.6	66.5	65.7	66.5	68.3	68.8
	91.2	90.9	90.8	91.0	90.6	90.9	91.0	90.9	90.7	90.9	90.3	90.6
	-1.2	-1.2	-1.1	-1.2	-1.2	-1.1	-1.0	-1.0	-1.1	-1.1	-1.1	-1.0
	9.5	9.7	9.9	9.7	10.0	9.5	9.0	9.4	9.9	9.5	9.6	9.2
	11.7/13.6	13.0/15.1	14.3/16.6	13.1/15.3	13.1/15.3	13.2/15.3	11.8/13.7	12.8/14.9	13.9/16.2	12.9/15.0	12.9/15.0	12.9/15.0
	0.45/0.52	0.50/0.58	0.53/0.62	0.50/0.58	0.51/0.59	0.50/0.58	0.53/0.62	0.48/0.56	0.48/0.56	0.49/0.57	0.53/0.61	0.53/0.61
	29.0	33.2	38.3	33.9	35.1	35.5	29.4	32.6	36.8	33.2	33.6	34.1
	94	94	90	92	85	89	98	97	94	96	91	93
	393	401	395	396	384	397	377	384	400	387	385	393
	671	712	598	656	676	625	724	679	646	679	695	616
	7.5	7.3	6.4	7.0	6.7	7.2	7.5	7.2	6.9	7.2	7.1	7.6
	0.61	0.66	0.68	0.65	0.70	0.65	0.67	0.68	0.69	0.68	0.69	0.68
	69/119	69/119	70/119	69/119	69/119	74/130	67/114	68/117	69/116	68/116	69/119	75/126
	135/102	145/101	147/98	143/100	136/93	153/109	141/96	144/97	147/97	144/96	134/94	147/97
	6.9	8.2	8.7	8.0	7.4	7.3	7.5	8.1	8.7	8.2	6.9	6.7
	8.3	10.1	12.1	10.3	9.7	11.2	13.6	14.1	14.9	14.2	9.3	11.2
	62.1	63.3	64.6	63.4	62.6	63.5	61.1	62.4	63.4	62.4	61.8	63.2
	82	80	83	82	84	91	83	86	86	85	78	90
	131	144	144	140	111	117	131	142	145	140	115	112
	0.63	0.56	0.58	0.58	0.75	0.78	0.64	0.61	0.59	0.61	0.68	0.80
	350	373	401	377	315	352	377	417	430	412	309	344
	449/917	478/1024	507/1117	481/1028	422/760	426/659	584/925	574/947	557/1048	571/975	464/807	438/665
	15.2/10.8	16.7/10.8	16.2/11.4	16.1/11.0	17.0/13.6	17.2/15.0	16.3/12.5	17.3/13.3	17.0/12.7	17.0/12.9	16.8/13.3	16.8/14.9
	89/134	104/141	104/165	100/148	93/138	96/128	122/151	130/166	121/171	125/164	101/142	96/126
	68.7	70.2	71.3	70.2	67.8	66.1	66.1	68.9	68.9	68.2	67.7	65.5
	7.5	8.0	8.3	8.0	7.8	8.0	8.0	7.5	8.0	7.8	8.1	8.1
	898	1035	1075	1010	957	970	878	975	995	959	992	971
	15	**17**	**20**	**52**			**11**	**21**	**16**	**48**		

*Protein Range: Low, <13.5%; Med, 13.5 - 14.5%; High, >14.5%.

HARD RED SPRING

EXPORT CARGO DATA

HARD RED SPRING	PNW AVERAGE		GREAT LAKES AVERAGE		GULF AVERAGE	
	2015	2014	2015	2014	2015	2014
WHEAT GRADE DATA:						
Test Weight (lb/bu)	61.9	61.3	62.2	62.0	62.0	61.9
(kg/hl)	81.5	80.6	81.8	81.5	81.6	81.4
Damaged Kernels (%)	0.5	0.5	1.6	1.6	1.2	1.3
Foreign Material (%)	0.1	0.1	0.1	0.1	0.1	0.1
Shrunken & Broken (%)	1.3	1.1	0.8	0.8	0.8	0.8
Total Defects (%)	1.8	1.7	2.5	2.5	2.1	2.2
Vitreous Kernels (%)	71	59	41	33	53	46
Grade	1 NS	1 NS	1 NS	1 NS	1 NS	1 NS
WHEAT NON-GRADE DATA:						
Dockage (%)	0.3	0.3	0.5	0.5	0.6	0.7
Moisture (%)	10.4	11.4	11.2	12.0	11.2	12.2
Protein (%) 12%/0% moisture basis	14.0/15.9	14.0/15.9	13.7/15.6	13.5/15.3	13.5/15.4	13.4/15.2
Ash (%) 14%/0% moisture basis	1.60/1.87	1.54/1.79	1.57/1.83	1.56/1.82	1.57/1.83	1.55/1.80
1000 Kernel Weight (g)	31.0	32.2	32.6	33.5	33.1	33.3
Kernel Size (%) lg/md/sm	41/56/3	47/49/3	58/40/2	60/38/2	58/39/2	60/39/2
Single Kernel: Hardness						
Weight (mg)						
Diameter (mm)						
Sedimentation (cc)						
Falling Number (sec)	404	356	369	347	398	370
DON (ppm)		<0.5		0.9		1.3
FLOUR DATA:						
Lab Mill Extraction (%)	69.6	71.1	70.9	71.1	70.2	71.4
Color: L*	90.2	89.8	90.1	89.7	90.3	89.7
a*	-1.1	-1.0	-0.9	-1.0	-0.9	-0.9
b*	9.6	9.5	9.3	9.3	9.1	9.1
Protein (%) 14%/0% moisture basis	13.9/16.2	13.1/15.3	13.4/15.5	12.7/14.7	13.3/15.5	12.5/14.6
Ash (%) 14%/0% moisture basis	0.55/0.64	0.58/0.68	0.55/0.64	0.59/0.68	0.55/0.64	0.58/0.67
Wet Gluten (%)	35.0	34.3	34.1	32.5	33.0	31.3
Gluten Index	78	89	85	92	85	94
Falling Number (sec)	455	409	412	383	444	403
Amylograph Viscosity: 65g (BU)	578	484	476	416	548	510
Starch Damage (%)						
SRC: GPI						
Water / 50% Sucrose						
5% Lactic Acid / 5% Na_2CO_3						
DOUGH PROPERTIES:						
Farinograph: Peak Time (min)	7.1	6.4	7.3	6.0	7.6	6.1
Stability (min)	8.6	8.4	9.4	8.7	10.5	9.5
Absorption (%)	62.72	62.14	62.39	62.00	61.27	61.41
Alveograph: P (mm)	79	80	76	84	78	83
L (mm)	127	122	122	119	122	114
P/L Ratio	0.62	0.65	0.63	0.71	0.65	0.73
W (10^{-4} joules)	315	309	303	327	320	321
Extensograph: Resistance (BU)						
(45/135 min) Extensibility (cm)						
Area (cm^2)						
BAKING EVALUATION:						
Pan Bread: Bake Absorption (%)	69.9	70.4	69.0	70.2	68.2	70.0
Crumb Grain and Texture (1-10)	7.6	7.4	7.7	7.7	7.7	7.6
Loaf Volume (cc)	988	1009	979	979	963	977
SAMPLE COUNT	**154**	**134**	**44**	**48**	**51**	**38**

HARD RED SPRING PRODUCTION

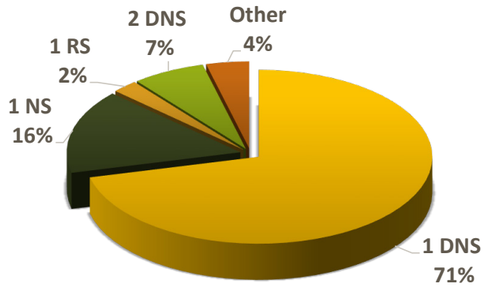
for the major producing states (million metric tons)

	2016	2015	2014	2013	2012
Idaho	0.4	0.4	0.4	0.5	0.5
Minnesota	2.0	2.3	1.8	1.8	2.0
Montana	2.1	2.1	2.9	2.8	2.6
North Dakota	7.3	8.7	8.0	6.4	7.0
Oregon	0.0	0.0	0.0	0.1	0.1
South Dakota	1.3	1.6	1.9	1.4	1.1
Washington	0.3	0.2	0.2	0.3	0.4
Seven-State Total	**13.4**	**15.4**	**15.1**	**13.3**	**13.7**
Total HRS Production	**13.4**	**15.4**	**15.1**	**13.4**	**13.7**

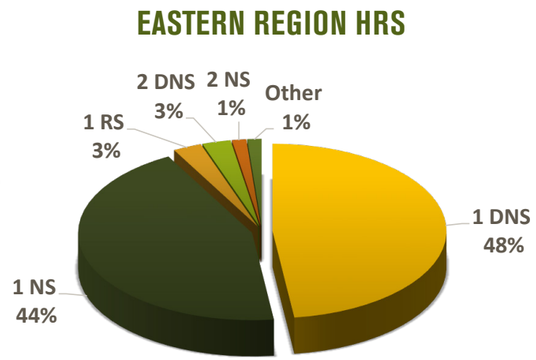
Based on USDA crop estimates as of September 30, 2016.

HRS GRADE DISTRIBUTIONS

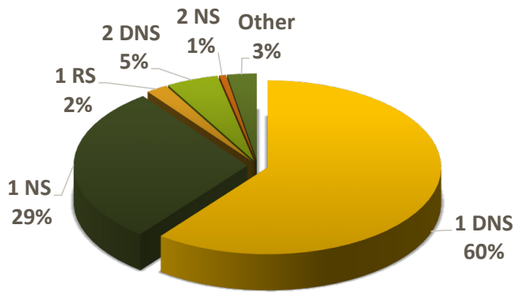
WESTERN REGION HRS



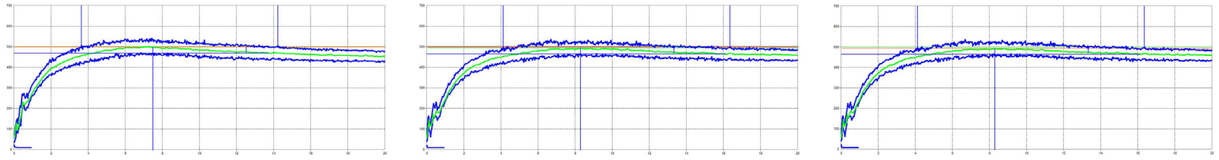
EASTERN REGION HRS



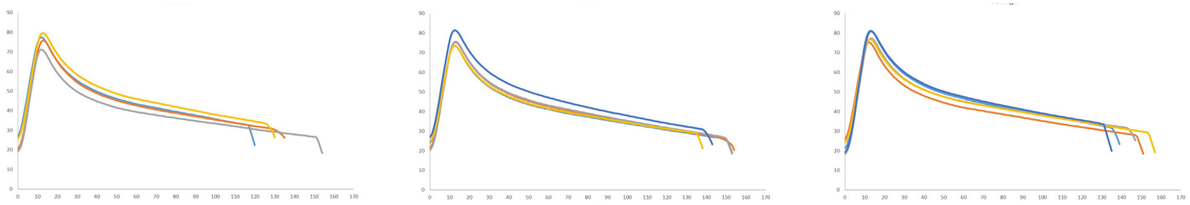
OVERALL



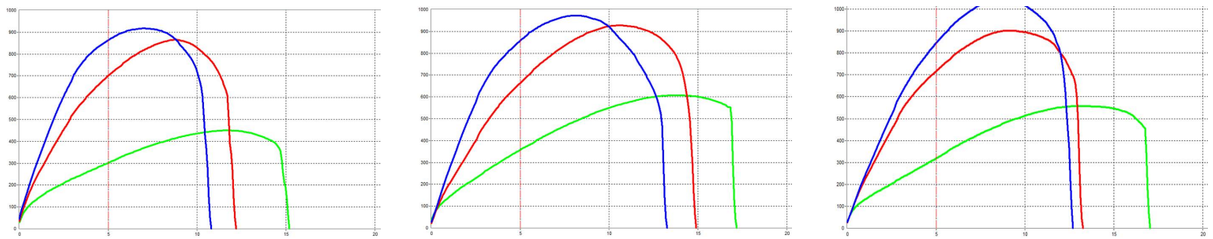
FARINOGRAMS*



ALVEOGRAMS



EXTENSOGRAMS



LOW PROTEIN | MEDIUM PROTEIN | HIGH PROTEIN

*Representing 2016 Composite Average

ABOUT HARD RED SPRING WHEAT

Highest protein content, hard endosperm, red bran, strong gluten, high water absorption. Used in pan breads, hearth breads, rolls, croissants, bagels, hamburger buns, pizza crust and for blending.

Croissants

HARD WHITE

OVERVIEW

HARVEST SURVEY

The 2016 hard white (HW) crop was grown primarily in Kansas, Colorado, Idaho, Nebraska and California. Other states such as Washington, Montana, North Dakota and South Dakota had limited production. USDA estimates 2016 HW production at 900,000 MT, up from 2015's 580,000 MT.

SURVEY METHODS:

The HW survey samples represent diverse growing conditions and were collected by state and private grain inspection agencies; commercial wheat handlers; Plains Grains, Inc. of Stillwater, OK; and state wheat commissions. The Federal Grain Inspection Service (FGIS) graded the samples. The Wheat Marketing Center (WMC), Portland, OR, performed all other tests. HW samples were made into six composites based on three growing regions (Pacific Northwest or PNW, California and Southern Plains) and three protein levels (<11.5%, 11.5 to 12.5%, and 12.5 to 13.5%). Wheat, flour and end-product methods are described in the Analysis Methods section of this booklet.

WHEAT AND GRADE DATA:

All composites are U.S. No. 1. Test weights range from 61.6 to 65.0 lb/bu (81.0 to 85.4 kg/hl). The ranges of other wheat quality parameters are: dockage from 0.1% to 0.9%, wheat moisture from 8.1% to 11.6%, protein from 9.9% to 13.3% (12% mb) and ash from 1.39% to 1.58% (14% mb). The thousand kernel weights (TKW) of PNW medium- and high-protein composites and California low- and high-protein composites are 30.3 g or higher, while the TKW of Southern Plains low- and medium-protein composites are 28.2 g and 26.4 g, respectively. Kernel hardness values are 70.0 to 75.5 and kernel diameters 2.54 to 3.00 mm. Falling number values are 352 sec or higher for all composites, indicating sound grain.

FLOUR, DOUGH AND BAKING DATA:

Buhler Laboratory mill straightgrade flour extractions range from 68.5% to 72.0%, L* values (whiteness) from 91.8 to 92.5, flour protein from 8.8% to 12.1% (14% mb) and flour ash from 0.42% to 0.48% (14% mb). These values are within historical ranges of HW flours.

Flour wet gluten values range from 21.7% to 35.3% depending on flour protein.

Amylograph peak viscosities are between 647 and 1105 BU, which indicate good starch pasting properties suitable for Asian noodle application. Starch damage values range from 5.0% to 7.3%. SRC lactic acid values are 122% to 160%, indicating medium to strong gluten strength.

Farinograph absorptions range from 58.5% to 70.5% and stability times from 5.8 to 21.0 min, exhibiting typically medium to strong dough characteristics of HW. HW farinograph water absorption is usually between that of HRW and HRS depending on protein content, but stability time is longer indicating more tolerance to overmixing. The California low-protein composite had an unusually short stability time of 5.8 min this year. The ranges of alveograph values are: 79 to 145 mm for P values; 60 to 113 mm for L values; and 179 to 527 (10^{-4} J) for W values. Extensograph data at 135 min resting show that resistance is in the range of 308 to 964 BU, extensibility from 10.9 to 17.2 cm and area from 65 to 137 cm^2.

Most samples show fairly good baking performance relative to protein content with bake absorptions in the range of 63.5% to 75.3%, loaf volumes of 737 to 887 cm^3 and crumb grain and texture scores of 5.0 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). For Chinese raw noodles, the L* values at time of production (0 hr) and after 24 hours of storage at room temperature are acceptable for all samples except for the PNW high-protein composite, which has a L* 24-hr value of 71.1 (72 is the minimum acceptable value at 24 hr). The sensory color stability score for the California high-protein composite is lower than the others. Cooked noodle texture is generally softer for all samples this year, probably due to higher starch pasting viscosities, but springiness and cohesiveness values are similar to or higher than last year. For Chinese wet noodles, sensory color stability scores are acceptable for all samples. Similar to Chinese raw noodles, the cooked noodle hardness values of all Chinese wet noodles are generally softer than last year, but still indicate acceptable texture. Overall, this year's HW should have acceptable color and texture when patent flour is used; noodle texture is softer but more elastic.

STEAMED BREAD EVALUATION:

HW flours were evaluated for Asian steamed breads in comparison with a control flour. Results show that most samples are acceptable for steamed breads except for the California high-protein composite, the total product score of which is low. The specific volumes are similar for all samples. Blending 10-25% of soft white (SW) flour with high protein HW flour would improve overall steamed bread quality.

SUMMARY:

HW 2016 production is estimated at 900,000 MT, up significantly from last year. Samples show good quality performance in milling, dough rheological properties and end products, including pan breads, Asian noodles and steamed breads. For Asian noodle applications, most samples have good noodle color and color stability in both raw noodle and wet noodle. Some samples have high starch pasting viscosities and are quite suitable for flour blending to improve noodle surface smoothness and springiness. For steamed breads, it is recommended that high protein HW flour be blended with a small portion of SW flour to avoid steamed bread shrinkage and improve product quality.

HARD WHITE PRODUCTION

for the major producing states (million metric tons)

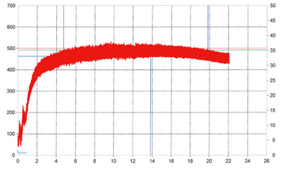
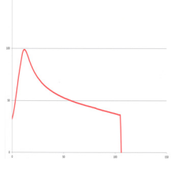
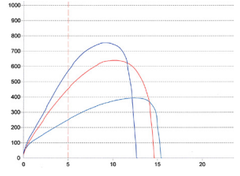
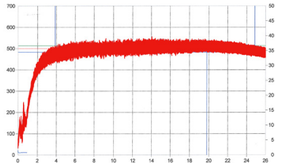
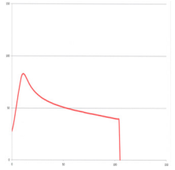
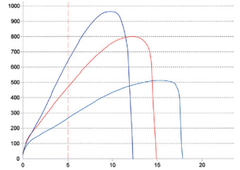
	2016	2015	2014	2013	2012
California	0.02	0.02	0.03	0.06	0.06
Colorado	0.20	0.12	0.12	0.06	0.05
Idaho	0.20	0.14	0.21	0.21	0.26
Kansas	0.38	0.26	0.13	0.17	0.21
Nebraska	0.08	0.04	0.02	0.00	0.00
Total 5-State Production	**0.88**	**0.58**	**0.51**	**0.50**	**0.58**
Total HW Production	**0.90**	**0.58**	**0.56**	**0.59**	**0.61**

Based on USDA crop estimates as of September 30, 2016.

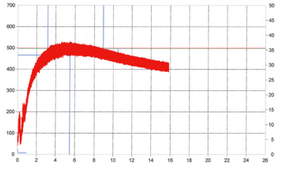
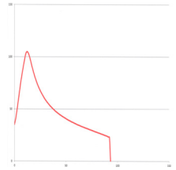
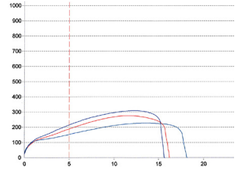
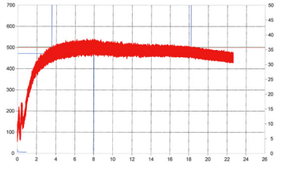
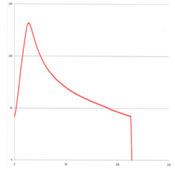
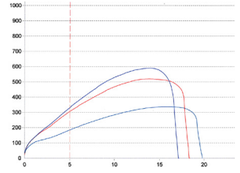
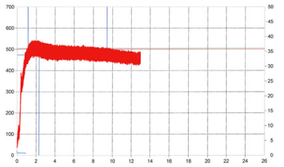
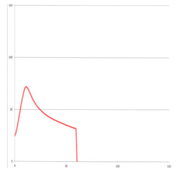
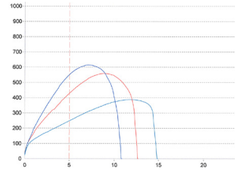
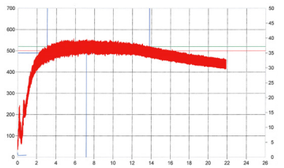
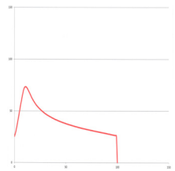
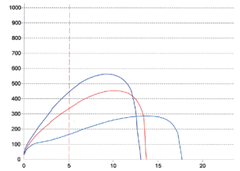
FIVE STATES SURVEYED

California • Colorado • Idaho

Kansas • Nebraska

	FARINOGRAMS	ALVEOGRAMS	EXTENSOGRAMS
PNW MEDIUM			
PNW HIGH			


Flat Bread

	FARINOGRAMS	ALVEOGRAMS	EXTENSOGRAMS
CALIFORNIA LOW			
CALIFORNIA HIGH			
SOUTHERN PLAINS LOW			
SOUTHERN PLAINS MEDIUM			

HARD WHITE

HARVEST DATA

HARD WHITE	PACIFIC NORTHWEST 2016 BY PROTEIN*		CALIFORNIA 2016 BY PROTEIN*		SOUTHERN PLAINS 2016 BY PROTEIN*	
	Med	High	Low	High	Low	Med
WHEAT GRADE DATA:						
Test Weight (lb/bu)	63.7	62.3	65.0	64.6	62.8	61.6
(kg/hl)	83.7	81.9	85.4	84.9	82.6	81.0
Damaged Kernels (%)	0.0	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 (%)	0.5	0.9	0.2	0.3	1.1	0.8
Total Defects (%)	0.5	1.0	0.2	0.3	1.1	0.8
Grade	1 HW	1 HW	1 HW	1 HW	1 HW	1 HW
WHEAT NON-GRADE DATA:						
Dockage (%)	0.1	0.5	0.2	0.9	0.4	0.5
Moisture (%)	8.9	9.2	9.1	8.2	11.6	10.9
Protein (%) 12%/0% moisture basis	11.9/13.5	13.3/15.1	11.4/13.0	13.0/14.8	9.9/11.2	12.1/13.7
Ash (%) 14%/0% moisture basis	1.49/1.73	1.52/1.77	1.51/1.76	1.58/1.84	1.39/1.62	1.40/1.63
1000 Kernel Weight (g)	34.3	30.3	40.1	40.6	28.2	26.4
Kernel Size (%) lg/md/sm	90/10/0	78/21/1	92/8/0	93/7/0	70/29/1	61/38/1
Single Kernel: Hardness	70.0	70.4	75.5	72.6	75.2	73.3
Weight (mg)	38.7	33.9	39.3	42.1	30.1	30.5
Diameter (mm)	2.87	2.66	2.92	3.00	2.59	2.54
Sedimentation (cc)	42.9	52.8	25.7	29.7	29.0	29.3
Falling Number (sec)	354	352	374	444	431	465
FLOUR DATA:						
Lab Mill Extraction (%)	71.9	71.3	72.0	68.5	70.5	70.3
Color: L*	92.5	91.9	91.9	91.8	92.3	92.2
a*	-1.8	-1.9	-1.8	-1.5	-2.1	-2.1
b*	7.2	7.0	7.6	6.7	8.1	8.6
Protein (%) 14%/0% moisture basis	11.3/13.1	12.1/14.1	10.5/12.2	12.1/14.1	8.8/10.2	10.9/12.7
Ash (%) 14%/0% moisture basis	0.45/0.52	0.46/0.53	0.47/0.55	0.48/0.56	0.44/0.51	0.42/0.49
Wet Gluten (%)	28.8	35.3	27.5	31.0	21.7	26.3
Gluten Index	97	89	88	95	95	85
Falling Number (sec)	364	386	409	421	389	466
Amylograph Viscosity 65 g (BU)	884	1105	647	734	1041	962
Starch Damage (%)	6.3	5.5	7.3	6.6	5.3	5.0
SRC: GPI	0.67	0.76	0.61	0.75	0.70	0.77
Water/50% Sucrose	62/116	64/123	67/107	65/109	63/108	60/104
5% Lactic Acid/5% Na_2CO_3	136/86	160/87	122/92	147/87	134/84	139/77
DOUGH PROPERTIES:						
Farinograph: Peak Time (min)	13.8	19.8	5.5	8.0	2.6	7.2
Stability (min)	15.1	21.0	5.8	14.7	8.3	10.7
Absorption (%)	61.8	61.8	67.2	70.5	58.5	60.3
Alveograph: P (mm)	109	91	115	145	79	81
L (mm)	106	104	93	113	60	100
P/L Ratio	1.03	0.88	1.24	1.28	1.32	0.81
W (10^{-4} joules)	383	358	301	527	179	266
Extensograph: Resistance (BU)	393/754	511/964	226/308	335/589	387/614	286/563
(45/135 min) Extensibility (cm)	15.5/12.8	17.8/12.4	18.2/15.8	19.8/17.2	15.0/10.9	17.8/13.2
Area (cm^2)	77/118	112/137	57/65	86/124	73/84	65/95
BAKING EVALUATION:						
Pan Bread: Bake Absorption (%)	66.6	67.0	72.3	75.3	63.5	65.1
Crumb Grain and Texture	7.0	6.5	6.8	6.5	5.0	6.3
Loaf Volume (cc)	878	887	737	783	766	826

*Protein Range: Low, <11.5%; Medium, 11.5 to 12.5%; High, 12.6 to 13.5%.

HARD WHITE

HARVEST DATA

HARD WHITE	PACIFIC NORTHWEST 2016 BY PROTEIN*		CALIFORNIA 2016 BY PROTEIN*		SOUTHERN PLAINS 2016 BY PROTEIN*	
	Med	High	Low	High	Low	Med
CHINESE RAW NOODLE-MAKING QUALITY:						
Color at 0/24 hour: L*	85.4/74.3	84.2/71.1	84.3/72.4	84.3/72.6	86.9/78.2	84.4/73.8
a*	0.1/0.8	0.0/0.8	-0.2/0.2	0.3/1.0	-0.6/-0.5	-0.5/-0.3
b*	16.8/23.5	18.9/24.4	17.6/21.5	16.0/22.0	16.8/23.7	21.0/28.1
Change in L* (0-24 hr)	11.0	13.1	11.9	11.8	8.7	10.6
Cooking Yield (5 min, %)	116	119	123	121	121	121
Sensory Color Stability Score	7.7	6.3	6.5	5.8	9.0	7.5
Instrumental Texture:						
Firmness (g)	1046	1050	961	1035	1000	1081
Springiness (%)	96.3	93.8	95.1	93.7	94.2	94.7
Cohesiveness	0.68	0.70	0.70	0.68	0.68	0.69
Chewiness (g)	687	684	641	663	642	700
CHINESE WET NOODLE-MAKING QUALITY:						
Uncooked Color at 0/24 hour: L*	82.5/70.6	81.5/67.9	81.8/68.9	81.7/69.7	84.7/75.4	80.9/69.3
a*	-1.4/-0.8	-1.7/-0.7	-1.5/-0.8	-1.0/-0.6	-1.6/-0.9	-1.8/-0.7
b*	20.0/22.9	20.4/22.3	18.6/21.5	18.2/22.9	19.1/23.0	23.7/25.8
Change in L* (0-24 hr)	11.8	13.6	12.9	12.0	9.3	11.5
Parboiled Color at 0/24 hour: L*	78.6/79.0	77.2/77.2	77.2/77.2	78.2/78.3	79.6/80.2	79.0/79.3
a*	-2.8/-3.2	-2.6/-3.0	-2.8/-2.9	-2.6/-2.8	-3.9/-3.8	-3.5/-3.5
b*	29.5/28.3	29.7/27.8	28.3/27.3	26.8/25.7	32.3/30.9	31.3/30.4
Cooking Yield (1.5 min, %)	59	61	68	62	67	69
Uncooked Color Stability Score	7.8	6.8	6.5	6.8	8.5	7.8
Parboiled Color Stability Score	7.0	7.0	6.8	6.5	8.0	7.5
Instrumental Texture:						
Firmness (g)	766	740	703	719	769	761
Springiness (%)	94.0	93.1	95.3	95.2	94.7	94.6
Cohesiveness	0.66	0.69	0.69	0.69	0.66	0.67
Chewiness (g)	476	473	462	474	479	484
ASIAN-TYPE STEAMED BREAD EVALUATION:						
Specific Volume (ml/g)	2.6	2.3	2.5	2.2	2.4	2.4
Total Score	71.9	68.5	69.3	65.2	68.5	69.0

*Protein Range: Low, <11.5%; Medium, 11.5 to 12.5%; High, 12.6 to 13.5%.

ABOUT HARD WHITE WHEAT

Medium to high protein content, hard endosperm, white bran. Used in Asian noodles, whole wheat or high extraction flour applications, pan breads and flat breads.

Asian Noodles

DURUM
OVERVIEW

NORTHERN GREAT PLAINS

WEATHER AND HARVEST:
The 2016 northern durum crop is the largest since 2000 and 50% larger than 2015 due to record yields and a one-third increase in planted area. Planting began in mid-April, slightly ahead of normal, but progressed slowly due to cool soil temperatures. Progress accelerated in May and finished ahead of average with 95% planted by month's end.

Crop emergence and early growing conditions were favorable in all areas. Plentiful moisture in northern areas boosted yield potential early, while lack of rain affected potential yield in some southern areas. Average to above-average temperatures kept crop development ahead of normal. Disease pressures were prevalent across northern areas, and many producers applied fungicides at flowering time, but continued high humidity kept the disease threat high. Disease was largely absent in the drier southern areas.

Harvest began in early August, ahead of average, and favorable weather conditions allowed rapid progress throughout August, reaching 70% completion by early September. Progress on the final portion was slowed by periodic rains and cooler temperatures but the majority of the crop was harvested by late September.

SURVEY METHODS:
National Agricultural Statistics Service state offices collected 210 samples North Dakota (155) and Montana (55) from producers in the field, farm bins and local elevators. Analysis was conducted by the Durum Quality Lab, North Dakota State University, Fargo, ND.

WHEAT AND GRADE DATA:
The average grade is U.S. No. 1 Hard Amber Durum (HAD), and grade qualities are very similar to 2015. Eighty-six percent of the crop is U.S. No. 2 or higher. Differences in moisture and disease pressure in the last half of the growing season resulted in a range of DON levels, but the crop benefited from mostly dry conditions during harvest.

Specific kernel factors that are strong features in 2016 include an above average test weight of 61.2 lb/bu (79.7 kg/hl), average damaged kernels of just 0.4% and an average vitreous kernel content of 90%. Nearly two-thirds of the crop has test weights above 60 lb/bu (78.1 kg/hl), and more than 80% is above 75% vitreous kernels. The portion of the crop with greater than 90% vitreous kernels is slightly lower than 2015 due in part to sporadic late harvest rains and lower protein levels. Contrasting classes are higher than average in portions of the crop, as some of the increased planted area was on previous hard red spring wheat ground.

The mostly dry harvest secured a sound crop with low average moisture of just 11.4% and average falling number of 423 sec. Sixty percent of the crop is above 400 sec, and only 2% below 300 sec. Protein levels are slightly lower, as expected with a record yield, averaging 13.4% (12% mb) compared with 13.9% last year and the 5-year average of 13.6%. There is a wider than normal range of protein due to vast differences in growing season moisture across the region.

Fusarium was prevalent across most northern areas, but non-existent in other regions. The crop average DON is 1.0 ppm, similar to 2015 at 0.8 ppm and the 5-year average of 1.2 ppm. In the most affected regions, DON is a significant marketing challenge. Although many producers applied fungicides at flowering time to control fusarium, high humidity throughout kernel fill favored DON development. Lab testing of semolina from the survey samples shows very minimal DON, indicating much of the DON in the 2016 crop may be on the exterior of the kernel.

SEMOLINA AND PROCESSING DATA:
Milling performance, based on a Buhler Laboratory mill, reveals a significant jump in total extraction, averaging 73.6%, and semolina extraction, averaging 67.9%. These are both three percentage points above the 5-year averages. Part of the increase can be attributed to the replacement of all purifier screens on the lab mill. The milled product reflects higher ash of 0.71%, compared to 0.64% in 2015, and a higher speck count. Wet gluten averages 32.4%, well below 37.0% last year and 35.4% for the 5-year average. The average gluten index of 60.8% is up from 2015 and the 5-year average.

Semolina properties show very high color scores with a b* value of 30.3. Mixing properties are similar to 2015 and slightly weaker than the 5-year average. Evaluation of the cooked spaghetti reflects some impact from lower protein with lower color scores, a slight increase in cooking loss and slightly lower cooked firmness values compared to last year and the 5-year averages.

SUMMARY:
Buyers will find larger supplies but a somewhat diverse quality mix in the 2016 crop. Grade factors remain high across a broad part of the region, but protein content, vitreous kernel levels and DON are factors that vary and will have a significant impact on prices. End-use performance of the crop is strong for milling yields and semolina color, but somewhat lower than the 5-year average for cooking qualities. Buyers can buy with confidence, but diligent contract specifications will be needed for DON levels which do not always correlate with grade parameters.

DESERT DURUM®

Desert Durum® is a registered certification mark owned by the Arizona Grain Research and Promotion Council and the California Wheat Commission, which authorize use of the mark only to designate durum produced 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 of varieties possessing quality traits specific to their needs. Annual production requirements can be pre-contracted with grain merchandisers ahead of the fall-winter planting season for harvest in late May to early July. Varietal identity is maintained by experienced growers planting certified seed and merchandisers who store and ship according to customers' preferred delivery schedules.

2016 Desert Durum® production acreage was less than in 2015, due largely to lower prices available at planting time. However, weather conditions during harvest were ideal and grain quality was uniformly very good. The crop still exhibits consistently large kernels and low moisture, traits that contribute to efficient transportation costs and high extraction rates.

Desert Durum® samples were either collected by an Federal Grain Inspection Service (FGIS) licensed inspection agency or submitted by handlers to a licensed agency. The California Wheat Commission Laboratory analyzed quality performance using methods described in the Analysis Methods of this booklet.

WHEAT AND GRADE DATA:
In 2016, the Desert Durum® average grade is U.S. No. 1 HAD. Test weight averages 62.9 lb/bu (82.6 kg/hl), slightly higher than 2015. The average vitreous kernel content (HVAC) is 97%, a high average typical of Desert Durum®. Average damaged kernels are 0.2% and total defects are 0.8%. Desert Durum® is characterized by low moisture content, and this year's average is 6.8%. Protein content average is 13.9% (12% mb), higher than both 2015 and the 5-year average.

SEMOLINA AND PROCESSING DATA:
Semolina color improved in 2016. The semolina b* value is 28.6, higher than both 2015 and the 5-year average of 25.6 and 26.4, respectively. Wet gluten of 33.6% and gluten index of 76% are similar to the 5-year average values. Semolina mixograph score is 8 and alveograph W value is 230 (10^{-4} J), both of which indicate high strength. Pasta color score was 8.3, comparable to the 5-year average. Pasta cooked firmness slightly decreased this year.

SUMMARY:
The 2016 Desert Durum® crop will deliver quality consistency for buyers. Desert Durum® typical kernel characteristics of high protein content, low kernel moisture, high test weight and high vitreous kernel percentage are present in this year's crop. The 2016 crop will deliver the valuable milling, semolina, and pasta quality traits that customers have learned to expect and appreciate.

DURUM PRODUCTION
for the major producing states (million metric tons)

	2016	2015	2014	2013	2012
Arizona	0.3	0.4	0.2	0.2	0.3
California	0.1	0.2	0.1	0.2	0.4
Montana	0.9	0.5	0.4	0.5	0.4
North Dakota	1.6	1.2	0.8	0.8	1.2
Total Durum Production	**2.8**	**2.3**	**1.5**	**1.7**	**2.2**

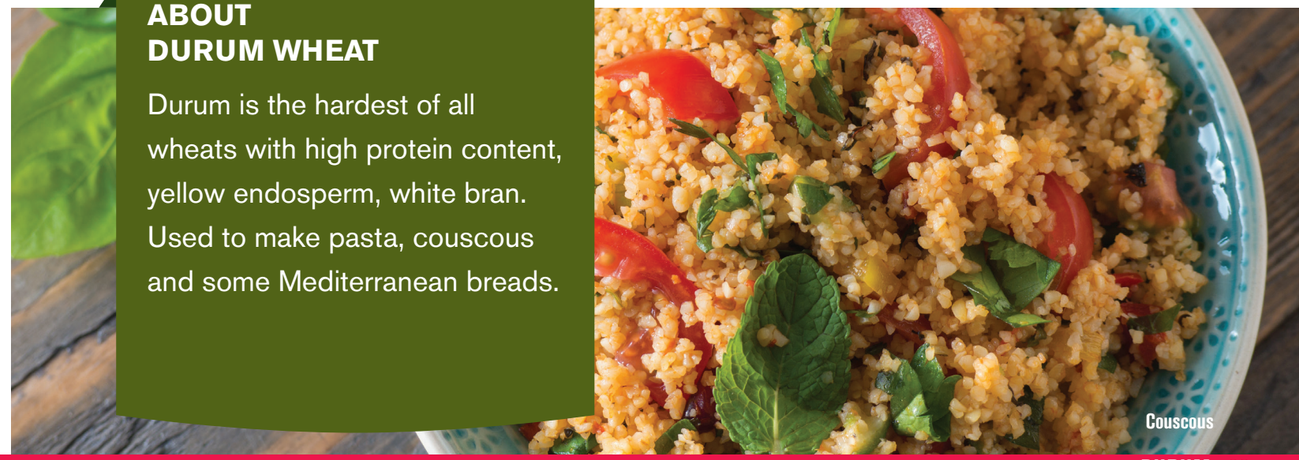
Based on USDA crop estimates as of September 30, 2016.

EXPORT CARGO SURVEY

The durum export cargo data represents 22 individual sublot samples provided by USDA's FGIS for crop year 2015 (collected from October 2015 through June 2016) and 53 samples for 2014. Grade data are the actual official grades on the individual sublots. Processing analysis was conducted by North Dakota State University.

ABOUT DURUM WHEAT

Durum is the hardest of all wheats with high protein content, yellow endosperm, white bran. Used to make pasta, couscous and some Mediterranean breads.



Couscous

DURUM

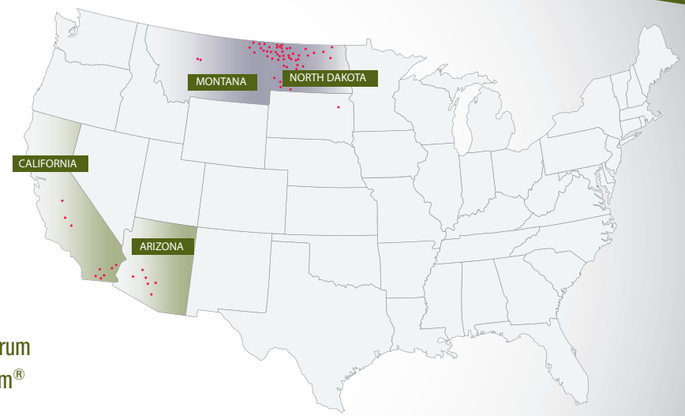
HARVEST AND EXPORT DATA

DURUM	HARVEST DATA						EXPORT CARGO DATA			
	NORTHERN DURUM			DESERT DURUM®			NORTHERN DURUM		DESERT DURUM®	
	2016	2015	5-Year Avg	2016	2015	5-Year Avg	2015	2014	2015	2014
WHEAT GRADE DATA:										
Test Weight (lb/bu)	61.2	60.6	60.2	62.9	62.4	62.7	60.6	60.0	61.5	62.0
(kg/hl)	79.7	78.9	78.3	81.9	81.3	81.8	78.9	78.1	80.1	80.7
Damaged Kernels (%)	0.4	0.3	0.4	0.2	0.4	0.2	3.2	4.3	0.8	1.1
Foreign Material (%)	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Shrunken and Broken (%)	0.8	1.0	1.1	0.4	0.7	0.5	1.4	1.4	0.7	0.6
Total Defects (%)	1.2	1.3	1.5	0.8	1.1	0.8	4.7	5.7	1.6	1.8
Contrasting Classes (%)	0.9	0.0	0.0	0.0	0.0	0.0	1.4	2.8	0.1	0.3
Vitreous Kernels (%)	90	91	85	97	92	96	69	62	92	90
Grade	1 HAD	1 HAD	1 HAD	1 HAD	1 HAD	1 HAD	2 AD	3 AD	1 HAD	1 HAD
WHEAT NON-GRADE DATA:										
Dockage (%)	0.2	0.9	1.0	0.5	0.5	0.4	0.6	0.5	0.4	0.4
Moisture (%)	11.4	11.2	11.6	6.8	7.7	6.7	11.8	12.3	7.5	6.9
Protein (%) 12%/0% moisture basis	13.4/15.2	13.9/15.8	13.6/15.5	13.9/15.8	14.0/15.9	13.6/15.5	13.5/15.3	13.2/15.0	13.7/15.5	13.8/15.6
Ash (%) 14%/0% moisture basis	1.61/1.87	1.57/1.83	1.61/1.87	1.76/2.04	1.71/1.99	1.74/2.03	1.64/1.90	1.63/1.90	1.64/1.91	1.68/1.95
1000 Kernel Weight (g)	40.0	38.5	38.9	49.6	53.0	48.4	39.1	39.9	46.9	48.6
Kernel Size (%) lg/md/sm	52/44/4	46/51/3	51/44/5	91/9/0	92/8/0	90/10/0	51/45/4	47/51/2	74/23/2	78/21/1
Falling Number (sec)	423	414	370	612	565	517	377	275	1414	1177
Sedimentation (cc)	54	62	52	65	64	64				
DON (ppm)	1.0	0.8	1.2					1.4		0.6
SEMOLINA DATA:										
Lab Mill Extraction (%)	73.6	70.6	70.1	76.0	76.0	75.2	72.2	70.6	72.1	71.8
Semolina Extraction (%)[1]	67.9	65.1	64.5	61.9	63.0	62.1	65.9	63.7	66.9	66.3
Color: L*	84.3	84.4	84.6	85.3	87.5	87.2	84.3	84.4	84.2	84.4
a*	-2.8	-3.1	-3.2	-3.2	-1.5	-2.1	-2.7	-2.8	-2.3	-2.9
b*	30.3	30.1	29.0	28.6	25.6	26.4	27.8	26.8	24.9	27.6
Protein (%) 14%/0% moisture basis	12.6/14.7	12.7/14.8	12.6/14.7	12.9/15.0	13.0/15.1	12.7/14.7	12.3/14.3	12.0/14.0	12.2/14.1	12.4/14.4
Ash (%) 14%/0% moisture basis	0.71/0.83	0.64/0.74	0.67/0.78	0.87/1.02	0.86/1.00	0.88/1.02	0.74/0.86	0.69/0.81	0.72/0.84	0.65/0.76
Specks (no/10 sq in)	30	24	26	25	24	19	29	28	26	24
Wet Gluten (%)	32.4	37.0	35.4	33.2	34.6	33.6				
Gluten Index	61	50	53	76	75	79	56	48	81	78
Mixograph: Classification	5.1	5.1	5.4	8.0	8.0		5.6	5.4	8.0	7.6
Peak Time (min)	2.8	2.2		4.5	2.7		2.9	2.8	3.4	3.0
Peak Height (MU)	6.2	5.9		6.5	7.2		5.8	5.3	6.0	5.8
Alveograph: P (mm)	45	49	47	107	104	108				
L (mm)	121	91	109	65	55	60				
P/L Ratio	0.4	0.6	0.5	1.7	1.9	1.8				
W (10^{-4} joules)	136	129	129	230	223	228				
SPAGHETTI PROCESSING DATA:										
Color Score	8.5	8.9	9.0	8.3	7.6	8.3	8.4	8.0	8.4	8.6
Cooked Weight (g)	31.0	31.0	31.5	29.3	29.0	29.4	31.0	31.4	30.4	30.5
Cooking Loss (%)	6.3	5.8	6.2	5.6	5.8	6.3	6.4	6.3	6.3	5.9
Cooked Firmness (g cm)	4.2	4.4	4.6	6.4	6.8	7.0	3.9	3.9	4.3	4.7
SAMPLE COUNT:							14	36	8	17

NOTE: Semolina extraction values for Desert Durum® and Northern Durum cannot be compared since they were milled using different laboratory mills. In contrast, milling data for the Durum Export Cargo samples can be compared since these samples were milled on the same mill.

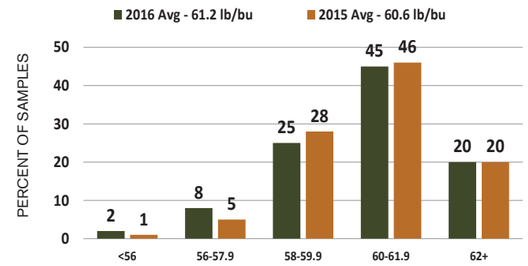
FOUR STATES SURVEYED

Arizona • California
Montana • North Dakota

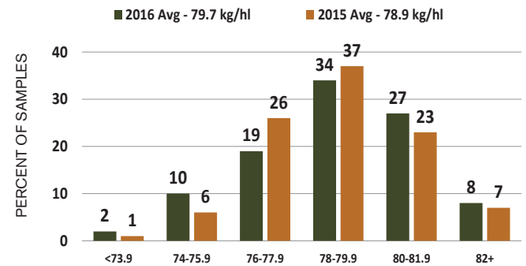


NORTHERN DURUM DISTRIBUTIONS

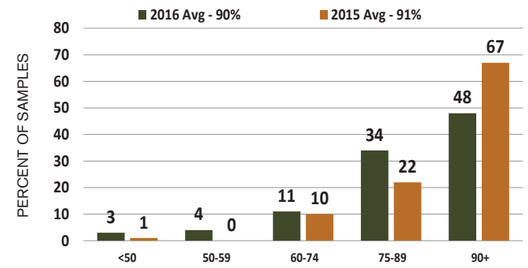
TEST WEIGHT | Pounds/Bushel



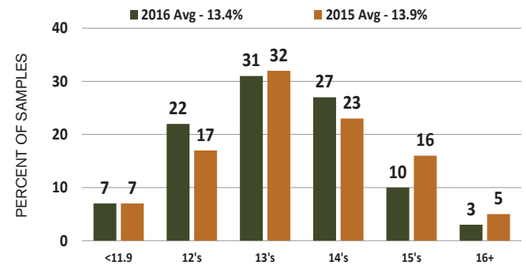
HECTOLITER WEIGHT | Kilograms/Hectoliter



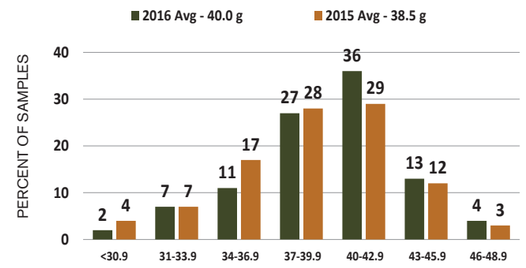
VITREOUS KERNELS | Percent



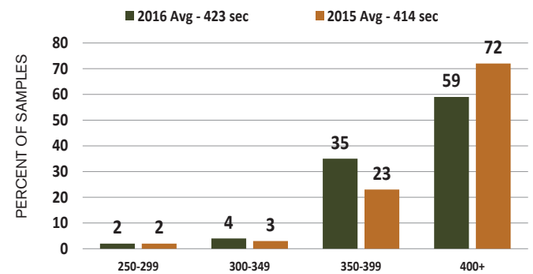
PROTEIN (12% MB) | Percent



1000 KERNEL WEIGHT | Grams



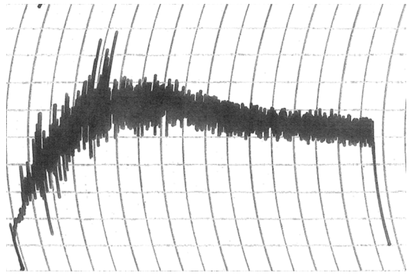
FALLING NUMBER | Seconds

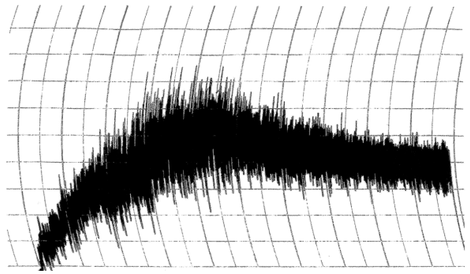


NORTHERN DURUM REGIONAL AVERAGE

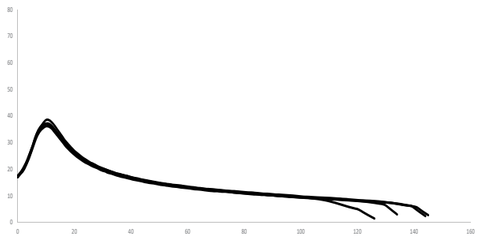
DESERT DURUM® REGIONAL AVERAGE

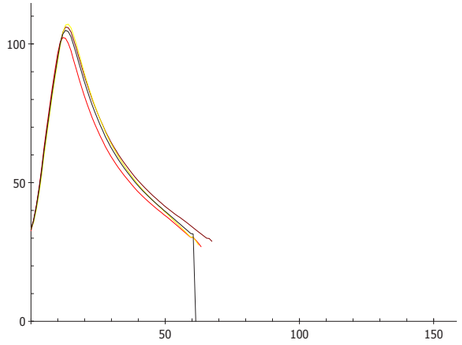
MIXOGRAMS



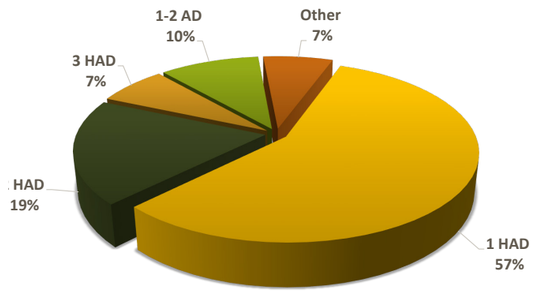


ALVEOGRAMS





NORTHERN DURUM GRADE DISTRIBUTION



SOFT WHITE

OVERVIEW

HARVEST SURVEY

WEATHER AND HARVEST:

The Pacific Northwest (PNW) had limited to adequate soil moisture at planting. Rainfall was short to adequate over most of the production area during late winter and early spring. Later spring conditions were generally dry and warm. Isolated rains occurred in early summer in some areas. Conditions at harvest were mainly hot and dry.

SURVEY METHODS:

A total of 402 soft white (SW) and 66 white club (WC) wheat survey samples were collected from state, private grain inspection agencies and commercial wheat handling operations. USDA's Federal Grain Inspection Service (FGIS) graded and tested wheat protein content on the samples. For further testing, three composite samples were made according to protein contents (<9.0%, 9.0 to 10.5%, and >10.5%) and one composite of all WC samples. Wheat and flour quality testing and data analyses were conducted by the Wheat Marketing Center (WMC), Portland, OR, using the methods described in the Analysis Methods section of this booklet. U.S. Wheat Associates (USW), the wheat commissions of Idaho, Oregon, and Washington, and many other wheat industry organizations supported this program.

WHEAT AND GRADE DATA:

The average test weight for the 2016 SW crop of 60.8 lb/bu (80.0 kg/hl) is greater than last year's average of 59.3 lb/bu (78.0 kg/hl), and WC test weight of 60.8 lb/bu (80.0 kg/hl) is greater than last year's average at 58.3 lb/bu (76.8 kg/hl). Shrunken and broken kernel percentages are lower for SW and WC than last year and the 5-year averages. Other FGIS grading factors for SW and WC are similar to last year and the 5-year averages. SW and WC dockage averages are the same as last year and similar to the 5-year averages. Wheat moisture content for SW increased to 9.8% from 8.9% last year, and WC moisture content increased to 9.6% from 8.0% last year.

SW wheat protein content at 10.1% (12% mb) is lower than last year and the 5-year averages. WC protein at 9.9% (12% mb) is significantly lower than last year at 11.7% and the 5-year average of 10.4%. SW and WC wheat ash contents (14% mb) are lower than last year and the 5-year averages. Thousand kernel weight for SW and WC are heavier than last year and 5-year averages. Both SW and WC kernel diameters are larger than last year, but smaller than the 5-year averages. Falling number values are 314 sec for SW and 301 sec for WC.

FLOUR, DOUGH AND BAKING DATA:

The 2016 SW crop Buhler Laboratory mill flour extraction of 75.0% is higher than last year and similar to the 5-year average, and WC extraction is much higher at 77.2% than last year's 70.8%. Flour protein contents (14% mb) are 8.9% and 8.8% for SW and WC, respectively. Flour ash contents (14% mb) for both SW and WC are lower than last year and the 5-year averages. Flour falling number values are 358 sec for SW and 325 sec for WC. Amylograph peak viscosity values are 393 BU for SW and 298 BU for WC, much lower than last year and the 5-year averages. Starch damage values are similar for SW and higher for WC than last year and the 5-year averages. The solvent retention capacity (SRC) water values for SW and WC are lower than last year and the 5-year averages; SRC sucrose and lactic acid values are lower than last year and the same as 5-year averages; and SRC sodium carbonate and SRC gluten performance index (GPI) values are similar to last year and the 5-year averages. Farinograph peak and stability times show SW has slightly weaker gluten properties than last year but is similar to the 5-year averages. WC farinograph data show similar gluten characteristics to last year and the 5-year averages. SW has a lower average alveograph L value than last year and the 5-year average. The WC alveograph L value is longer than last year and similar to the 5-year average. Extensograph resistance and extensibility values for SW and WC are shorter than last year and the 5-year averages. Sponge cake volume for SW of 1184 cm^3 is smaller than last year and the 5-year average, but the total score is higher than last year and the 5-year average. The WC sponge cake volume of 1233 cm^3 is smaller than last year and similar to the 5-year average, and total score is higher than last year and the 5-year average. SW and WC cookie diameter values are smaller 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 with control flour. Specific volumes are less for SW and WC than last year and the 5-year averages. Total scores for SW and WC are lower than last year and the 5-year averages.

SUMMARY:

The 2016 PNW SW wheat crop is generally characterized by having higher than average test weight, lower than average protein content, greater than average kernel size and weight, less than average falling number value and acceptable finished product characteristics. This year's WC crop quality characteristics follow the same trends as SW. The high protein segment of the SW crop provides opportunities in blends for Asian noodles, steamed breads, flat breads and pan breads.

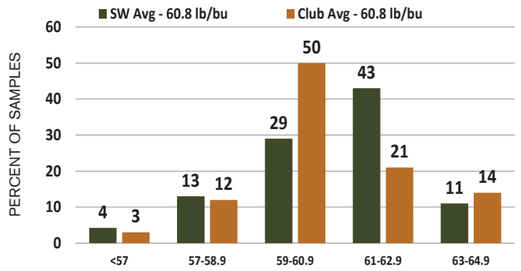
EXPORT CARGO SURVEY

The PNW SW export cargo data show the results of analyses of individual sublot samples including 90 drawn from the 2014 crop and 60 from the 2015 crop (August 2015 through May 2016). Representative samples are selected from official FGIS samples. Grade data are the actual grades on the individual sublots. WMC conducted milling and processing analyses.

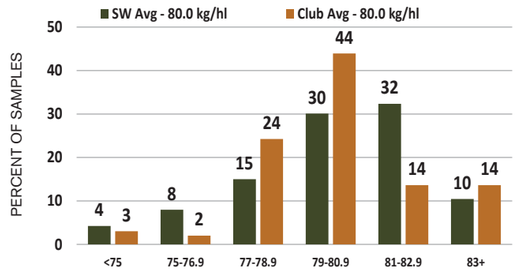
THREE STATES SURVEYED

Idaho • Oregon • Washington

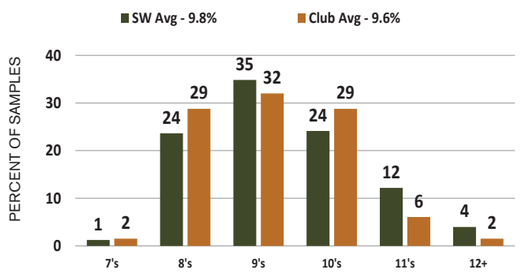
TEST WEIGHT | Pounds/Bushel



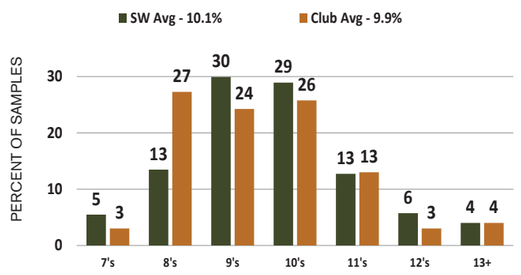
HECTOLITER WEIGHT | Kilograms/Hectoliter



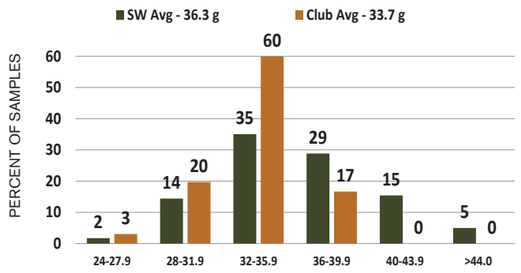
WHEAT MOISTURE | Percent



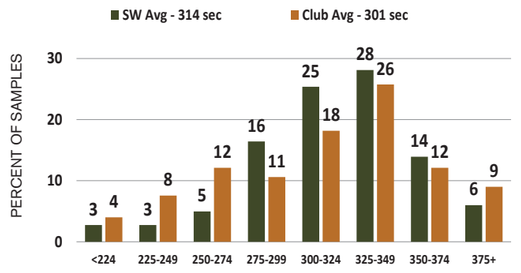
PROTEIN (12% MB) | Percent



1000 KERNEL WEIGHT | Grams



FALLING NUMBER | Seconds



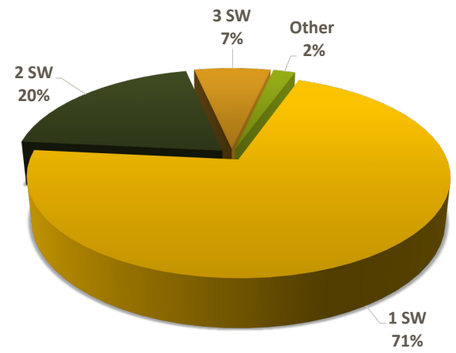
PACIFIC NORTHWEST SOFT WHITE WHEAT PRODUCTION

for the major producing states (million metric tons)

	2016		2015		2014		2013		2012	
	SW	CLUB	SW	CLUB	SW	CLUB	SW	CLUB	SW	CLUB
Washington	3.1	0.4	2.3	0.2	2.2	0.2	2.9	0.3	2.5	0.4
Oregon	1.0	0.0	1.0	0.0	1.1	0.0	1.3	0.0	1.4	0.0
Idaho	1.7	0.0	1.5	0.0	1.6	0.0	1.7	0.0	1.5	0.0
Three-State Total	**5.8**	**0.5**	**4.7**	**0.3**	**4.9**	**0.2**	**5.9**	**0.3**	**5.4**	**0.5**
Three-State Total Soft White Wheat	**6.2**		**4.9**		**5.1**		**6.2**		**5.9**	
Total US Soft White Wheat	**6.9**		**5.4**		**5.5**		**6.7**		**6.5**	

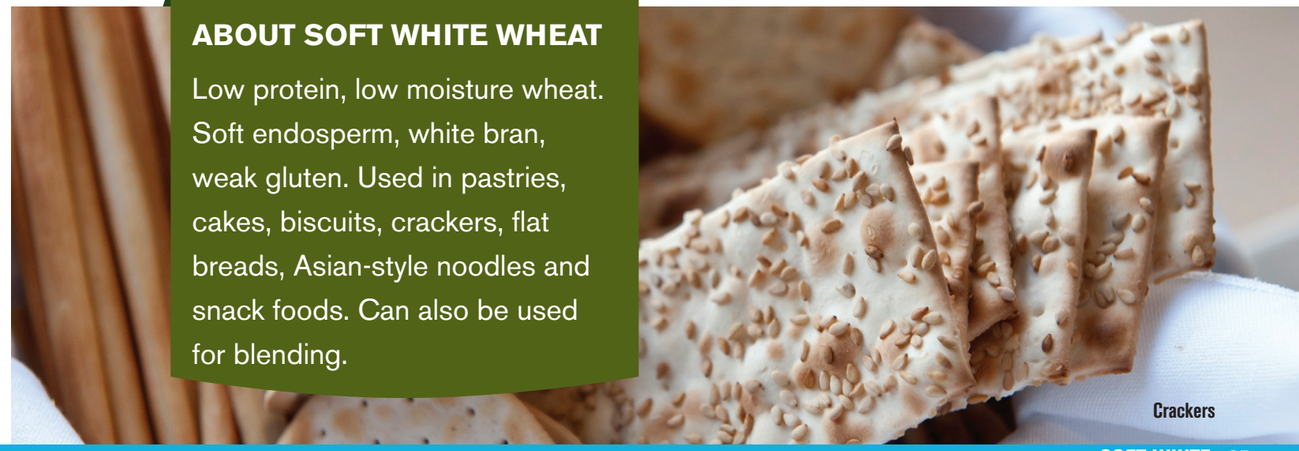
Based on USDA crop estimates as of September 30, 2016.

SW GRADE DISTRIBUTION



ABOUT SOFT WHITE WHEAT

Low protein, low moisture wheat. Soft endosperm, white bran, weak gluten. Used in pastries, cakes, biscuits, crackers, flat breads, Asian-style noodles and snack foods. Can also be used for blending.



Crackers

SOFT WHITE

HARVEST DATA

SOFT WHITE	2016 SOFT WHITE BY PROTEIN*				CLUB	2015		5-YEAR AVERAGE	
	Low	Med	High	Overall	AVERAGE	SW	Club	SW	Club
WHEAT GRADE DATA:									
Test Weight (lb/bu)	60.6	61.4	60.2	60.8	60.8	59.3	58.3	60.6	60.3
(kg/hl)	79.7	80.7	79.2	80.0	80.0	78.0	76.8	79.7	79.3
Damaged Kernels (%)	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Foreign Material (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1
Shrunken & Broken (%)	0.6	0.5	0.7	0.6	0.8	1.0	2.3	0.7	1.2
Total Defects (%)	0.6	0.5	0.7	0.6	0.9	1.1	2.4	0.8	1.3
Grade	1 SW	1 SW	1 SW	1 SW	1 WC	2 SW	1 WC	1 SW	1 WC
WHEAT NON-GRADE DATA:									
Dockage (%)	0.6	0.5	0.6	0.6	0.8	0.6	0.8	0.5	0.7
Moisture (%)	10.2	9.7	9.7	9.8	9.6	8.9	8.0	9.3	8.8
Protein (%) 12%/0% moisture basis	8.3/9.4	9.8/11.1	11.6/13.2	10.1/11.4	9.9/11.3	10.9/12.3	11.7/13.3	10.2/11.6	10.4/11.9
Ash (%) 14%/0% moisture basis	1.35/1.57	1.36/1.58	1.30/1.52	1.34/1.56	1.18/1.37	1.41/1.64	1.39/1.61	1.36/1.58	1.29/1.49
1000 Kernel Weight (g)	37.8	36.7	33.9	36.3	33.7	30.8	25.7	34.6	31.6
Kernel Size (%) lg/md/sm	90/9/1	88/11/1	84/15/1	88/11/1	77/22/1	74/25/1	54/44/2	83/16/1	75/24/1
Single Kernel: Hardness	27.2	32.3	34.6	31.1	34.5	32.4	37.0	32.8	33.9
Weight (mg)	38.1	37.3	34.5	36.6	33.2	34.3	29.1	37.7	33.9
Diameter (mm)	2.76	2.70	2.64	2.69	2.57	2.63	2.40	2.75	2.58
Sedimentation (cc)	11.3	13.7	20.0	15.2	11.6	17.9	13.7	16.3	11.7
Falling Number (sec)	304	317	327	314	301	354	363	336	327
FLOUR DATA:									
Lab Mill Extraction (%)	75.5	75.3	74.2	75.0	77.2	72.6	70.8	75.1	75.2
Color: L*	92.1	91.8	91.9	91.9	91.6	92.3	92.2	92.1	92.0
a*	-2.0	-2.0	-1.9	-1.9	-1.9	-2.4	-2.2	-2.4	-2.3
b*	7.0	7.1	7.0	7.0	6.9	7.7	7.3	8.0	7.6
Protein (%) 14%/0% moisture basis	7.4/8.6	8.6/10.0	10.3/12.0	8.9/10.3	8.8/10.2	9.5/11.0	10.1/11.7	9.0/10.7	9.3/10.9
Ash (%) 14%/0% moisture basis	0.41/0.48	0.38/0.44	0.38/0.44	0.39/0.45	0.35/0.41	0.50/0.58	0.49/0.57	0.51/0.59	0.49/0.57
Wet Gluten (%)	20.7	22.7	26.9	23.6	15.8	26.0	25.1	23.4	22.7
Gluten Index	66	56	56	58	63	63	41	63	45
Falling Number (sec)	339	344	393	358	325	397	417	368	361
Amylograph Viscosity 65 g (BU)	399	412	359	393	298	629	647	515	491
Starch Damage (%)	4.8	4.6	4.1	4.5	4.7	4.6	4.2	4.5	3.8
SRC: GPI	0.53	0.57	0.61	0.57	0.49	0.61	0.49	0.56	0.49
Water/50% Sucrose	50/100	54/99	53/110	53/103	50/96	59/110	53/100	57/103	54/95
5% Lactic Acid/5% Na_2CO_3	94/76	102/79	115/79	104/78	82/73	115/77	85/75	104/81	83/76
DOUGH PROPERTIES:									
Farinograph: Peak Time (min)	1.2	3.0	2.7	2.4	1.6	3.3	2.0	2.2	1.6
Stability (min)	2.7	3.3	2.1	2.8	1.5	3.1	1.3	2.8	1.5
Absorption (%)	52.2	53.3	54.6	53.8	52.8	54.2	53.6	53.9	52.6
Alveograph: P (mm)	36	39	36	37	26	43	31	40	28
L (mm)	80	104	136	90	80	97	65	109	81
P/L Ratio	0.45	0.38	0.26	0.41	0.33	0.44	0.48	0.38	0.36
W (10^{-4} joules)	74	95	114	85	45	118	53	100	50
Extensograph: Resistance (BU)	145	148	187	161	74	195	90	173	93
(45 min) Extensibility (cm)	16.0	17.3	20.5	16.8	16.8	19.5	18.9	18.0	17.5
Area (cm^2)	36	39	57	41	18	57	26	47	24
BAKING EVALUATION:									
Sponge Cake: Volume (cc)	1205	1152	1224	1184	1233	1266	1267	1227	1232
Score	55	46	46	48	49	44	39	47	48
Cookie: Diameter (cm)	8.6	8.3	8.3	8.4	8.5	8.6	8.8	8.6	8.9
Spread Ratio (width/height)	9.0	8.3	8.1	8.3	9.1	9.9	11.0	9.9	11.2
Pan Bread: Bake Absorption (%)[1]			59.4						
Crumb Grain and Texture (1-10)[1]			4.8						
Loaf Volume (cc)[1]			714						
CHINESE SOUTHERN-TYPE STEAMED BREAD EVALUATION:									
Specific Volume (ml/g)	1.9	1.9	1.9	1.9	2.1	2.2	2.4	2.1	2.3
Total Score	66.9	67.9	68.0	67.7	64.8	67.8	65.8	68.2	66.0
PRODUCTION OF 3 STATES (%)	**19**	**50**	**31**	**100**	**100**	**100**	**100**	**100**	**100**

*Protein Range: Low, <9.0%; Medium, 9.0 - 10.5%; High, >10.5%.

[1]Bread Bake for High Protein SW only

SOFT WHITE

EXPORT CARGO DATA

SOFT WHITE	EXPORT CARGO DATA	
	2015	2014
WHEAT GRADE DATA:		
Test Weight (lb/bu)	60.8	61.2
(kg/hl)	80.0	80.5
Damaged Kernels (%)	0.2	0.1
Foreign Material (%)	0.1	0.1
Shrunken & Broken (%)	1.4	0.9
Total Defects (%)	1.6	1.1
Grade	1 SW	1 SW
WHEAT NON-GRADE DATA:		
Dockage (%)	0.3	0.3
Moisture (%)	8.8	8.9
Protein (%) 12%/0% moisture basis	10.8/12.3	10.5/11.9
Ash (%) 14%/0% moisture basis	1.37/1.59	1.28/1.49
1000 Kernel Weight (g)	33.5	36.2
Kernel Size (%) lg/md/sm	73/26/1	81/18/0
Single Kernel: Hardness		
Weight (mg)		
Diameter (mm)		
Sedimentation (cc)	16.8	16.1
Falling Number (sec)	366	366
FLOUR DATA:		
Lab Mill Extraction (%)	71.9	72.2
Color: L*	92.4	92.4
a*	-1.8	-2.1
b*	7.4	7.3
Protein (%) 14%/0% moisture basis	9.3/10.8	8.9/10.3
Ash (%) 14%/0% moisture basis	0.45/0.52	0.42/0.49
Wet Gluten (%)	25.1	24.6
Gluten Index	66	64
Falling Number (sec)	385	381
Amylograph Viscosity 65 g (BU)	550	467
Starch Damage (%)		
SRC: GPI		
Water/50% Sucrose		
5% Lactic Acid/5% Na_2CO_3		
DOUGH PROPERTIES:		
Farinograph: Peak Time (min)	2.4	2.6
Stability (min)	3.5	3.2
Absorption (%)	52.4	53.2
Alveograph: P (mm)	40	42
L (mm)	102	87
P/L Ratio	0.39	0.48
W (10^{-4} joules)	109	103
Extensograph: Resistance (BU)		
(45 min) Extensibility (cm)		
Area (cm^2)		
BAKING EVALUATION:		
Sponge Cake: Volume (cc)	1236	1191
Score	40	46
Cookie: Diameter (cm)	8.4	8.6
Spread Factor (width/height)		
Pan Bread: Bake Absorption (%)[1]		
Crumb Grain and Texture (1-10)[1]		
Loaf Volume (cc)[1]		
CHINESE SOUTHERN-TYPE STEAMED BREAD EVALU		
Specific Volume (ml/g)		
Total Score		
SAMPLE COUNT:	**60**	**90**

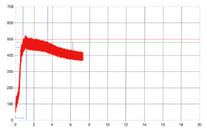
Pastries

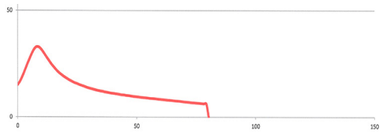
FARINOGRAMS*

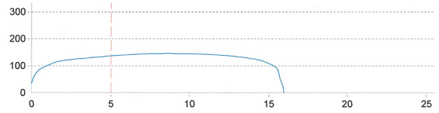
ALVEOGRAMS

EXTENSOGRAMS

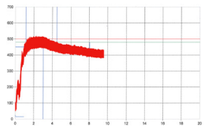
LOW PROTEIN

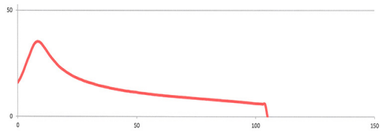


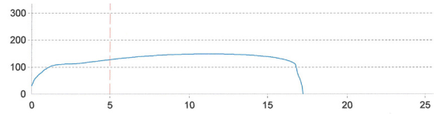




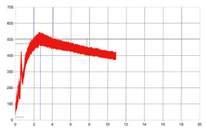
MEDIUM PROTEIN

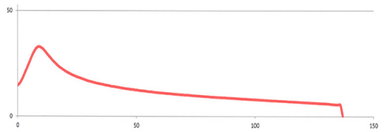


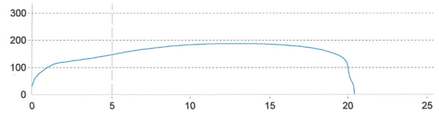




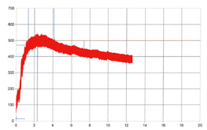
HIGH PROTEIN

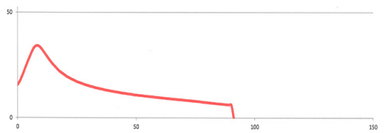


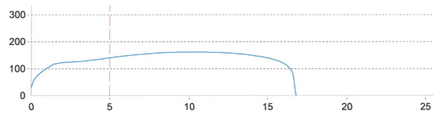




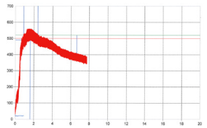
AVERAGE PROTEIN

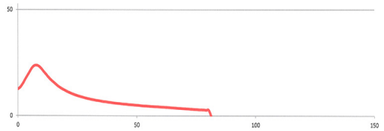


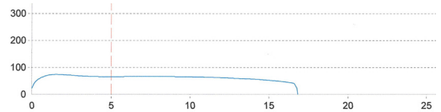




CLUB







*Representing 2016 Composite Average

SOFT RED WINTER

OVERVIEW

HARVEST SURVEY

WEATHER AND HARVEST:

Soft red winter wheat (SRW) grows over a wide area of the eastern United States. USDA estimates the area seeded to SRW in fall 2015 for the 2016 harvest at 6.6 million acres (2.7 million hectares), down from 7.1 million acres (3.0 million hectares) seeded in 2014 and below the 5-year average. However, the estimate for average yield per harvested acre is up from the previous two years. The 2016 SRW production, estimated at 9.4 million metric tons (MMT), is down 0.4 MMT from the 2015 crop and below the 5-year average. Winter temperatures were generally mild, and much of the SRW growing area received ample to excessive moisture throughout the spring months. The rain benefited yields and quality in some states, but had adverse effects in others. The start of SRW harvest was also delayed by rain but harvest generally progressed rapidly once fields dried enough for it to begin.

SURVEY METHODS:

Great Plains Analytical Laboratory in Kansas City, MO, collected 484 samples for analysis from elevators in 18 reporting areas across nine states. Samples were collected at two different times, reflecting early and late harvest in all areas except Arkansas where the small planted area and limited production resulted in just one sampling per area this year. Test weight, moisture, protein, thousand kernel weight, wheat ash and falling number were determined on all individual samples, and the remaining tests were determined on 33 composite samples. The results were weighted by the estimated production for each reporting area and combined into "Composite Average", "East Coast" and "Gulf Port" values. Gulf Port states include Arkansas, Illinois, Indiana, Kentucky, Missouri and Ohio and account for 79% of the 2016 SRW production in the states surveyed. East Coast states include Maryland, North Carolina and Virginia and represent the remaining 21% of production in the states surveyed. The states surveyed account for an estimated 64% of total SRW 2016 production.

WHEAT AND GRADE DATA:

When weighted by production, the overall average grade of the samples collected for the 2016 SRW harvest survey is U.S. No. 2. The overall weighted average test weight is 58.6 lb/bu (77.2 kg/hl) similar to the 5-year average and well above the 56.9 lb/bu (75.0 kg/hl) average in 2015. The Gulf Port average of 59.3 lb/bu (78.0 kg/hl) is well above 2015 and the 5-year average, reflecting the favorable growing conditions in most of the Gulf tributary states. The East Coast test weight average of 56.0 lb/bu (73.8 kg/hl) reflects poorer growing conditions in Maryland, Virginia and especially North Carolina. Other Gulf Port grade factors, moisture and dockage are more favorable than the 5-year averages while the East Coast grade factors are similar to or slightly poorer than previous values. The overall average wheat protein content of 9.4% (12% mb) is below last year and the 5-year average. The Gulf Port protein average of 9.1% is well below previous values, while the East Coast average of 10.4% is above 2015 and the 5-year average. Sedimentation and wet gluten show similar relationships with the overall and Gulf Port averages below last year and the 5-year averages and the 2016 East Coast values above last year and the 5-year averages. The overall average falling number of 330 sec is well above 2015 and the 5-year average and indicates little sprout damage in the crop. Only a few samples had a falling number below 300 sec in 2016. The overall DON average of 0.6 parts per million (ppm) is well below the 2015 value of 2.2 ppm and the 5-year average of 1.4 ppm, indicating the crop sampled is relatively free of DON. The Gulf Port DON value of 0.5 ppm is also well below last year and the 5-year average while the East Coast value of 1.1 ppm is somewhat above both.

FLOUR, DOUGH AND BAKING DATA:

Buhler Laboratory mill flour extraction averages are below the 5-year averages overall and for both East Coast and Gulf Port states. Farinograph peak, stability and absorption values are similar to 5-year averages. Alveograph P values are similar to 5-year averages, and the L and W values are higher than the 5-year averages. The overall and Gulf Port cookie spread ratios are higher than last year and the 5-year average while the East Coast ratio is similar to past values. The overall, Gulf Port and East Coast average loaf volumes are above last year and the 5-year averages.

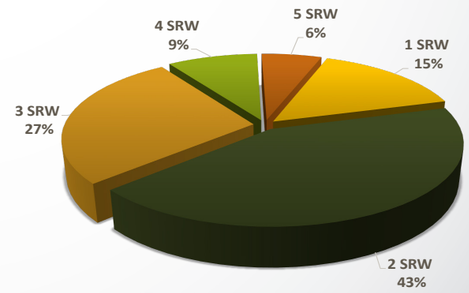
SUMMARY:

The mild winter and wet growing season affected the SRW growing area in different ways. Gulf Port states generally benefitted from very good growing conditions and had high test weights and low protein while excessively wet conditions in eastern states affected quality and caused much lower test weights in some areas. However, the entire crop in the states sampled is largely free of sprout damage, and the overall and Gulf Ports DON values are well below last year and the 5-year averages. Buyers are encouraged to review quality specifications to ensure their purchases meet their expectations.

EXPORT CARGO SURVEY

Export data represents 185 sublot samples for crop years 2016 and 2015 from Gulf of Mexico and East Coast ports. The Federal Grain Inspection Service (FGIS) selected the samples and reported grades on the sublots. Great Plains Analytical Laboratory conducted the milling and baking analyses.

SRW GRADE DISTRIBUTION*

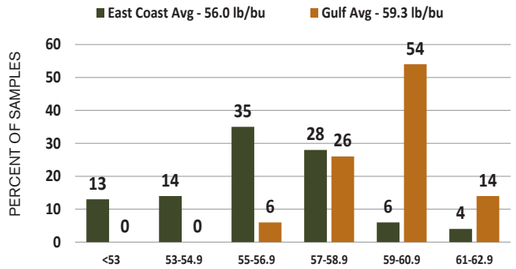


*Based on 33 composite samples.

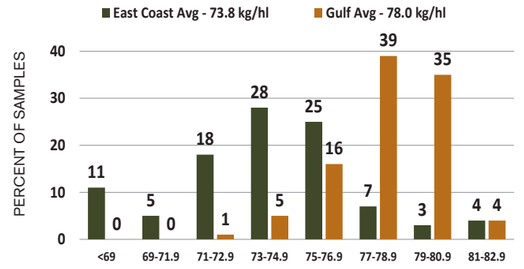
NINE STATES SURVEYED

Arkansas • Illinois • Indiana
Kentucky • Maryland
Missouri • North Carolina
Ohio • Virginia

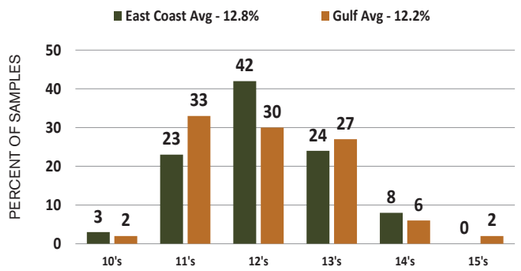
TEST WEIGHT | Pounds/Bushel



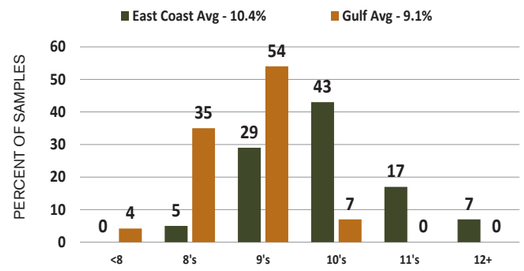
HECTOLITER WEIGHT | Kilograms/Hectoliter



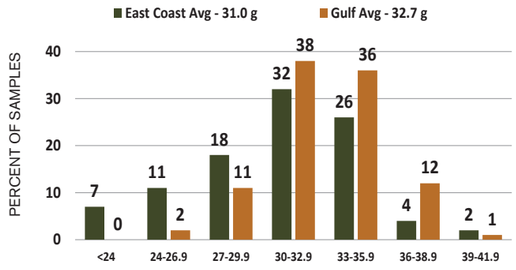
WHEAT MOISTURE | Percent



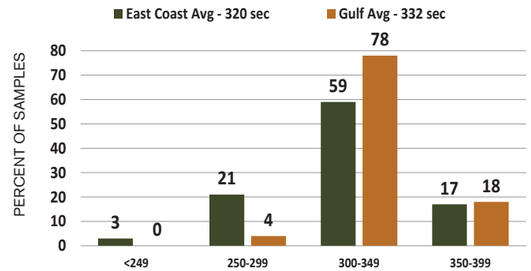
PROTEIN (12% MB) | Percent



1000 KERNEL WEIGHT | Grams



FALLING NUMBER | Seconds



SOFT RED WINTER PRODUCTION

for the major producing states (million metric tons)

	2016	2015	2014	2013	2012
Alabama	0.3	0.4	0.4	0.5	0.3
Arkansas	0.2	0.4	0.7	1.0	0.7
Georgia	0.1	0.2	0.3	0.6	0.3
Illinois	0.9	0.9	1.2	1.5	1.1
Indiana	0.6	0.5	0.7	0.9	0.5
Kentucky	0.9	0.9	1.0	1.2	0.8
Maryland	0.5	0.5	0.5	0.5	0.4
Michigan	0.8	0.7	0.7	0.8	0.7
Missouri	1.1	0.9	1.2	1.5	1.0
North Carolina	0.4	0.8	1.2	1.4	1.2
New York	0.2	0.2	0.1	0.2	0.1
Ohio	1.2	0.9	1.1	1.2	0.8
Pennsylvania	0.3	0.3	0.3	0.3	0.3
Tennessee	0.7	0.7	0.9	1.1	0.6
Virginia	0.3	0.4	0.5	0.5	0.4
Wisconsin	0.5	0.4	0.4	0.4	0.5
Surveyed-States Total*	**6.0**	**6.0**	**8.0**	**9.8**	**7.0**
Sixteen-State Total	**9.0**	**8.9**	**11.1**	**13.7**	**9.7**
Total SRW Production	**9.4**	**9.8**	**12.4**	**15.5**	**11.4**

Based on USDA crop estimates as of September 30, 2016.

**Nine states denoted by italices were surveyed accounting for 64% of 2016 SRW production.*

ABOUT SOFT RED WINTER WHEAT

Low protein content, soft endosperm, red bran, weak gluten. Used in pastries, cakes, cookies, crackers, pretzels and flat breads. Can also be used for blending.

Cookies (Biscuits)

SOFT RED WINTER

HARVEST DATA

SOFT RED WINTER	COMPOSITE AVERAGE			EAST COAST*			GULF PORTS*		
	2016	2015	5-YEAR AVERAGE	2016	2015	5-YEAR AVERAGE	2016	2015	5-YEAR AVERAGE
WHEAT GRADE DATA:									
Test Weight (lb/bu)	58.6	56.9	58.5	56.0	57.3	58.4	59.3	56.9	58.5
(kg/hl)	77.2	75.0	76.9	73.8	75.5	76.9	78.0	74.9	77.0
Damaged Kernels (%)	0.8	3.7	1.7	1.7	1.0	1.5	0.5	4.3	1.7
Foreign Material (%)	0.1	0.1	0.1	0.3	0.1	0.2	0.1	0.1	0.1
Shrunken & Broken (%)	0.5	0.5	0.5	0.7	0.5	0.5	0.5	0.6	0.5
Total Defects (%)	1.4	4.3	2.3	2.7	1.6	2.1	1.1	4.9	2.4
Grade	2 SRW	3 SRW	2 SRW	3 SRW	3 SRW	2 SRW	2 SRW	3 SRW	2 SRW
WHEAT NON-GRADE DATA:									
Dockage (%)	0.5	0.7	0.6	0.6	0.8	0.7	0.4	0.7	0.6
Moisture (%)	12.4	13.2	13.0	12.8	12.4	12.9	12.2	13.3	13.0
Protein (%) 12%/0% moisture basis	9.4/10.7	10.0/11.4	10.0/11.3	10.4/11.8	10.1/11.5	10.1/11.4	9.1/10.4	10.0/11.4	9.9/11.3
Ash (%) 14%/0% moisture basis	1.46/1.70	1.43/1.66	1.49/1.74	1.55/1.80	1.39/1.62	1.46/1.70	1.44/1.68	1.43/1.66	1.50/1.74
1000 Kernel Weight (g)	32.3	31.9	32.6	31.0	32.6	34.0	32.7	31.7	32.2
Kernel Size (%) lg/md/sm	83/16/01	82/17/01	83/16/01	80/19/01	83/16/01	85/14/01	84/15/01	82/17/01	83/16/01
Single Kernel: Hardness	24.8	18.5	23.1	20.5	15.7	20.2	25.9	19.2	23.7
Weight (mg)	34.9	32.9	32.9	34.1	33.2	33.7	35.1	32.8	32.7
Diameter (mm)	2.61	2.68	2.64	2.61	2.66	2.64	2.61	2.69	2.64
Sedimentation (cc)	12.1	13.2	12.4	15.2	13.6	13.1	11.3	13.1	12.3
Falling Number (sec)	330	265	305	320	324	316	332	251	303
DON (ppm)	0.6	2.2	1.4	1.1	0.7	0.9	0.5	2.6	1.6
FLOUR DATA:									
Lab Mill Extraction (%)	67.3	72.9	71.7	66.9	74.0	71.8	67.5	72.6	71.7
Color: L*	90.6	91.5	92.6	90.4	91.8	92.9	90.6	91.4	92.5
a*	-2.1	-3.0	-2.9	-2.1	-3.1	-3.0	-2.1	-3.0	-2.9
b*	9.3	8.1	8.1	9.5	8.2	8.3	9.3	8.0	8.1
Protein (%) 14%/0% moisture basis	7.6/8.9	8.5/9.9	8.4/9.8	8.4/9.7	8.6/10.0	8.5/9.9	7.4/8.6	8.5/9.9	8.4/9.8
Ash (%) 14%/0% moisture basis	0.43/0.50	0.50/0.58	0.45/0.52	0.44/0.51	0.48/0.56	0.44/0.52	0.43/0.50	0.51/0.59	0.45/0.53
Wet Gluten (%)	21.3	22.6	22.3	23.2	22.9	22.6	20.8	22.5	22.2
Gluten Index	88	86	82	85	88	81	88	86	82
Falling Number (sec)	319	261	306	320	321	317	319	247	304
Amylograph Viscosity 65 g (BU)	588	218	447	488	322	444	614	193	448
Starch Damage (%)	4.4	5.4	4.7	4.3	4.7	4.5	4.4	5.6	4.8
SRC: GPI	0.61	0.51	0.59	0.61	0.49	0.58	0.61	0.50	0.59
Water / 50% Sucrose	53/100	57/111	56/107	54/101	59/111	57/107	54/97	58/108	56/104
5% Lactic Acid / 5% Na_2CO_3	106/75	99/85	110/81	108/76	97/85	110/82	104/75	95/83	108/80
DOUGH PROPERTIES:									
Farinograph: Peak Time (min)	1.4	1.5	1.5	1.7	1.6	1.6	1.3	1.4	1.5
Stability (min)	2.7	2.6	2.7	2.6	2.7	2.7	2.7	2.6	2.7
Absorption (%)	52.6	53.4	52.9	53.5	53.3	53.2	52.4	53.5	52.8
Alveograph: P (mm)	37	35	36	39	35	36	36	35	36
L (mm)	96	88	88	111	86	90	92	88	87
P/L Ratio	0.38	0.40	0.41	0.35	0.41	0.40	0.39	0.40	0.41
W (10^{-4} joules)	86	73	80	97	73	81	83	73	80
Extensograph: Resistance (BU)	213	146	NA	200	168	NA	216	141	NA
(45 min) Extensibility (cm)	15.7	17.7	NA	17.1	17.3	NA	15.3	17.8	NA
Area (cm^2)	59	44	NA	61	50	NA	58	43	NA
BAKING EVALUATION:									
Cookie: Diameter (cm)	10.5	10.5	NA	10.4	10.5	NA	10.5	10.6	NA
Spread Ratio (width/height)	9.6	9.3	9.3	9.2	9.2	9.2	9.7	9.3	9.3
Pan Bread: Bake Absorption (%)	54.6	55.3	NA	55.6	54.4	NA	54.4	55.6	NA
Crumb Grain and Texture (1-10)	5.4	5.1	5.1	4.9	5.4	5.1	5.5	5.1	5.0
Loaf Volume (cc)	718	704	708	743	726	722	711	699	704
PRODUCTION OF 9 STATES (%):	100			21			79		

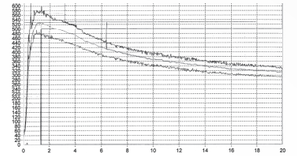
*East Coast - Maryland, Virginia and North Carolina; Gulf Ports - Arkansas, Illinois, Indiana, Kentucky, Missouri and Ohio

SOFT RED WINTER

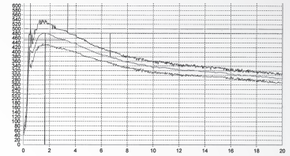
SOFT RED WINTER	EXPORT CARGO DATA	
	2016	2015
WHEAT GRADE DATA:		
Test Weight (lb/bu)	59.0	58.5
(kg/hl)	77.7	77.0
Damaged Kernels (%)	2.3	3.4
Foreign Material (%)	0.1	0.1
Shrunken & Broken (%)	0.9	0.9
Total Defects (%)	3.2	4.4
Grade	2 SRW	2 SRW
WHEAT NON-GRADE DATA:		
Dockage (%)	0.7	0.7
Moisture (%)	12.3	12.5
Protein (%) 12%/0% moisture basis	9.6/10.9	10.0/11.4
Ash (%) 14%/0% moisture basis	1.41/1.64	1.50/1.75
1000 Kernel Weight (g)	31.1	30.2
Kernel Size (%) lg/md/sm	84/16/1	81/18/1
Single Kernel: Hardness		
Weight (mg)		
Diameter (mm)		
Sedimentation (cc)	11.5	11.4
Falling Number (sec)	310	251
DON (ppm)		
FLOUR DATA:		
Lab Mill Extraction (%)	68.4	68.6
Color: L*	91.2	91.3
a*	-2.1	-2.1
b*	8.8	8.5
Protein (%) 14%/0% moisture basis	7.7/9.0	8.1/9.4
Ash (%) 14%/0% moisture basis	0.43/0.50	0.42/0.48
Wet Gluten (%)	20.7	22.0
Gluten Index	94	88
Falling Number (sec)	314	295
Amylograph Viscosity 65 g (BU)	416	355
Starch Damage (%)		
SRC: GPI		
Water / 50% Sucrose		
5% Lactic Acid/5% Na_2CO_3		
DOUGH PROPERTIES:		
Farinograph: Peak Time (min)	1.3	1.3
Stability (min)	2.4	2.4
Absorption (%)	53.0	52.7
Alveograph: P (mm)	47	42
L (mm)	76	90
P/L Ratio	0.62	0.46
W (10^{-4} joules)	109	105
Extensograph: Resistance (BU)		
W (10^{-4} joules)		
Area (cm^2)		
BAKING EVALUATION:		
Cookie: Diameter (cm)		
Spread Ratio (width/height)	9.1	9.3
Pan Bread: Bake Absorption (%)		
Crumb Grain and Texture (1-10)	5.0	5.1
Loaf Volume (cc)	690	695
SAMPLE COUNT:	40	145

FARINOGRAMS*

EAST COAST

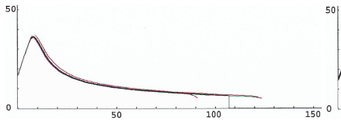


GULF



ALVEOGRAMS

EAST COAST



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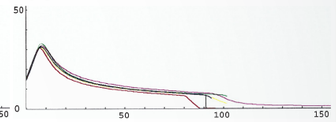
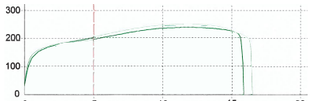


EXTENSOGRAMS

EAST COAST



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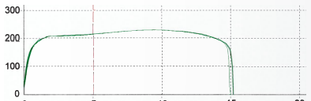
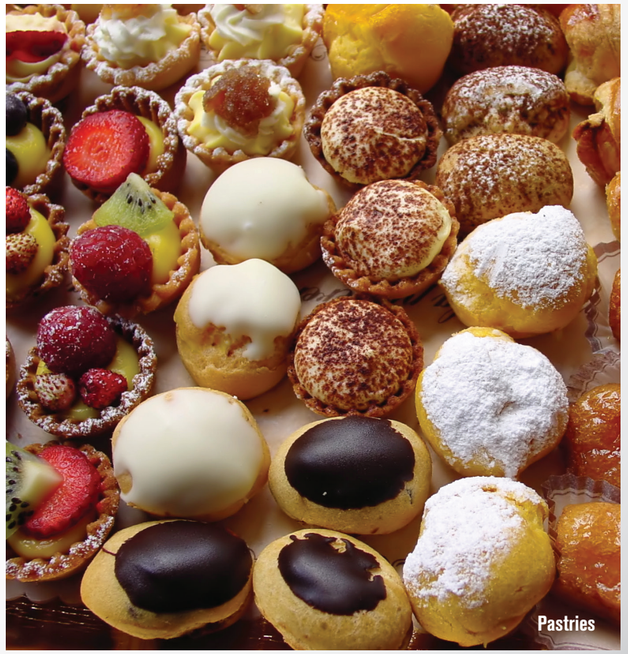


*Representing 2016 Composite Average



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 - kg/hl = lb/bu x 1.292 + 0.630, for other classes – kg/hl = lb/bu x 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, DurumGas 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: Cereal Foods World (Cereal Science Today) 5:(3), 71 (1960). Wheat is sifted with a RoTap sifter using Tyler No. 7 (2.82 mm) and No. 9 (2.00 mm) screens. Kernels remaining on the No. 7 screen are "Large," passing through the No. 7 screen but not the No. 9 are "Medium," and passing through the No. 9 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 with bran dusting flour by Buhler MLU-303 and shorts sifting flour using 119 micron sieve; HRW (Midwestern), SRW, HRS and HW – AACC 26-21.02. 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* – redgreen 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 with 50 g bowl. Absorption is reported on 14% mb.

ALVEOGRAPH: AACC 54-30.02.

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): AACC 56-11.02.

SEMOLINA DATA

LABORATORY MILLING EXTRACTION: Northern samples are milled using a modified Buhler lab 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. Pacific Southwest samples are milled on an integrated system, including a pre-break using a modified Chopin CD2 mill comprising three rolls. Coarse particles pass through a Witt Mill. Sifter screens are 136 microns (µm), 240 µm, 465 µm, 660 µm. Lastly, the semolina passes through a purifier.

ASH: AACC 08-01.01 on 14.0% mb.

COLOR: Minolta Method using Minolta Chroma Meter CR-310 (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 x 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 inches.

MIXOGRAPH: 10g of semolina are mixed in a 10g (Northern) or 35g (Pacific Southwest) bowl with 5.8 ml of distilled water to give maximum dough consistency. 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, 45 ppm ascorbic acid, 0.10% malted barley flour in a 200g Swanson pin mixer with head speed of 100 to 120 rpm and 120-min fermentation. Loaf volume is measured after 1 hour 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. Spaghetti is dried using modified Buhler low-temperature drying cycle as described by Debbouz, Pitz, Moore and D'Appolonia, Cereal Chemistry: 72 (1):128-131. Color scores are determined by the procedure described by Walsh, Macaroni Journal 52: (4) 20 (1970), using a Minolta Color Difference Meter (Northern CR-310, 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%, K2CO3 0.45%, Na2CO3 0.45% and distilled water 32%. Noodle sheet color is measured by stacking three dough sheets and taking two readings from each side of two dough sheets (eight readings total) using a Minolta CR-310 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 26o-27o 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 (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 club wheat 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 sponge cake, steamed bread and bread and HW bread and steamed bread: Laser light using a Tex Vol Instrument (BVM-L370).

UNITED STATES

WHEAT GRADES AND GRADE REQUIREMENTS

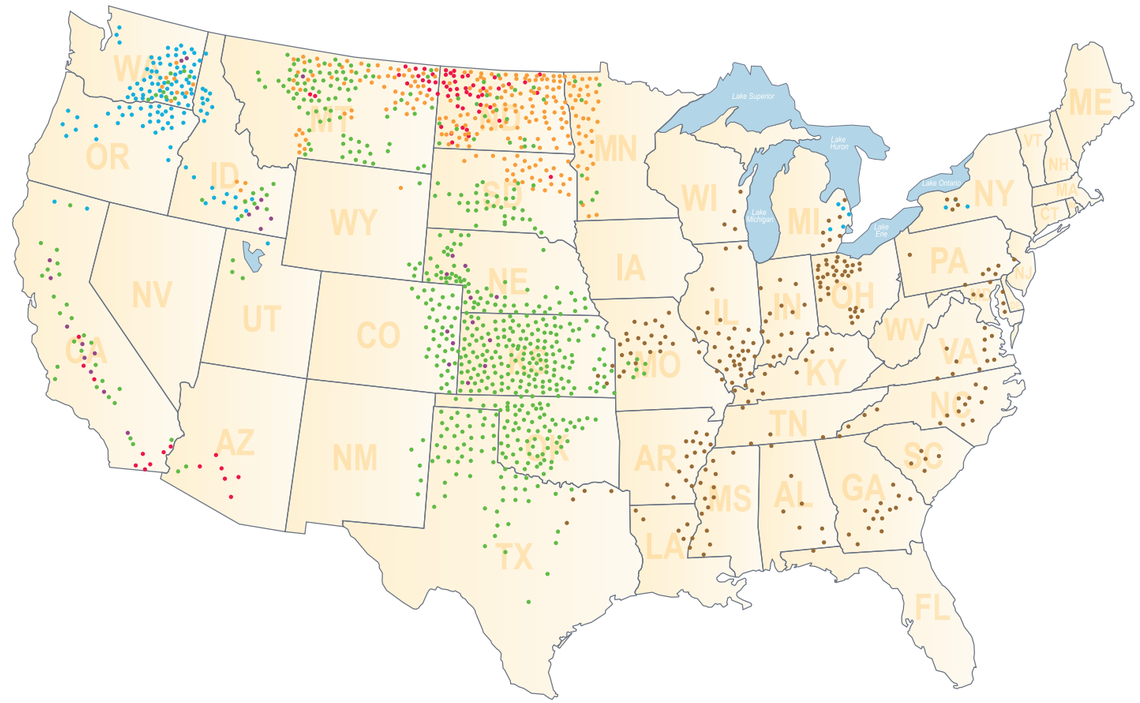
GRADING FACTORS	GRADES U.S. NO. 1	2	3	4	5
	MINIMUM LIMITS:				
Test Weight (lb/bu)					
Hard Red Spring or White Club	58.0	57.0	55.0	53.0	50.0
All other classes and subclasses	60.0	58.0	56.0	54.0	51.0
Test Weight (kg/hl)					
Hard Red Spring or White Club	76.4	75.1	72.5	69.9	66.0
Durum	78.2	75.6	73.0	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[1]	3.0	5.0	8.0	12.0	20.0
Wheat of Other Classes[2]					
Contrasting classes	1.0	2.0	3.0	10.0	10.0
Total[3]	3.0	5.0	10.0	10.0	10.0
Stones	0.1	0.1	0.1	0.1	0.1
	MAXIMUM COUNT LIMITS (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[4]	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

U.S. WHEAT... THE WORLD'S MOST RELIABLE CHOICE



HARD RED WINTER

Medium to high protein, medium hard endosperm, red bran, medium gluten content and mellow gluten. Used in pan breads, Asian noodles, hard rolls, flatbreads and general-purpose flour.

SOFT RED WINTER

Low protein content, soft endosperm, red bran, weak gluten. Used in pastries, cakes, cookies, crackers, pretzels and flat breads. Can also be used for blending.

HARD WHITE

Medium to high protein content, hard endosperm, white bran. Used in Asian noodles, whole wheat or high extraction flour applications, pan breads and flat breads.

HARD RED SPRING

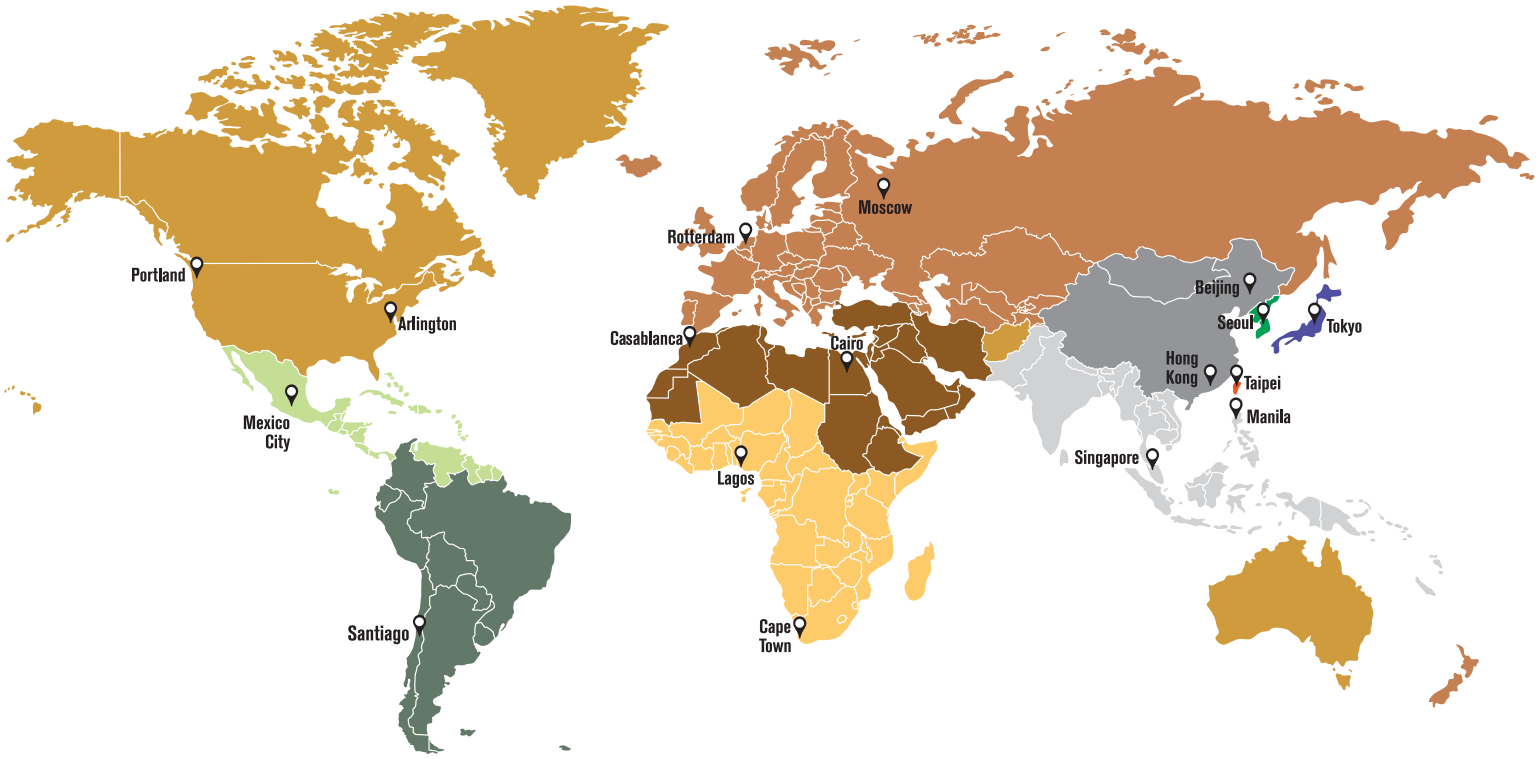
Highest protein content, hard endosperm, red bran, strong gluten, high water absorption. Used in pan breads, hearth breads, rolls, croissants, bagels, hamburger buns, pizza crust and for blending.

SOFT WHITE

Low protein, low moisture wheat, soft endosperm, white bran, weak gluten. Used in pastries, cakes, biscuits, crackers, flat breads, Asian-style noodles and snack foods.

DURUM

Hardest of all wheats, high protein content, yellow endosperm, white bran. Used to make pasta, couscous and some Mediterranean breads.



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