



U.S. WHEAT ASSOCIATES

The World's Most Reliable Choice

2015 Crop Quality Report



To Our Valued Customers:

Following abundant carryover from 2014/15, world wheat supplies for 2015/16 increased with each passing week as the North American harvest progressed. The big picture shows plentiful supply, but sometimes the big picture can obscure subtle details that matter more than the initial story.

While there is much wheat in the world, not all of it meets the qualities that millers and their downstream customers need. Yes, many of the world's wheat farmers faced challenging growing conditions that affected quality. Fortunately, U.S. farmers are once again poised to supply the range of classes and characteristics needed to produce hundreds of high quality end products.

For example, the variety of conditions across the hard red winter (HRW) production area assure that most buyers will be able to find the quality and quantity they need in this year's crop. A third year of unusual drought in the Pacific Northwest reduced supplies of very low protein soft white (SW) but created favorable buying opportunities for those who can use a bit more protein. Unusually persistent rains during crop development and harvest in many states increased DON levels and hurt the soundness of the soft red winter (SRW) crop. However, the data reveal that SRW quality was better in some areas. As I write this, there is good reason to believe our hard red spring (HRS) and durum crops will be of exceptional quality.

This report and the skilled service from your local or regional U.S. Wheat Associates (USW) office will be particularly valuable this marketing year. Because our organization only represents the wheat farmers who help fund our work, you can be confident that USW provides service and technical support with your best interests in mind. We also wish to thank USDA's Foreign Agricultural Service for the resources that have helped us serve customers like you for 55 years.

From all my USW colleagues, and on behalf of our 18 state wheat commission member organizations as well as our educational and service partners, thank you for continuing to choose U.S. wheat — and we wish you much success in the 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
Washington Grain Commission
Wyoming Wheat Marketing Commission

U.S. Wheat Associates (USW) is the industry's market development organization working in more than 100 countries. Its mission is to "develop, maintain, and expand international markets to enhance the profitability of U.S. wheat producers." The activities of USW are made possible by producer checkoff dollars managed by 18 state wheat commissions and through cost-share funding provided by USDA's Foreign Agricultural Service. For more information, visit www.uswheat.org.

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2015 CROP QUALITY REPORT OVERVIEW

SUMMARY OF CLASSES

	Hard Red Winter ¹		Hard Red Spring		Northern Durum ²		Desert Durum®		Soft White		Soft Red Winter	
	2015	5-Year Avg	2015	5-Year Avg	2015	5-Year Avg	2015	5-Year Avg	2015	5-Year Avg	2015	5-Year Avg
Test Weight (lb/bu)	59.0	60.7	61.6	61.4	60.6	60.0	62.4	62.8	59.3	60.6	56.9	58.7
(kg/hl)	77.6	79.8	81.1	80.8	78.9	78.2	81.3	81.7	78.0	79.8	75.0	77.2
Grade	2 HRW	1 HRW	1 DNS	1 NS	1 HAD	1 HAD	1 HAD	1 HAD	2 SW	1 SW	3 SRW	2 SRW
Dockage (%)	0.8	0.5	0.6	0.7	0.9	1.0	0.5	0.4	0.6	0.5	0.7	0.6
Wheat Moisture (%)	11.4	11.1	12.0	12.2	11.2	11.6	7.7	6.4	8.9	9.4	13.2	13.0
Wheat Protein (%) ³	12.4	12.7	14.1	14.1	13.9	13.5	14.0	13.4	10.9	10.0	10.0	10.0
Wheat Ash (%) ³	1.59	1.54	1.51	1.57	1.57	1.62	1.71	1.74	1.41	1.35	1.43	1.52
1000 Kernel Weight (g)	29.6	29.1	31.7	30.4	38.5	39.2	53.0	48.0	30.8	35.3	31.9	32.6
Wheat Falling Number (sec)	400	405	371	382	414	354	565	445	354	333	265	319
Flour/Semolina Extraction (%)	74.1	73.3	67.5	68.6	65.1	64.8	62.6	62.1	72.6	74.7	72.9	71.1
Flour/Semolina Ash (%) ³	0.59	0.50	0.52	0.51	0.64	0.68	0.86	0.86	0.50	0.51	0.50	0.44
Wet Gluten (%)	29.2	29.5	34.3	34.7	37.0	35.1	34.6	32.5	26.0	22.6	22.6	22.4
Farinograph:												
Peak Time (min)	4.8	5.3	7.1	6.7	n/a	n/a	n/a	n/a	3.3	1.8	1.5	1.5
Stability (min)	6.9	11.9	10.8	11.0	n/a	n/a	n/a	n/a	3.1	2.9	2.6	2.8
Absorption (%)	59.6	58.5	62.1	64.0	n/a	n/a	n/a	n/a	54.2	53.5	53.4	52.6
Alveograph W (10 ⁻⁴ joules)	214	250	312	365	129	124	223	208	118	98	73	82
Loaf Volume (cc)	870	825	974	965	n/a	n/a	n/a	n/a	n/a	n/a	704	714
Production (mmt)	22.5	20.9	15.4	12.9	1.7	1.4	0.6	0.5	5.4	6.4	9.8	10.9
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¹HRW data does not include California.

²Durum extraction and ash values are for semolina.

³Protein - 12% moisture basis; ash - 14% moisture basis.



US Production by Class

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

	2015	2014	2013	2012	2011
Hard Red Winter	22.5	20.1	20.3	27.2	21.2
Hard Red Spring	15.4	15.1	13.4	13.7	10.8
Hard White	0.6	0.6	0.6	0.6	0.7
Durum	2.2	1.5	1.6	2.3	1.4
Soft White	5.4	5.5	6.8	6.5	7.9
Soft Red Winter	9.8	12.4	15.5	11.4	12.5
Total	55.8	55.1	58.1	61.3	54.2

Based on USDA crop estimates of September 30, 2015.

US Supply and Demand

Estimated for 2015/2016 (year beginning June 1)
(million metric tons)

	HRW	HRS	Durum	White	SRW	TOTAL
Beginning Stocks	8.0	5.8	0.7	1.8	4.2	20.5
Production	22.5	15.4	2.2	6.0	9.8	55.8
Imports	0.3	1.2	1.1	0.3	0.5	3.4
Total Supply	30.8	22.3	4.0	8.1	14.5	79.7
Domestic Use	13.4	7.8	2.1	2.9	7.0	33.2
Exports	6.5	8.0	1.1	3.8	3.7	23.1
Total Demand	19.9	15.8	3.2	6.7	10.6	56.3
Ending Stocks	10.9	6.5	0.8	1.3	3.9	23.4
Stocks Five-year Average	8.6	4.8	0.7	1.8	4.1	20.0

Based on USDA Supply/Demand estimates of October 9, 2015.

Planting and Harvest Dates

WHEAT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
HRW Planting												
HRW Harvest												
HRS Planting												
HRS Harvest												
HW Planting												
HW Harvest												
Durum Planting												
Durum Harvest												
SW Planting												
SW Harvest												
SRW Planting												
SRW Harvest												

 California-Arizona Planting Dates
 California-Arizona Harvest Dates

 Other States Planting Dates
 Other States 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 42.) 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, such as 14%, 12% or dry matter, so results can be meaningfully 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.

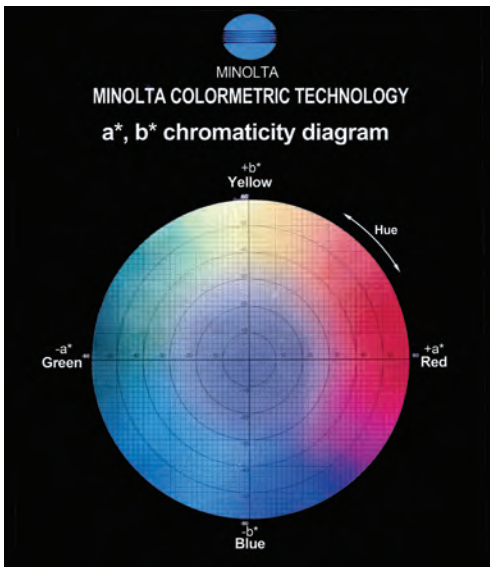
Sedimentation value is a measure of the sediment that results when lactic acid is added to a sifted ground wheat sample and can be used as an indicator of gluten quality and thus the baking quality of wheat flour.

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.

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.**

WHAT THE TESTS MEAN

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 generates a curve that indicates the power being 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** is the amount of water (as a percent by weight of 14 percent 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.

FARINOGRAPH



Photo courtesy of Wheat Marketing Center

WHAT THE TESTS MEAN

- **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 (B.U.), 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. Peak height is a function of protein content, water absorption and dough strength. Peak height increases with protein content and dough strength and decreases with water absorption.

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 percent moisture basis. 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 to 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 percent moisture basis.

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 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.

ALVEOGRAPH



Photo courtesy of Wheat Marketing Center

MIDWEST AND PNW HARVEST SURVEY

Weather and Harvest: Wheat producers in most areas had adequate moisture at planting for the 2015 HRW crop. However, conditions were dry over most of the HRW growing region in the late fall and winter months and into early spring. Over 20 inches (51 cm) of rain fell in May 2015 in north Texas and southern Oklahoma, and lesser amounts fell as far north as Nebraska. The rain was detrimental to nearly mature wheat in Texas and Oklahoma, but had a beneficial effect for Kansas and Nebraska. Rain and cooler-than-normal temperatures helped establish wheat disease conditions throughout the southern and central areas with varying effects on yield and quality.

The PNW and Montana crops experienced less than adequate rainfall and unseasonably hot temperatures in early spring, which caused stress and early maturity. The widely varying growing conditions across all states resulted in more quality variation than normally found in HRW.

Survey Methods: USDA ARS Hard Winter Wheat Quality Lab and Plains Grains, Inc. collected and analyzed a total of 500 samples (equaling 94% of the long-term average due to environment production factors). Grade and non-grade factors were determined on each sample. Functionality tests were done on 95 composites representing growing areas and protein ranges of <11.5%, 11.5% to 12.5%, and >12.5%. Results are presented as Gulf-tributary (about 76% of production), PNW-tributary (24%), and Overall averages. The methods are described in the Analysis Methods section of this booklet.

Wheat and Grade Data: Overall, seventy-six percent of samples graded U.S. No. 2 or better compared to 67% in the Gulf tributary and 89% in the PNW tributary. The overall average test weight is 59.0 lbs/bu (77.6kg/hl) which is below the minimum for U.S. No. 1 and below recent averages. The average dockage of 0.8% is above last year's 0.4% and the 5-year average of 0.5%. Total defects of 1.8% are also slightly higher than 2014 and the 5-year average. The overall average thousand kernel weight of 29.6 g is above the 5-year average of 29.1 g, but below last year's 30.7. Average kernel diameter of 2.59 mm is similar to the 5-year average and last year. The average protein of 12.4% is lower than 2014 and slightly lower than the 5-year average of 12.7%. Kernels are generally smaller in the higher protein southern region and larger with lower protein to the north. Approximately 22% of samples were less than 11.5% protein, 41% between 11.5% and 12.5%, and 37% above 12.5%. The average falling number of 400 seconds is indicative of sound wheat.

Flour and Baking Data: The Buhler lab mill flour yield overall averages 74.1%, comparable to the 2014 average of 73.9% but above the 5-year average of 73.3%. Average flour ash content exceeds 2014 and the 5-year average. Protein loss during flour conversion averaged 0.7% (14% mb), which is below the 5-year average loss of 1.0%. The W value of 214 10^{-4} J is

significantly below 2014's 266 and the 5-year average of 250 10^{-4} J. Overall average bake absorption of 62.5% is lower than 2014's 63.7%, but is higher than the 5-year average of 61.8%. Farinograph peak time and stability of 4.8 min and 6.9 min, respectively, are both significantly lower than last year and the 5-year average. Overall average loaf volume of 870 cc is somewhat higher than 2014's 859 cc and significantly higher than the 5-year average of 825 cc.

Summary: The 2015 HRW crop has protein quantity comparable to the 5-year average, though lower than the last two years. of exceptionally high protein. While peak and stability times are below average, this crop has very good wheat to flour conversion, good bake absorption and good farinograph water absorption. Loaf volumes are outstanding and significantly exceed long-term averages. The crop meets or exceeds typical HRW contract specifications and can provide high value to the customer.

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 2015 crop has high protein, low moisture, high flour extraction, and strong baking performance, all of which make California wheat very good for blending. A record warm winter resulted in the lowest snow pack in 500 years, and the state experienced a fourth consecutive year of drought. A high percentage of wheat was again cut for non-grain purposes in 2015. 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 is conducted by the California Wheat Commission laboratory.

EXPORT CARGO SURVEY

The export cargo data represent 371 subplot samples provided by USDA's Federal Grain Inspection Service for marketing years 2015 and 2014. Of 80 2015-crop samples collected in July and August, 51 are from Gulf and 29 from PNW ports. Of the 291 2014-crop samples, 203 are from Gulf and 88 from PNW ports. Grade data are the official grades on the individual sublots. Milling and baking analyses were by Great Plains Analytical Laboratory, Kansas City, MO.



HARD RED WINTER | MIDWESTERN HARVEST DATA



Hard Red Winter	Composite Average					
	2015 By Protein				2014	5-Year
	Low	Med	High	Overall	Overall	Average
Wheat Grade Data:						
Test Weight (lb/bu)	59.8	59.2	58.6	59.0	60.7	60.7
(kg/hl)	78.5	77.9	77.1	77.6	79.9	79.8
Damaged Kernels (%)	0.3	0.5	0.5	0.5	0.5	0.3
Foreign Material (%)	0.3	0.1	0.1	0.2	0.1	0.1
Shrunken & Broken (%)	1.0	1.1	1.4	1.2	0.8	1.2
Total Defects (%)	1.6	1.7	2.0	1.8	1.4	1.6
Grade	2 HRW	2 HRW	2 HRW	2 HRW	1 HRW	1 HRW
Wheat Non-Grade Data:						
Dockage (%)	0.7	0.7	0.7	0.8	0.4	0.5
Moisture (%)	11.1	11.5	11.3	11.4	11.7	11.1
Protein (%) 12%/0% moisture basis	10.9/12.4	12.2/13.9	13.3/15.1	12.4/14.1	13.3/15.1	12.7/14.4
Ash (%) 14%/0% moisture basis	1.51/1.76	1.57/1.83	1.62/1.88	1.59/1.85	1.49/1.73	1.54/1.78
1000 Kernel Weight (g)	30.7	29.7	29.0	29.6	30.7	29.1
Kernel Size (%) lg/md/sm	70/29/1	63/35/2	60/38/2	63/36/1	58/41/1	55/52/3
Single Kernel: Hardness	53.4	61.1	63.1	60.8	64.0	68.5
Weight (mg)	30.7	29.7	29.0	29.6	30.7	29.1
Diameter (mm)	2.62	2.59	2.58	2.59	2.62	2.59
Sedimentation (cc)	44.5	46.3	53.1	50.2	56.4	53.7
Falling Number (sec)	390	398	408	400	385	405
DON (ppm)	0.5	0.5	0.7	0.6	< 0.5	<0.5
Flour Data:						
Lab Mill Extraction (%)	73.7	74.3	74.1	74.1	73.9	73.3
Color: L*	88.7	87.9	87.4	87.6	91.2	91.7
a*	-1.4	-1.2	-1.1	-1.1	-2.0	-1.9
b*	9.5	9.8	9.7	9.7	9.7	10.4
Protein (%) 14%/0% moisture basis	9.5/11.1	10.8/12.5	11.9/13.8	11.4/13.3	12.3/14.3	11.4/13.3
Ash (%) 14%/0% moisture basis	0.52/0.61	0.57/0.67	0.61/0.71	0.59/0.69	0.54/0.63	0.50/0.58
Wet Gluten (%)	21.9	27.9	30.4	29.2	32.2	29.5
Gluten Index	98	93	91	92	92	94
Falling Number (sec)	415	420	432	425	404	424
Amylograph Viscosity 65 g (BU)	486	455	438	441	462	591
Starch Damage (%)	6.6	6.7	6.5	6.6	6.3	6.0
SRC: GPI	0.62	0.61	0.59	0.59		
Water / 50% Sucrose	70/119	72/120	70/127	71/125		
5% Lactic Acid / 5% Na ₂ CO ₃	135/99	135/101	137/105	136/104		
Dough Properties:						
Farinograph: Peak Time (min)	4.2	4.7	4.9	4.8	6.2	5.3
Stability (min)	7.6	6.6	7.1	6.9	9.3	11.9
Absorption (%)	55.2	58.7	60.4	59.6	60.3	58.5
Alveograph: P (mm)	67	73	78	75	77	77
L (mm)	89	94	95	94	112	98
P/L Ratio	0.75	0.78	0.82	0.80	0.69	0.79
W (10 ⁻⁴ joules)	198	207	223	214	266	250
Extensograph: Resistance (BU)	375/613	318/460	313/429	315/440	341/491	336/517
(45/135 min) Extensibility (cm)	13.1/11.6	14.0/13.7	14.9/15.1	14.6/14.5	15.0/14.5	14.9/14.2
Area (cm ²)	81/107	75/103	81/112	78/107	90/122	90/125
Baking Evaluation:						
Pan Bread: Bake Absorption (%)	59.1	61.8	63.2	62.5	63.7	61.8
Crumb Grain and Texture (1-10)	6.2	6.6	6.4	6.4	6.4	6.0
Loaf Volume (cc)	820	855	882	870	859	825
% of Area Production:	6	31	63	100		

Protein Range: Low, less than 11.5%; Med, 11.5 - 12.5%; High, 12.5% or greater.

Gulf Exportable Average						PNW Exportable Average					
2015 By Protein				2014	5-Year	2015 By Protein				2014	5-Year
Low*	Med	High	Overall	Overall	Average	Low	Med	High	Overall	Overall	Average
59.7	58.9	58.3	58.7	60.3	60.5	60.2	60.3	59.7	60.1	61.5	61.2
78.5	77.6	76.7	77.3	79.4	79.6	78.7	79.0	78.2	78.6	80.9	80.5
0.3	0.7	0.6	0.6	0.5	0.3	0.1	0.1	0.1	0.1	0.4	0.3
0.4	0.2	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1.0	1.2	1.4	1.3	0.9	1.2	1.0	1.0	1.3	1.1	0.7	1.1
1.7	1.9	2.1	1.9	1.6	1.6	1.3	1.2	1.5	1.3	1.2	1.5
2 HRW	2 HRW	2 HRW	2 HRW	1 HRW	1 HRW	1 HRW	1 HRW	2 HRW	1 HRW	1 HRW	1 HRW
0.7	0.7	0.8	0.8	0.4	0.5	0.9	0.6	0.6	0.7	0.5	0.5
11.3	11.8	11.7	11.7	12.0	11.1	10.5	10.4	9.9	10.3	11.1	11.0
10.9/12.4	12.2/13.9	13.2/15.0	12.5/14.2	13.7/15.5	12.9/14.6	10.7/12.2	12.0/13.7	13.6/15.4	12.0/13.7	12.3/14.0	12.1/13.8
1.51/1.76	1.58/1.84	1.65/1.91	1.61/1.87	1.50/1.75	1.55/1.80	1.50/1.75	1.53/1.78	1.53/1.78	1.52/1.77	1.47/1.70	1.49/1.72
30.6	29.3	28.8	29.3	29.7	28.4	31.1	30.8	29.7	30.6	32.8	31.0
70/29/1	63/35/2	60/38/2	63/36/1	51/48/1	52/46/2	69/30/1	65/34/1	58/40/2	65/34/1	72/27/1	63/35/2
51.6	60.3	62.4	60.3	63.6	69.1	59.2	63.5	65.3	62.4	64.8	66.4
30.6	29.3	28.8	29.3	29.7	28.4	31.1	30.8	29.7	30.6	32.8	31.0
2.61	2.58	2.58	2.58	2.59	2.57	2.64	2.61	2.59	2.61	2.69	2.65
44.4	45.2	51.0	49.2	57.1	53.2	44.8	49.9	59.8	53.3	54.9	54.8
392	398	404	400	386	405	385	399	419	399	383	399
0.5	0.5	0.7	0.7	< 0.5	<0.5	0.5	<0.5	0.5	0.5	< 0.5	<0.5
74.0	74.5	73.9	74.1	73.6	73.1	72.6	73.7	74.8	74.0	74.5	73.7
88.8	87.8	87.2	87.4	91.0	91.7	88.4	88.3	87.9	88.1	91.5	92.0
-1.4	-1.2	-1.1	-1.1	-2.0	-1.8	-1.3	-1.2	-1.1	-1.2	-2.1	-2.0
9.6	9.9	9.8	9.8	9.7	10.4	9.3	9.4	9.5	9.4	9.9	10.2
9.5/11.1	10.9/12.6	11.9/13.8	11.6/13.4	12.8/14.9	11.7/13.6	9.5/11.1	10.6/12.3	11.8/13.8	10.9/12.7	11.2/13.0	10.8/12.6
0.52/0.61	0.59/0.68	0.63/0.72	0.61/0.72	0.56/0.65	0.51/0.60	0.52/0.61	0.52/0.61	0.54/0.63	0.53/0.62	0.51/0.59	0.46/0.54
21.8	28.6	31.0	30.1	34.6	30.4	22.3	25.9	28.5	26.4	27.2	27.2
98	92	90	90	90	94	97	96	97	96	97	97
417	423	427	426	398	427	408	410	446	425	417	414
483	463	415	430	449	594	495	429	512	474	488	576
6.7	6.7	6.6	6.6	6.3	6.0	6.3	6.6	6.4	6.5	6.5	6.1
0.62	0.59	0.57	0.58			0.64	0.66	0.65	0.66		
71/121	73/122	71/129	72/127			68/114	66/114	65/122	66/117		
136/100	135/103	135/107	135/106			134/97	138/95	143/98	140/96		
4.5	4.7	4.8	4.8	6.7	5.5	3.3	4.8	5.3	4.7	5.1	4.6
7.9	6.3	6.6	6.6	9.7	12.0	6.8	7.6	8.7	8.0	8.4	11.6
55.2	59.0	60.7	60.1	61.7	58.9	55.2	57.7	59.4	58.0	59.1	57.8
68	72	77	75	77	77	64	77	80	76	77	77
89	96	93	94	115	97	88	87	101	93	105	99
0.76	0.75	0.83	0.80	0.67	0.79	0.72	0.89	0.79	0.82	0.74	0.77
203	201	208	206	267	245	184	225	272	238	263	262
379/634	294/418	287/374	291/393	325/464	326/500	364/548	394/594	396/604	390/591	375/549	364/563
12.9/11.4	14.1/14.1	15.1/15.5	14.8/15.0	15.3/14.9	14.9/14.3	13.8/12.2	13.7/12.7	14.5/13.8	14.0/13.1	14.5/13.8	14.9/13.8
80/108	71/98	74/103	74/102	87/120	86/123	84/104	90/118	101/139	94/124	95/127	98/132
58.9	61.8	63.2	62.7	63.7	62.0	59.6	61.6	63.2	62.0	61.8	61.1
6.3	6.7	6.3	6.4	6.4	6.0	5.9	6.4	6.7	6.4	6.8	6.2
825	861	883	876	873	832	803	837	880	850	828	808
2	21	53	76			4	10	10	24		

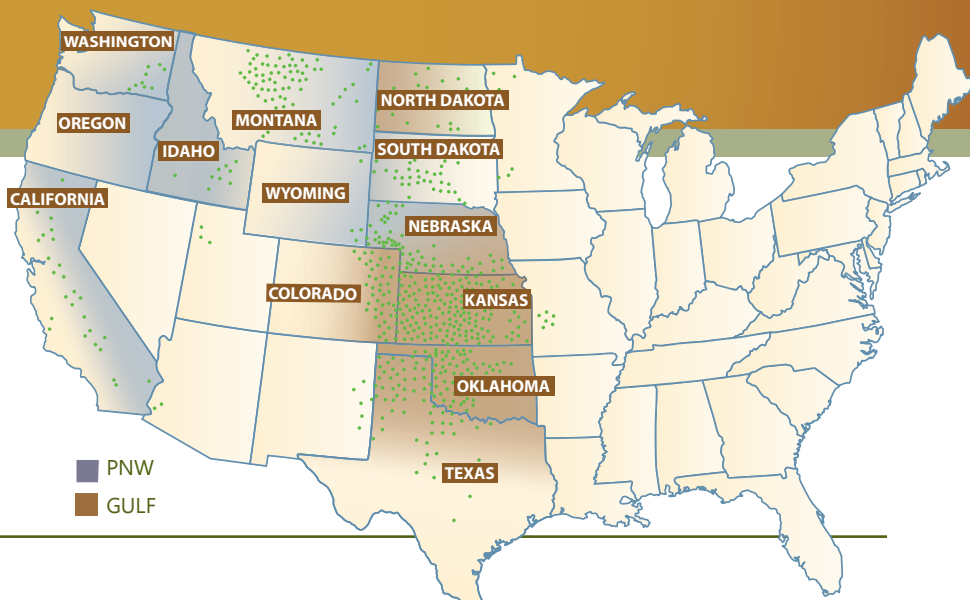
HARD RED WINTER | CALIFORNIA AND EXPORT DATA

Hard Red Winter	California Harvest Data				Export Cargo Data			
	Medium Protein		High Protein		Gulf		PNW	
	2015	2014	2015	2014	2015	2014	2015	2014
Wheat Grade Data:								
Test Weight (lb/bu)	63.9	62.8	63.2	62.2	59.9	60.6	61.7	62.0
(kg/hl)	84.0	82.6	83.0	81.8	78.9	79.7	81.2	81.5
Damaged Kernels (%)	0.2	0.0	0.2	0.0	1.0	0.9	0.3	0.3
Foreign Material (%)	0.2	0.3	0.1	0.3	0.2	0.2	0.1	0.1
Shrunken & Broken (%)	0.5	0.7	0.6	0.8	1.4	1.2	1.3	1.2
Total Defects (%)	0.9	1.0	0.9	1.1	2.6	2.4	1.6	1.6
Grade	1 HRW	1 HRW	1 HRW	1 HRW	2 HRW	1 HRW	1 HRW	1 HRW
Wheat Non-Grade Data:								
Dockage (%)	0.8	0.6	0.8	0.8	0.6	0.5	0.3	0.3
Moisture (%)	9.0	8.5	8.2	8.4	11.6	11.6	10.5	10.8
Protein (%) 12%/0% moisture basis	11.9/13.5	11.6/13.1	13.2/15.0	13.0/14.8	12.7/14.4	12.8/14.5	12.2/13.9	12.4/14.0
Ash (%) 14%/0% moisture basis	1.42/1.65	1.49/1.73	1.41/1.64	1.52/1.76	1.58/1.84	1.51/1.76	1.42/1.66	1.37/1.60
1000 Kernel Weight (g)	41.4	38.6	39.8	37.6	27.3	28.5	28.9	30.0
Kernel Size (%) lg/md/sm	88/12/0	84/16/0	84/15/1	80/19/1	62/36/2	64/35/1	61/37/1	69/30/1
Single Kernel: Hardness	73.0	69.0	74.3	74.0				
Weight (mg)	41.4	38.6	39.8	37.6				
Diameter (mm)	3.00	2.90	2.90	2.90				
Sedimentation (cc)	93.0	101.0	101.0	103.0	33.9	34.8	44.2	48.3
Falling Number (sec)	374	363	399	356	372	406	401	394
DON (ppm)						<0.5		<0.5
Flour Data:								
Lab Mill Extraction (%)	69.7	69.2	69.6	69.7	67.5	69.5	68.7	69.4
Color: L*	95.4	95.2	95.3	95.4	89.8	91.5	89.9	91.6
a*	0.1	0.0	0.1	-0.1	-2.0	-2.9	-2.0	-2.9
b*	7.2	7.4	7.4	7.5	9.2	8.6	9.1	8.5
Protein (%) 14%/0% moisture basis	10.6/12.3	10.5/12.2	11.8/13.7	11.7/13.6	11.2/13.0	11.3/13.2	11.2/13.0	11.3/13.1
Ash (%) 14%/0% moisture basis	0.38/0.45	0.41/0.53	0.37/0.43	0.39/0.45	0.49/0.56	0.48/0.56	0.47/0.55	0.46/0.53
Wet Gluten (%)	29.0	31.0	32.7	34.1	30.4	30.6	29.9	29.9
Gluten Index	97	95	92	92	97	96	97	97
Falling Number (sec)	396	335	420	378	392	429	405	408
Amylograph Viscosity 65 g (BU)					494	622	576	574
Starch Damage (%)								
SRC: GPI	0.40		0.43					
Water / 50% Sucrose	82/123		78/115					
5% Lactic Acid / 5% Na ₂ CO ₃	96/120		97/114					
Dough Properties:								
Farinograph: Peak Time (min)	11.1	11.8	15.1	15.2	6.6	6.7	6.6	6.7
Stability (min)	21.9	23.7	22.9	18.5	12.6	13.0	12.8	13.6
Absorption (%)	64.5	62.8	65.4	64.9	59.3	59.0	59.8	60.0
Alveograph: P (mm)	110	115	113	116	90	81	95	92
L (mm)	87	79	93	80	104	100	91	95
P/L Ratio	1.27	1.45	1.21	1.45	0.86	0.81	1.05	0.97
W (10 ⁻⁴ joules)	378	348	394	364	296	280	307	315
Extensograph: Resistance (BU)								
(45/135 min) Extensibility (cm)								
Area (cm ²)								
Baking Evaluation:								
Pan Bread: Bake Absorption (%)	65.0		66.0					
Crumb Grain and Texture (1-10)	8.0	7.0	9.0	8.0	6.9	6.8	7.0	6.6
Loaf Volume (cc)	915	876	960	946	913	876	864	863
Number of Samples					51	203	29	88

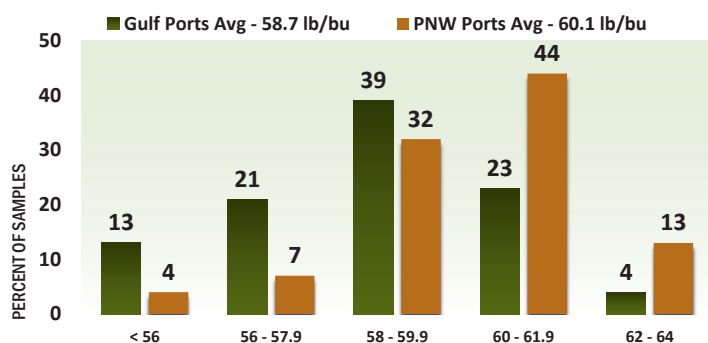
California HRW Protein Range: Med, 11.0 - 12.4%; High, 12.5% or greater.

THIRTEEN STATES SURVEYED

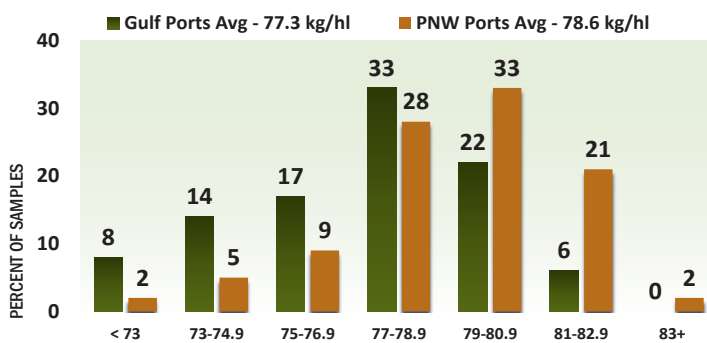
California • Colorado • Idaho • Kansas
Montana • Nebraska • North Dakota
Oklahoma • Oregon • South Dakota
Texas • Washington • Wyoming



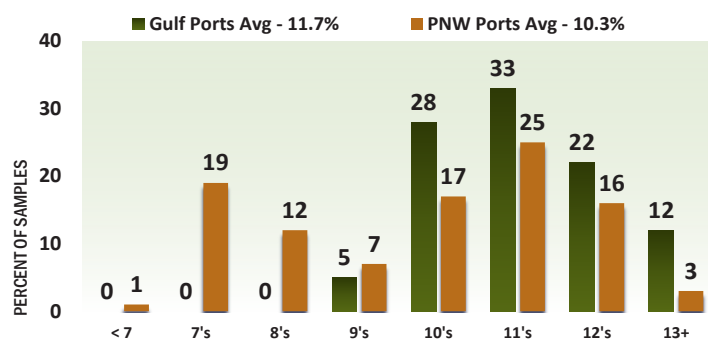
TEST WEIGHT | Pounds/Bushel



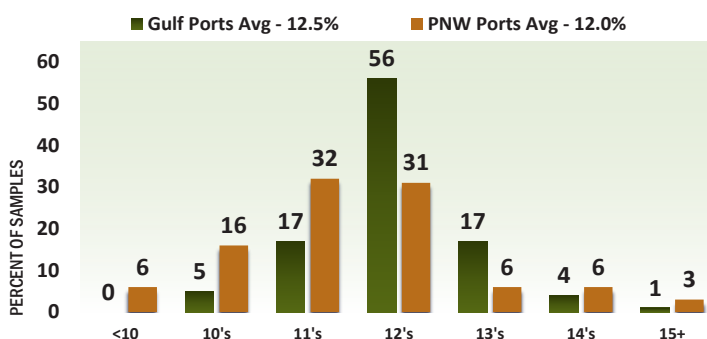
HECTOLITER WEIGHT | Kilograms/Hectoliter



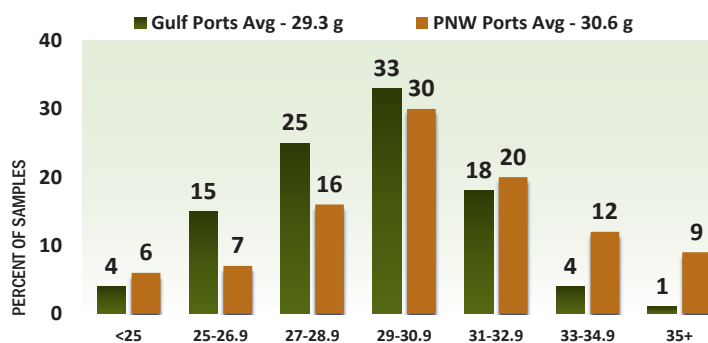
WHEAT MOISTURE | Percent



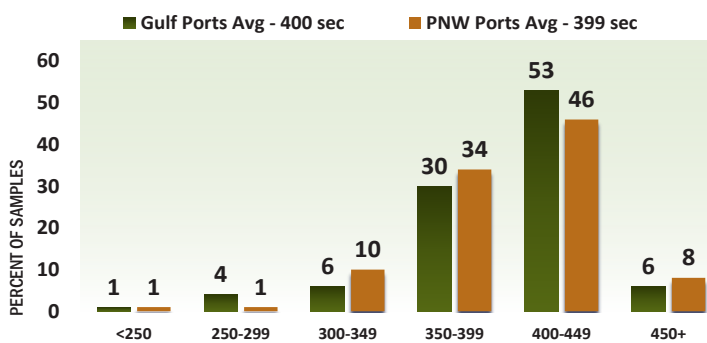
PROTEIN (12% MB) | Percent



1000 KERNEL WEIGHT | Grams

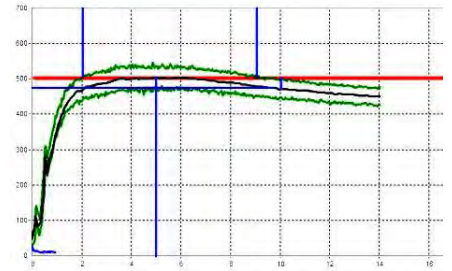
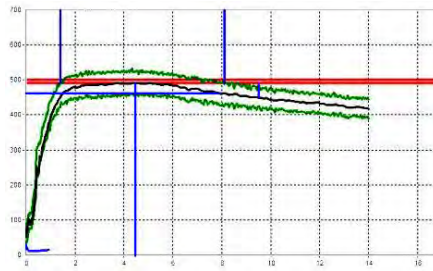
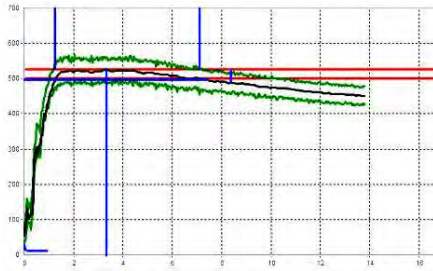


FALLING NUMBER | Seconds

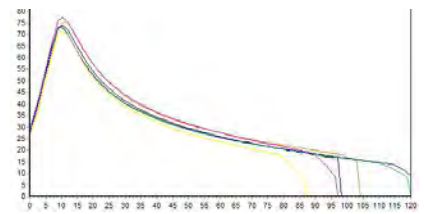
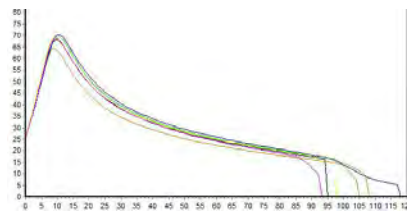
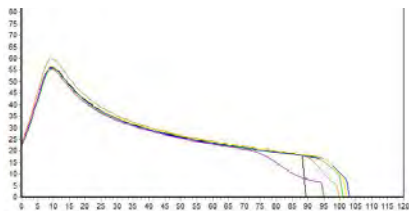


HARD RED WINTER | PHYSICAL DOUGH PROPERTIES

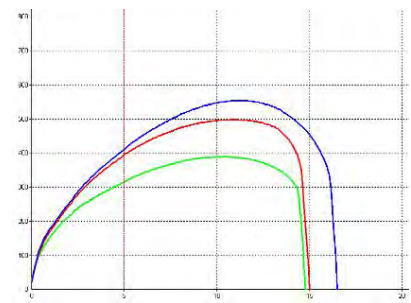
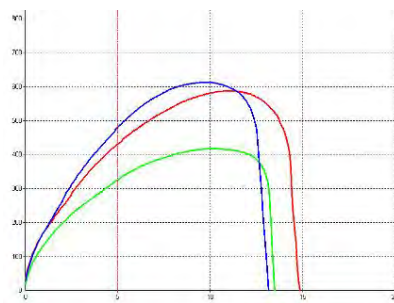
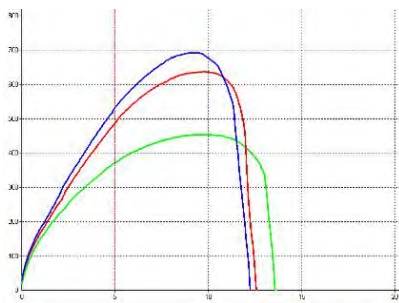
FARINOGRAMS*



ALVEOGRAMS



EXTENSOGRAMS



LOW PROTEIN

MEDIUM PROTEIN

HIGH PROTEIN

*Representing 2015 Composite Average



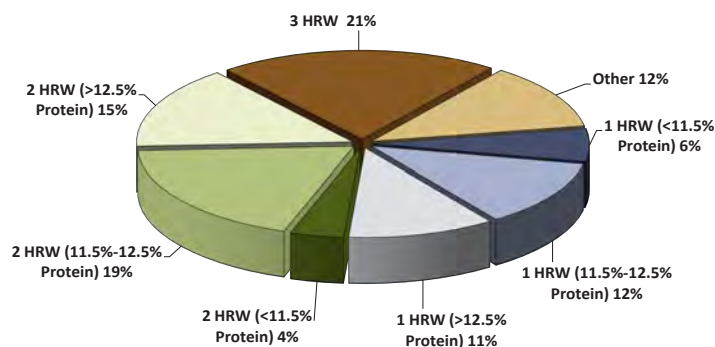
Hard Red Winter Production

for the major growing region (million metric tons)

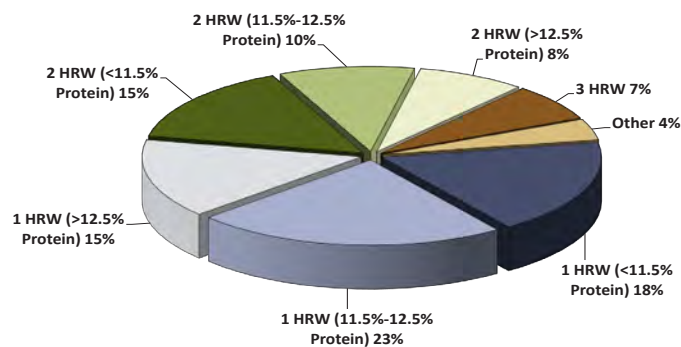
	2015	2014	2013	2012	2011
California	0.3	0.3	0.7	0.6	0.8
Colorado	2.0	2.3	1.1	2.0	2.1
Idaho	0.4	0.3	0.4	0.4	0.4
Kansas	8.5	6.5	8.6	10.2	7.4
Montana	2.5	2.5	2.2	2.3	2.4
Nebraska	1.2	1.9	1.1	1.5	1.8
North Dakota	0.2	0.7	0.2	1.1	0.4
Oklahoma	2.7	1.3	2.8	4.2	1.9
Oregon	0.0	0.1	0.1	0.1	0.1
South Dakota	1.2	1.6	0.7	1.6	1.8
Texas	2.7	1.7	1.7	2.4	1.3
Washington	0.3	0.3	0.4	0.6	0.5
Wyoming	0.1	0.1	0.1	0.1	0.1
Thirteen-State Total	22.1	19.8	20.0	27.0	20.9
Total HRW Production	22.5	20.1	20.3	27.3	21.2

Based on USDA crop estimates of September 30, 2015.

GULF EXPORTABLE



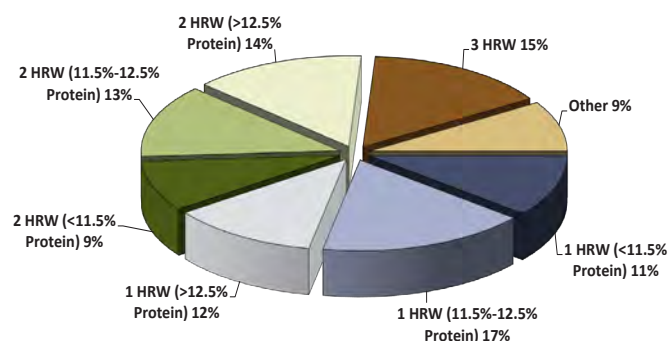
PNW EXPORTABLE



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.

OVERALL



HARVEST SURVEY

Weather and Harvest: A warm, dry spring allowed planting to begin in early April, about three weeks ahead of normal. With steady progress, planting was complete in most areas by the end of May. Timely rains and moderate temperatures provided nearly ideal growing conditions in eastern areas where record yields were achieved. In the west, especially in the Pacific Northwest, minor to severe drought stressed the crop much of the season. Warmer temperatures in the latter half of the season accelerated crop maturity but also limited disease pressures, with the greatest pressures evident in the central part of the region.

Harvest began in late July, about two weeks ahead of normal. Warm, dry conditions allowed rapid progress, and harvest was 90% complete by the end of August. Sporadic rains in early September slowed the final harvest, but not enough to affect quality. Most areas were complete by the middle of September, securing a sound, high quality crop.

Samples and Methods: Sample collection and analysis were conducted by the Hard Red Spring Wheat Quality Lab, Department of Plant Sciences, North Dakota State University, Fargo, ND. A total of 805 samples were collected from fields, on-farm bin sites or elevators during harvest in Minnesota (120), Montana (141), North Dakota (386), South Dakota (85) and Washington, Idaho and Oregon (73). The samples represent approximately 98% of the 2015 hard red spring (HRS) crop. Samples were segregated by export region (East and West) 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 2015 HRS crop produced high grades, high protein and sound kernel traits. Production is up slightly from 2014 with a larger share of the 2015 crop produced in the central and eastern areas due to higher planted acres and record yields there. Production is lower than 2014 across the western half of the region due to lower planted area and reduced yields due to minor to severe mid-summer drought conditions. The crop has improved functional performance over 2014 for mill yields and loaf volumes, similar to slightly stronger dough properties, and good bake quality.

The average grade is No. 1 Dark Northern Spring (DNS) with more than 90% of the samples grading No. 1, and more than two thirds classed as DNS. This is a notable improvement over the 2014 crop. Specifically, the crop averages 61.6 lbs/bu (81 kg/hl) test weight, 0.3% damage and 77% vitreous kernels. Test weight and kernel damage are similar to last year and the 5-year average. Approximately 80% of the crop exceeds 60 lb/bu (78.9 kg/hl) test weight.

Average protein is 14.1% (12% mb), up from 13.6% in 2014 and similar to the 5-year average. Protein averages 14.3% in the West and 13.9% in the East, but all parts of the region show improvement in kernel protein levels compared to

2014. Sixty-four percent of the samples in the West and 60% in the East were above 14% protein, and less than 15% fell below 13% protein in both regions. The warm, dry harvest also secured a crop with lower kernel moisture and improved crop soundness relative to 2014. Kernel moisture is 12%, about one-half percentage point lower than 2014, and the average falling number is 371 sec, up from 337. More than 60% of the crop in both regions exceed 400 sec, and less than 2% fall below 300 sec.

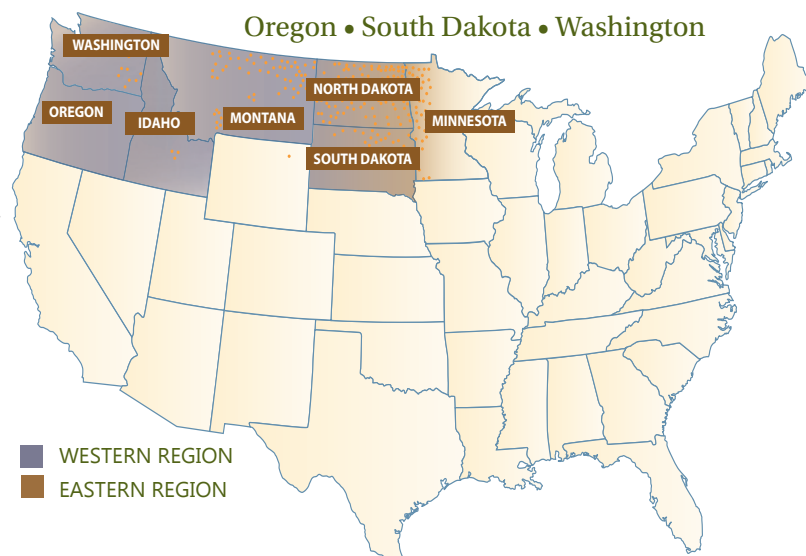
Disease pressures were minimal and more isolated than in 2014. The vast majority of the samples analyzed had no detectable DON, and the overall DON average is reported as less than the DON detection limit of 0.5 ppm, the same as 2014 and the 5-year average.

Flour and Baking Data: Milling yield based on a Buhler Lab Mill averages 67.5%, up 1.5 percentage points from 2014, with similar improvement shown in both regions. Flour ash is 0.52%, up from 0.45% in 2014, paralleling the higher kernel ash in the 2015 crop. Wet gluten values average 34.3%, up from just 31.9% last year and similar to the 5-year average. Amylograph values are very high reflecting the soundness of the 2015 crop.

The farinograph indicates similar to slightly stronger dough properties compared to 2014 with somewhat stronger values across the West. The crop average stability is 10.8 min, up from 9.4 in 2014 and similar to the 5-year average. The West averages 11.2 min compared to 9.3 in 2014, and the East averages 10.4, up from 9.5 min. Across both regions stability improves with protein levels, ranging from 8.8 min in the low protein segment to 12.7 min in high protein. Absorption values are similar to 2014, averaging 62.1%, but lower than the 5-year average. Absorption values are about 1 percentage point higher in the West compared with the East, but absorption increases with protein in both regions.

SEVEN STATES SURVEYED

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



Extensograph resistance and extensibility are similar to 2014 and the 5-year average. The alveograph indicates a slightly weaker crop with an average W value of 312×10^{-4} J compared with 392 in 2014 and 365 for a 5-year average. The P/L ratio fell to 0.71 compared with 0.99 in 2014.

Bake absorption of 67.7% is similar to 2014, but the average loaf volume of 974 cc is higher than 2014's 944. All the increase in loaf volume is attributed to the East which averages 992 cc; the West average is 957 cc, down from 968 in 2014. Bread scores are good in both regions and similar to 2014.

Summary: Buyers will appreciate the 2015 crop for its high grades and overall soundness, and will find value in the

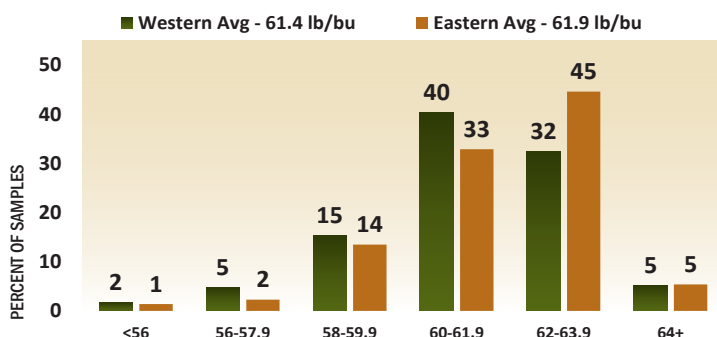
higher protein levels, lower moisture content, minimal DON and notably improved vitreous kernel levels compared with 2014. There is a slight improvement in dough strength overall, as measured on the farinograph, most notably in the West, and there are higher loaf volumes in the East. While some functional traits are lower than expected, based on the improved protein levels, higher protein segments of the crop provide parallel improvements in absorption, dough stability, loaf volume and bread scores. Buyers can buy with confidence as extreme quality differences in the 2015 crop are minimal. With stocks remaining from previous years, diligent contract specifications are still encouraged to attain the best quality.

Continued on next page



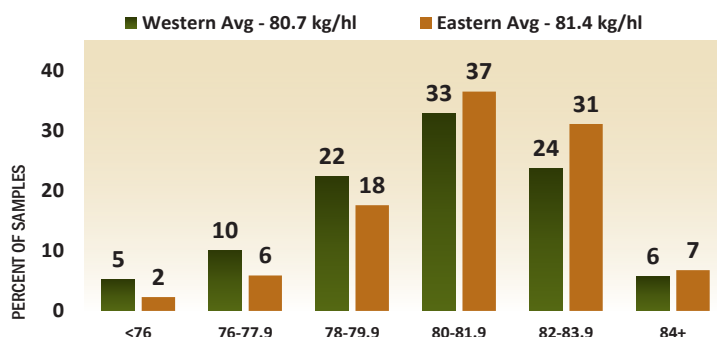
TEST WEIGHT

Pounds/Bushel



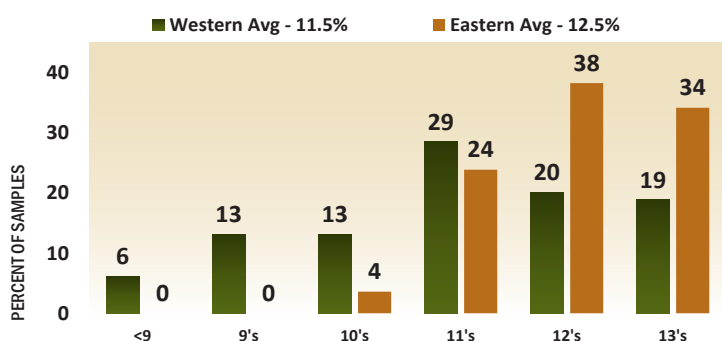
HECTOLITER WEIGHT

Kilograms/Hectoliter



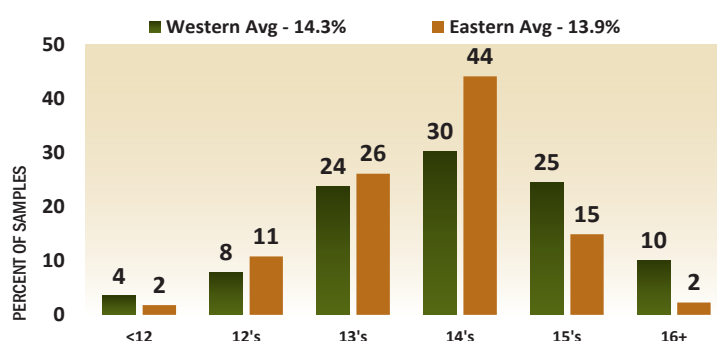
WHEAT MOISTURE

Percent



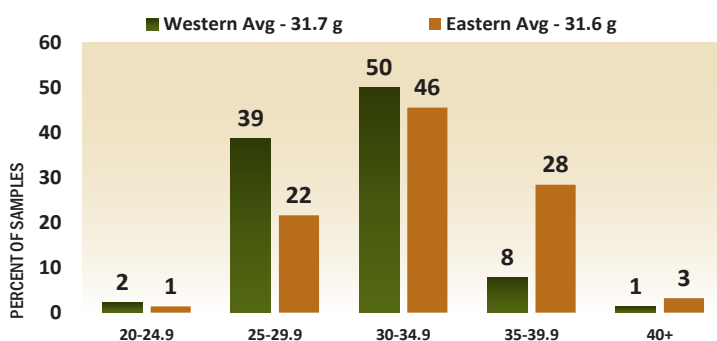
PROTEIN (12% MB)

Percent



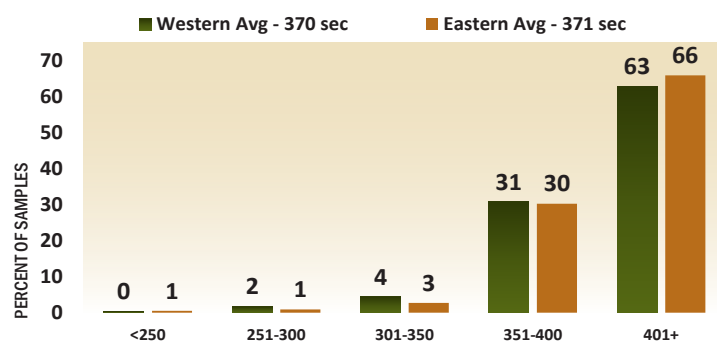
1000 KERNEL WEIGHT

Grams



FALLING NUMBER

Seconds



HARD RED SPRING | HARVEST DATA

EXPORT CARGO SURVEY

The export cargo data represents 377 individual subplot samples provided by USDA's Federal Grain Inspection Service for crop years 2014 (collected from October 2014 through June 2015) and 2013. Of 131 2014-crop samples, 88 were from the PNW, 23 from Gulf ports and 20 from Great Lakes ports. Grade data are the official grades on the individual subplots. Milling and baking analyses were conducted by North Dakota State University.



Hard Red Spring	Composite Average					
	2015 By Protein				2014	5-year
	Low	Med	High	Overall	Overall	Average
Wheat Grade Data:						
Test Weight (lb/bu)	62.0	62.0	61.1	61.6	61.2	61.4
(kg/hl)	81.5	81.5	80.3	81.1	80.5	80.8
Damaged Kernels (%)	0.4	0.2	0.4	0.3	0.2	0.1
Foreign Material (%)	0.0	0.0	0.0	0.0	0.0	0.0
Shrunken & Broken (%)	1.5	0.8	1.0	1.0	0.7	1.2
Total Defects (%)	1.9	1.0	1.4	1.4	0.9	1.3
Vitreous Kernels (%)	71	78	79	77	48	68
Grade	1 NS	1 DNS	1 DNS	1 DNS	1 NS	1 NS
Wheat Non-Grade Data:						
Dockage (%)	0.6	0.6	0.6	0.6	0.6	0.7
Moisture (%)	12.2	12.2	11.7	12.0	12.6	12.2
Protein (%) 12%/0% moisture basis	12.7/14.4	14.0/15.9	15.3/17.3	14.1/16.0	13.6/15.5	14.1/16.0
Ash (%) 14%/0% moisture basis	1.51/1.76	1.51/1.75	1.50/1.75	1.51/1.75	1.47/1.71	1.57/1.83
1000 Kernel Weight (g)	31.5	31.6	31.9	31.7	31.6	30.4
Kernel Size (%) lg/md/sm	49/48/3	50/48/2	44/53/3	48/50/2	55/43/2	44/52/4
Single Kernel: Hardness	83.7	82.7	81.6	82.6	80.2	82.0
Weight (mg)	33.9	32.8	31.9	32.8	30.9	32.6
Diameter (mm)	2.41	2.38	2.32	2.36	2.33	2.45
Sedimentation (cc)	57.4	62.2	65.6	62.2	65.8	60.8
Falling Number (sec)	375	355	382	371	337	382
DON (ppm)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Flour Data:						
Lab Mill Extraction (%)	69.0	67.4	66.4	67.5	66.1	68.6
Color: L*	90.6	90.3	90.4	90.4	90.7	90.8
a*	-1.2	-1.2	-1.2	-1.2	-1.1	-1.0
b*	9.5	9.9	9.9	9.8	9.4	9.3
Protein (%) 14%/0% moisture basis	11.8/13.7	12.9/15.0	14.0/16.3	13.0/15.1	12.4/14.4	12.9/15.1
Ash (%) 14%/0% moisture basis	0.52/0.60	0.51/0.60	0.52/0.61	0.52/0.60	0.45/0.53	0.51/0.60
Wet Gluten (%)	29.5	34.3	37.9	34.3	31.9	34.7
Gluten Index	95	89	82	88	98	93
Falling Number (sec)	381	381	389	384	367	396
Amylograph Viscosity: 65g (BU)	719	657	688	685	511	597
Starch Damage (%)	7.3	7.2	6.3	6.9	7.4	7.7
SRC: GPI	0.67	0.69	0.71	0.69	0.67	0.65
Water / 50% Sucrose	69/116	69/120	69/120	69/119	75/122	76/161
5% Lactic Acid / 5% Na ₂ CO ₃	131/95	136/94	137/91	135/93	158/116	154/106
Dough Properties:						
Farinograph: Peak Time (min)	6.2	7.1	7.6	7.1	6.4	6.7
Stability (min)	8.8	10.3	12.7	10.8	9.4	11.0
Absorption (%)	60.7	62.1	63.2	62.1	62.2	64.0
Alveograph: P (mm)	81	82	80	81	106	95
L (mm)	112	111	116	113	107	114
P/L Ratio	0.72	0.73	0.69	0.71	0.99	0.85
W (10 ⁻⁴ joules)	309	312	314	312	392	365
Extensograph: Resistance (BU)	450/708	462/793	418/828	442/783	445/765	434/633
(45/135 min) Extensibility (cm)	17.8/14.1	16.0/13.1	17.2/13.4	16.9/13.5	16.7/13.5	16.9/15.4
Area (cm ²)	103/133	95/141	94/145	97/140	96/136	96/125
Baking Evaluation:						
Pan Bread: Bake Absorption (%)	66.7	67.7	68.6	67.7	67.6	64.9
Crumb Grain and Texture (1-10)	7.5	8.0	8.1	7.9	7.7	8.1
Loaf Volume (cc)	900	984	1019	974	944	965
% Area Production:	27	36	37	100		

Protein Range: Low, less than 13.5%; Med, 13.5 - 14.5%; High, 14.5% or greater.

HARVEST DATA

HARD RED SPRING

Western Regional Average						Eastern Regional Average					
2015 By Protein				2014	5-year	2015 By Protein				2014	5-year
Low	Med	High	Overall	Overall	Average	Low	Med	High	Overall	Overall	Average
61.8	61.9	60.7	61.4	60.7	61.2	62.1	62.1	61.5	61.9	61.8	61.6
81.3	81.4	79.9	80.7	79.8	80.5	81.7	81.6	80.9	81.4	81.3	81.0
0.4	0.2	0.3	0.3	0.2	0.1	0.4	0.2	0.6	0.4	0.3	0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.4	1.0	1.2	1.5	1.0	1.4	0.7	0.6	0.6	0.6	0.3	0.9
2.8	1.2	1.5	1.8	1.2	1.5	1.1	0.8	1.2	1.0	0.6	1.0
74	83	80	79	48	73	68	75	77	74	48	65
1 NS	1 DNS	1 DNS	1 DNS	1 NS	1 NS	1 NS	1 DNS	1 DNS	1 NS	1 NS	1 NS
0.7	0.6	0.6	0.6	0.6	0.7	0.5	0.5	0.5	0.5	0.5	0.6
11.7	11.7	11.2	11.5	12.0	11.6	12.6	12.5	12.5	12.5	13.2	12.7
12.6/14.3	13.9/15.8	15.5/17.5	14.3/16.2	13.9/15.7	14.2/16.2	12.7/14.4	14.0/15.9	15.0/16.9	13.9/15.8	13.4/15.2	13.9/15.8
1.53/1.78	1.50/1.75	1.51/1.75	1.51/1.76	1.44/1.68	1.54/1.80	1.50/1.75	1.51/1.75	1.49/1.73	1.50/1.75	1.50/1.74	1.59/1.85
31.4	31.3	32.1	31.7	30.5	29.9	31.5	31.8	31.5	31.6	32.7	30.9
43/55/2	42/56/2	39/58/3	41/57/2	47/51/3	39/57/4	55/42/3	56/42/2	52/46/2	55/43/2	62/36/2	49/48/3
83.4	82.6	80.1	81.7	82.7	81.3	84.0	82.7	83.9	83.4	77.7	82.7
33.6	32.1	31.8	32.4	31.8	32.3	34.2	33.4	31.9	33.2	29.9	32.9
2.35	2.34	2.29	2.32	2.42	2.43	2.47	2.40	2.37	2.41	2.23	2.47
59.7	64.7	66.7	64.3	67.8	62.0	55.2	60.4	63.9	60.0	63.7	59.5
378	347	382	370	318	373	373	362	383	371	357	390
<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
67.4	67.0	66.0	66.6	65.4	67.7	70.5	67.8	67.0	68.3	66.8	69.3
90.6	90.7	90.5	90.6	90.8	90.9	90.6	90.1	90.3	90.3	90.6	90.7
-1.3	-1.2	-1.2	-1.2	-1.2	-1.1	-1.0	-1.1	-1.1	-1.1	-1.0	-0.9
10.1	10.1	9.9	10.0	9.6	9.4	8.9	9.8	9.9	9.6	9.2	9.2
11.6/13.5	12.9/15.0	14.2/16.5	13.1/15.3	12.7/14.7	13.1/15.2	11.9/13.8	12.9/15.0	13.8/16.1	12.9/15.0	12.1/14.1	12.8/14.9
0.50/0.58	0.50/0.58	0.52/0.60	0.51/0.59	0.45/0.52	0.49/0.57	0.53/0.62	0.52/0.61	0.53/0.61	0.53/0.61	0.46/0.53	0.53/0.62
30.5	34.0	38.6	35.1	33.2	35.3	28.6	34.6	36.8	33.6	30.6	34.1
94	89	77	85	98	91	97	89	89	91	98	94
385	373	391	384	358	398	377	387	388	385	377	395
663	677	684	676	483	607	773	643	693	695	540	592
7.1	7.2	6.1	6.7	7.1	7.4	7.5	7.2	6.6	7.1	7.7	7.9
0.67	0.70	0.71	0.69	0.63	0.64	0.67	0.69	0.70	0.69	0.71	0.67
68/116	69/120	70/120	69/119	71/120	76/134	70/117	70/119	68/120	69/119	79/123	77/128
132/94	137/94	138/91	136/93	160/136	158/114	131/96	134/94	136/92	134/93	155/96	151/98
6.3	7.2	7.6	7.1	6.8	7.2	6.2	7.0	7.7	7.0	6.0	6.3
9.7	10.5	12.6	11.2	9.3	11.1	8.0	10.1	12.9	10.4	9.5	11.1
61.0	62.4	63.6	62.6	62.1	63.9	60.5	61.8	62.5	61.6	62.2	63.9
85	85	82	84	106	95	77	79	77	78	106	95
104	115	113	111	107	117	120	108	120	115	106	110
0.81	0.74	0.72	0.75	0.99	0.82	0.64	0.74	0.64	0.68	0.99	0.87
306	328	312	315	390	371	311	300	318	309	395	359
432/678	433/739	408/824	422/760	426/743	439/641	467/737	483/833	434/835	464/807	464/788	431/626
18.5/13.4	16.4/13.4	16.6/13.8	17.0/13.6	17.1/13.5	17.2/15.4	17.1/14.7	15.7/12.8	18.0/12.8	16.8/13.3	16.4/13.5	16.7/15.4
101/125	92/133	88/150	93/138	95/131	99/127	104/140	97/147	103/138	101/142	98/140	94/123
66.2	67.6	68.9	67.8	68.1	65.1	67.1	67.8	68.0	67.7	67.1	64.7
7.0	7.8	8.3	7.8	7.9	8.1	8.0	8.3	8.0	8.1	7.4	8.2
875	938	1020	957	968	967	925	1018	1018	992	918	963
13	15	22	51			14	20	15	49		

Protein Range: Low, less than 13.5%; Med, 13.5 - 14.5%; High, 14.5% or greater.

HARD RED SPRING | EXPORT CARGO DATA

Hard Red Spring	Export Cargo Data					
	PNW Average		Great Lakes Average		Gulf Average	
	2014	2013	2014	2013	2014	2013
Wheat Grade Data:						
Test Weight (lb/bu)	61.1	62.4	62.2	62.8	61.8	62.7
(kg/hl)	80.3	82.0	81.8	82.5	81.3	82.5
Damaged Kernels (%)	0.5	0.3	1.2	0.9	1.2	0.8
Foreign Material (%)	0.1	0.1	0.1	0.1	0.1	0.1
Shrunken & Broken (%)	1.2	1.0	0.7	0.6	0.7	0.8
Total Defects (%)	1.7	1.4	2.0	1.6	2.0	1.8
Vitreous Kernels (%)	59	74	35	45	45	58
Grade	1 NS	1 NS	1 NS	1 NS	1 NS	1 NS
Wheat Non-Grade Data:						
Dockage (%)	0.3	0.3	0.4	0.4	0.6	0.5
Moisture (%)	11.6	11.2	12.3	11.1	12.4	11.7
Protein (%) 12%/0% moisture basis	14.0/15.9	13.9/15.8	13.6/15.5	13.8/15.7	13.4/15.3	13.6/15.4
Ash (%) 14%/0% moisture basis	1.51/1.76	1.54/1.79	1.53/1.78	1.51/1.75	1.54/1.79	1.50/1.74
1000 Kernel Weight (g)	31.9	32.4	33.5	34.7	33.2	33.8
Kernel Size (%) lg/md/sm	46/50/4	47/49/4	61/37/2	64/34/1	60/40/2	59/38/2
Single Kernel: Hardness		79.8				82.0
Weight (mg)		31.0				31.8
Diameter (mm)		2.69				2.76
Sedimentation (cc)						
Falling Number (sec)	353	402	348	387	363	405
DON (ppm)		<0.5		0.8		<0.5
Flour Data:						
Lab Mill Extraction (%)	71.5	71.3	71.3	71.2	71.5	71.7
Color: L*	89.7	90.0	89.5	89.6	89.5	89.7
a*	-1.0	-1.0	-1.0	-1.0	-0.9	-0.9
b*	9.4	9.5	9.2	9.7	9.0	9.3
Protein (%) 14%/0% moisture basis	13.2/15.3	13.1/15.3	12.8/14.9	13.0/15.1	12.6/14.6	12.8/14.8
Ash (%) 14%/0% moisture basis	0.59/0.69	0.57/0.66	0.59/0.69	0.57/0.66	0.58/0.67	0.57/0.66
Wet Gluten (%)	34.1	34.7	32.5	34.1	31.3	33.0
Gluten Index	89	92	92	86	94	94
Falling Number (sec)	409	447	389	420	401	435
Amylograph Viscosity: 65g (BU)	492	567	483	493	522	563
Starch Damage (%)						
SRC: GPI						
Water / 50% Sucrose						
5% Lactic Acid / 5% Na ₂ CO ₃						
Dough Properties:						
Farinograph: Peak Time (min)	6.5	6.7	5.9	6.1	6.0	6.4
Stability (min)	8.5	8.4	8.7	8.3	9.4	9.2
Absorption (%)	62.0	63.0	62.2	63.1	61.7	62.5
Alveograph: P (mm)	79	88	86	94	83	90
L (mm)	122	122	112	107	113	112
P/L Ratio	0.65	0.72	0.77	0.87	0.73	0.81
W (10 ⁻⁴ joules)	306	332	318	319	315	326
Extensograph: Resistance (BU)						
(45/135 min) Extensibility (cm)						
Area (cm ²)						
Baking Evaluation:						
Pan Bread: Bake Absorption (%)	70.6	71.0	71.2	71.1	70.8	70.5
Crumb Grain and Texture (1-10)	7.3	7.9	7.6	7.9	7.5	8.0
Loaf Volume (cc)	1035	917	1004	919	1014	913
Sample Count:	88	197	20	6	23	43

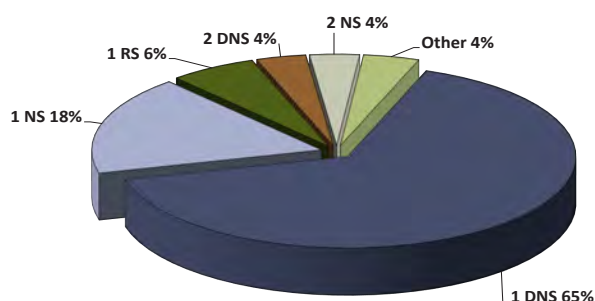
Hard Red Spring Production

for the major producing states (million metric tons)

	2015	2014	2013	2012	2011
Idaho	0.4	0.4	0.5	0.5	0.6
Minnesota	2.3	1.8	1.8	2.0	1.9
Montana	2.1	2.9	2.8	2.6	2.1
North Dakota	8.7	8.0	6.4	7.0	4.7
Oregon	0.0	0.0	0.1	0.1	0.1
South Dakota	1.6	2.0	1.4	1.1	1.0
Washington	0.2	0.2	0.3	0.4	0.5
Seven-State Total	15.3	15.3	13.3	13.7	11.0
Total HRS Production	15.4	15.3	13.4	13.7	11.0

Based on USDA crop estimates of September 30, 2015.

WESTERN REGION

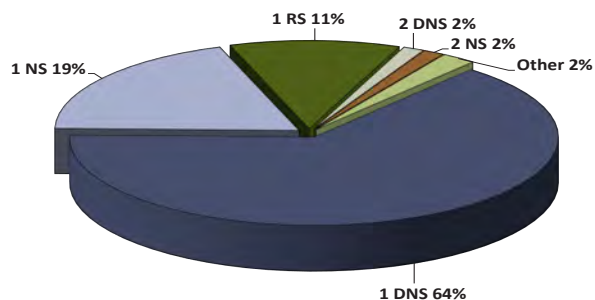


ABOUT HARD RED SPRING WHEAT

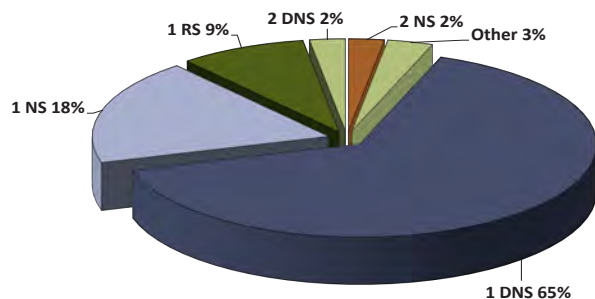
Highest protein content, hard endosperm, red bran, strong gluten, high water absorption.

Used in pan breads, hearth breads, rolls, croissants, bagels, hamburger buns, pizza crust and for blending.

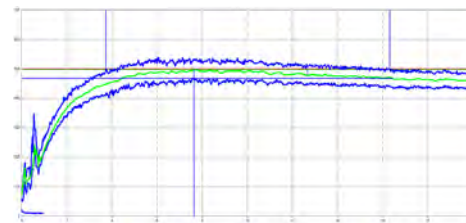
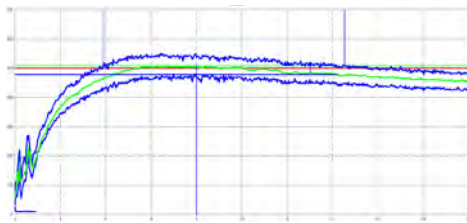
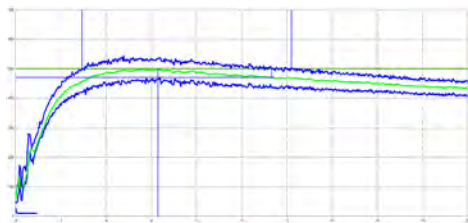
EASTERN REGION



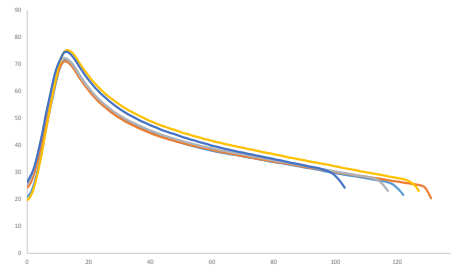
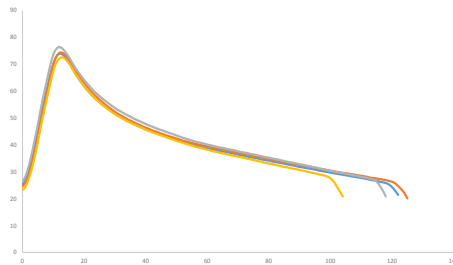
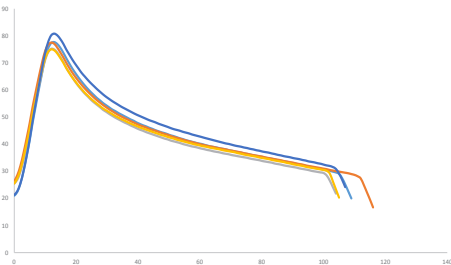
OVERALL



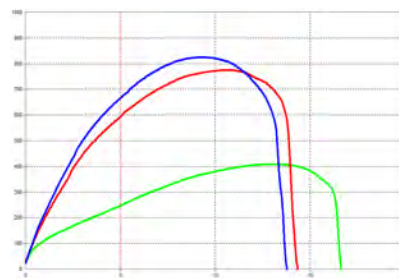
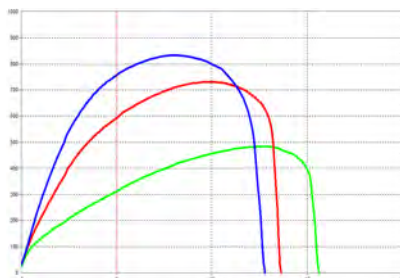
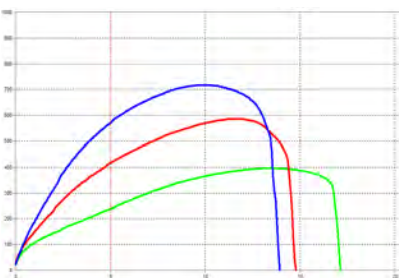
FARINOGRAMS*



ALVEOGRAMS



EXTENSOGRAMS



LOW PROTEIN

MEDIUM PROTEIN

HIGH PROTEIN

*Representing 2015 Composite Average



HARVEST SURVEY

Hard white wheat (HW) for the 2015 crop was primarily grown in Idaho, Kansas, Colorado, Nebraska, California and Montana. Other states such as Washington, North Dakota and South Dakota had limited production. U.S. Wheat Associates estimates 2015 HW production at 654,000 MT, up from 2014's 534,000 MT reported by USDA.

Survey Methods: The 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 seven composites based on the three growing regions sampled (Pacific Northwest or PNW, California, and Southern Plains) and four protein levels (<11.5%, 11.5 to 12.5%, 12.6 to 13.5%, and >13.5%). Wheat, flour and end-product methods are described in the Analysis Methods section of this booklet.

Wheat and Grade Data: The grade for the PNW high-protein, California medium- and high-protein, and Southern Plains low-protein composites is U.S. No. 1, while the PNW high-protein and Southern Plains medium- and high-protein composites graded U.S. No. 2. Test weights range from 58.1 to 64.2 lbs/bu (76.5 to 84.4 kg/hl). Wheat moisture ranges from 8.6% to 10.6%, wheat proteins from 10.0% to 15.1% (12% mb), and ash from 1.24% to 1.70% (14% mb). The thousand kernel weights (TKW) of PNW high-protein and California medium- and high-protein composites are 30.7 g or higher, while the TKW values of other composites are less than 30 g. Kernel diameters range from 2.47 to 2.90 mm. Falling number values are 318 sec or higher for all composites, indicating sound grain.

Flour, Dough and Baking Data: Buhler laboratory mill straight-grade flour extractions range from 69.5% to 72.6%, L* values (whiteness) from 91.2 to 92.1, flour protein from 8.6% to 14.0% (14% mb), and flour ash from 0.42% to 0.52% (14% mb). These values are typical of HW flours.

Flour wet gluten contents range from 21.5% to 35.5% depending on flour protein content. Amylograph peak viscosities are between 569 and 937 BU, which show good starch pasting properties. Starch damage values are in the range of 5.1% to 8.9%. Lactic acid SRC values are 129% to 176%, indicating medium to strong gluten strength.

Farinograph absorptions range from 57.9% to 69.1% and stability times from 6.2 to 37.8 min, exhibiting typically medium to strong dough characteristics of HW. HW farinograph water absorption is usually similar to that of

HRW, but stability time is longer indicating more tolerance to overmixing, but the Southern Plains medium- and very high-protein composites had unusually short stability times this year. The ranges of alveograph values are: 68 to 141 mm for P values; 86 to 144 mm for L values; and 177 to 510 10^{-4} J for W values. Extensograph data at 135-minute resting show that resistance is in the range of 365 to 1283 BU, extensibility from 8.2 to 20.9 cm and area from 70 to 161 cm^2 .

Most samples show very good baking performance relative to protein content, with bake absorptions in the range of 63.0% to 74.0%, loaf volumes of 792 to 955 cc and crumb grain and texture scores of 5.5 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 0 hr of production and after 24 hr of storage at room temperature are acceptable for all samples except for the Southern Plains very high-protein composite which has an L* 24-hr value of 70.8 (72 is the minimum value at 24 hr). Sensory color stability scores are acceptable for all except for the PNW very high- and Southern Plains very high-protein composites that look too yellow. Cooked noodle texture is acceptable for PNW high- and very high-protein and Southern Plains medium- and very high-protein composites. Other composites have softer noodle texture (a minimum of 1200 g is considered acceptable). For Chinese wet noodles, sensory color stability scores are acceptable for most samples except for the Southern Plains very high-protein composite. The cooked noodle texture values of all Chinese wet noodles are generally acceptable for most samples. Overall, this year's HW samples have acceptable noodle quality when the wheat protein is below 13.5%.

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 PNW very high-protein composite, the specific volume and total product score of which are low. Blending 25% of SW flour with high protein HW flour would improve overall steamed bread quality.

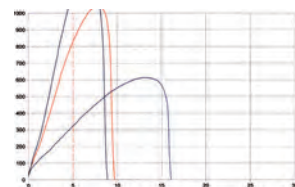
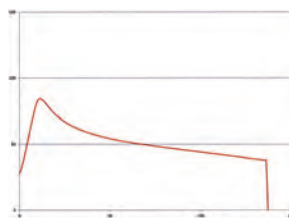
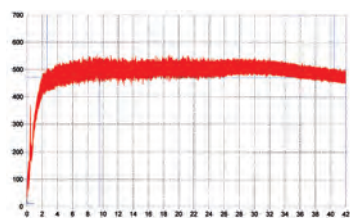
Summary: HW 2015 production is estimated at 654,000 MT, higher than last year. This year's samples show good quality performance in milling, dough rheological properties and end products, including pan breads, Asian noodles and steamed breads. For Asian noodle applications, it is recommended to blend very-high protein HW flour with some SW flour to improve noodle color while maintaining good noodle texture. For steamed breads, it is recommended that very-high protein HW flour be blended with SW flour to avoid steamed bread shrinkage and improve product quality.

FARINOGRAMS

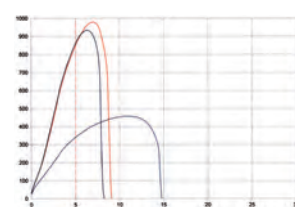
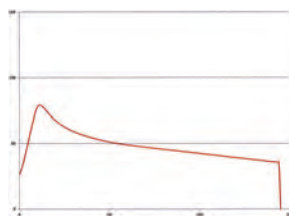
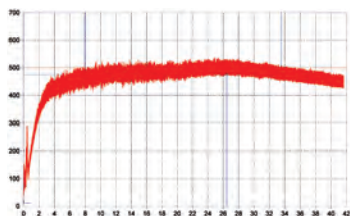
ALVEOGRAMS

EXTENSOGRAMS

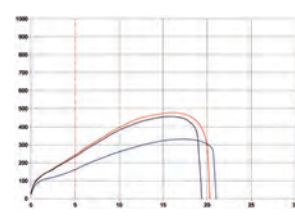
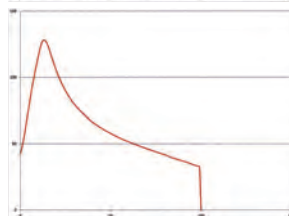
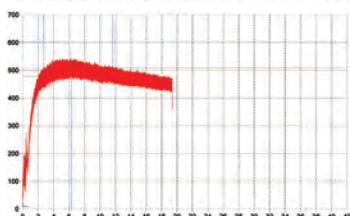
PNW HIGH



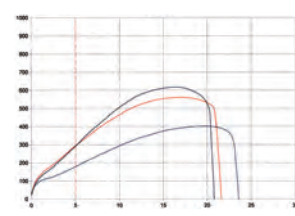
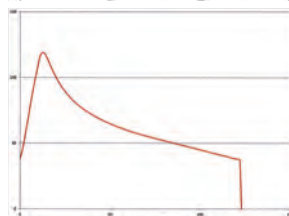
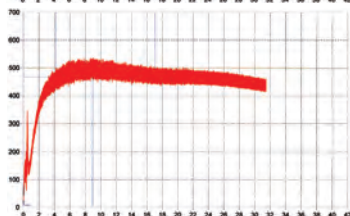
PNW VERY HIGH



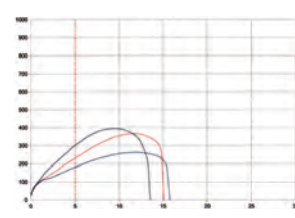
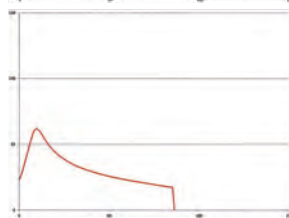
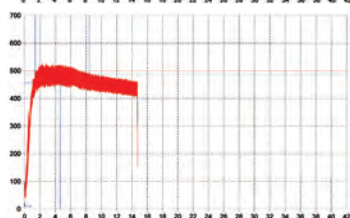
CALIFORNIA
MEDIUM



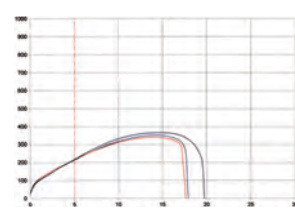
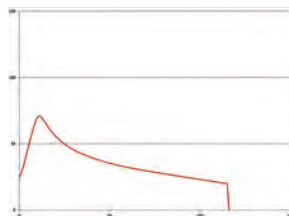
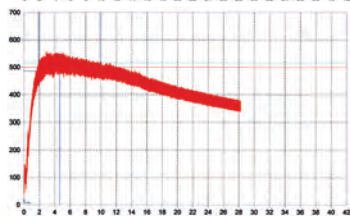
CALIFORNIA
HIGH



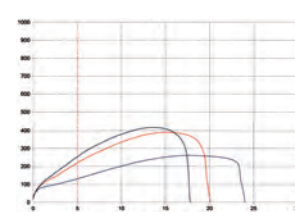
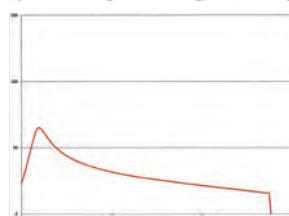
SOUTHERN
PLAINS LOW



SOUTHERN
PLAINS MEDIUM



SOUTHERN
PLAINS VERY
HIGH



Hard White	Pacific Northwest		California		Southern Plains		
	High	Very High	Medium	High	Low	Medium	Very High
Wheat Grade Data:							
Test Weight (lb/bu)	60.6	58.1	64.0	64.2	61.8	61.9	59.8
(kg/hl)	79.7	76.5	84.1	84.4	81.3	81.4	78.7
Damaged Kernels (%)	0.0	0.0	0.2	0.0	0.2	2.0	0.2
Foreign Material (%)	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Shrunken & Broken (%)	0.8	1.8	0.8	0.6	1.0	1.2	3.1
Total Defects (%)	0.8	1.8	1.2	0.6	1.2	3.2	3.3
Grade	1 HW	2 HW	1 HW	1 HW	1 HW	2 HW	2 HW
Wheat Non-Grade Data:							
Dockage (%)	0.6	0.8	0.3	0.0	1.7	0.6	1.0
Moisture (%)	9.4	8.6	10.5	10.3	9.6	10.6	10.4
Protein (%) 12%/0% moisture basis	13.1/14.9	15.1/17.2	11.7/13.3	13.2/15.0	10.0/11.4	12.2/13.9	14.1/16.0
Ash (%) 14%/0% moisture basis	1.48/1.72	1.60/1.86	1.30/1.51	1.24/1.45	1.56/1.81	1.55/1.81	1.70/1.97
1000 Kernel Weight (g)	30.7	25.1	35.2	33.2	27.0	26.3	24.3
Kernel Size (%) lg/md/sm	81/18/1	59/39/2	86/14/0	89/11/0	77/22/1	72/27/1	66/33/1
Single Kernel: Hardness	62.5	73.5	86.1	82.3	57.6	68.2	66.1
Weight (mg)	34.6	27.4	38.8	39.0	31.8	30.7	29.6
Diameter (mm)	2.68	2.47	2.85	2.90	2.67	2.65	2.56
Sedimentation (cc)	49.2	64.9	38.1	46.4	27.3	29.9	38.1
Falling Number (sec)	330	318	367	340	400	339	434
Flour Data:							
Lab Mill Extraction (%)	72.2	69.5	72.6	71.4	72.6	72.2	69.7
Color: L*	92.1	91.6	91.4	91.5	92.0	91.6	91.2
a*	-2.1	-1.9	-2.2	-1.9	-2.5	-2.2	-2.3
b*	7.7	7.8	8.3	7.6	9.0	8.2	9.1
Protein (%) 14%/0% moisture basis	12.1/14.0	14.0/16.2	10.7/12.5	12.2/14.2	8.6/10.0	11.0/12.8	12.9/15.0
Ash (%) 14%/0% moisture basis	0.42/0.49	0.43/0.50	0.50/0.58	0.50/0.58	0.44/0.51	0.47/0.54	0.52/0.61
Wet Gluten (%)	27.3	35.5	29.3	34.3	21.5	29.1	32.5
Gluten Index	99	92	92	95	89	88	83
Falling Number (sec)	380	424	415	449	389	377	463
Amylograph Viscosity 65 g (BU)	937	807	623	716	915	569	884
Starch Damage (%)	6.0	5.1	8.9	6.9	5.1	6.3	5.2
SRC: GPI	0.80	0.77	0.57	0.72	0.65	0.71	0.67
Water/50% Sucrose	68/130	69/134	80/131	79/126	67/108	69/119	67/119
5% Lactic Acid/5% Na ₂ CO ₃	176/91	176/93	142/120	169/107	129/92	151/94	140/89
Dough Properties:							
Farinograph: Peak Time (min)	9.6	26.5	6.4	9.0	4.7	4.7	7.0
Stability (min)	37.8	25.6	8.9	12.9	7.1	8.0	6.2
Absorption (%)	60.3	63.2	68.4	69.1	57.9	61.9	60.7
Alveograph: P (mm)	93	87	141	131	68	78	71
L (mm)	136	144	99	123	86	115	137
P/L Ratio	0.68	0.60	1.42	1.07	0.79	0.68	0.52
W (10 ⁻⁴ joules)	463	458	420	510	177	272	273
Extensograph: Resistance (BU)	613/1283	456/935	332/458	402/616	262/394	351/365	261/417
(45/135 min) Extensibility (cm)	16.1/8.9	14.8/8.2	21.2/19.5	23.7/20.9	15.9/13.6	18.0/19.9	24.0/17.8
Area (sq cm)	117/125	88/86	89/112	119/161	56/70	83/96	82/96
Baking Evaluation:							
Pan Bread: Bake Absorption (%)	65.3	68.3	73.5	74.0	63.0	66.7	65.6
Crumb Grain and Texture	6.3	6.0	5.5	5.5	6.5	6.5	7.0
Loaf Volume (cc)	955	930	792	878	796	808	908

Protein Range: Low, less than 11.5%; Medium, 11.5 to 12.5%; High, 12.6 to 13.5%; Very High, greater than 13.5%.

Hard White	Pacific Northwest		California		Southern Plains		
	High	Very High	Medium	High	Low	Medium	Very High
Chinese Raw Noodle-Making Quality:							
Color at 0/24 hour: L*	84.6/74.2	83.4/73.4	84.1/74.2	84.3/74.5	85.8/76.1	85.2/74.8	80.9/70.8
a*	0.6/1.9	1.1/2.7	0.1/1.1	0.7/1.4	-0.2/0.6	0.1/1.1	0.5/1.8
b*	16.0/24.3	16.8/26.8	17.3/25.2	15.6/24.3	17.0/25.4	15.5/24.6	21.3/30.2
Change in L* (0-24 hr)	10.4	10.0	10.0	9.8	9.7	10.4	10.1
Cooking Yield (5 min, %)	122	118	128	127	149	124	134
Sensory Color Stability Score	6.2	5.7	7.0	6.8	8.2	6.1	5.5
Instrumental Texture:							
Firmness (g)	1200	1459	1064	1067	736	1128	1194
Springiness (%)	94.8	95.1	93.2	94.5	85.1	95.1	94.6
Cohesiveness	0.67	0.65	0.69	0.70	0.67	0.65	0.66
Chewiness (g)	760	899	682	705	423	699	744
Chinese Wet Noodle-Making Quality:							
Uncooked Color at 0/24 hour: L*	79.6/69.7	79.1/70.9	81.3/70.8	80.3/70.3	83.7/73.3	79.0/67.2	79.0/65.2
a*	-1.1/0.3	-0.3/0.7	-1.7/-0.5	-1.0/-0.3	-1.6/-0.5	-0.9/0.4	-1.0/0.2
b*	21.9/23.2	23.1/26.9	19.8/24.8	21.9/25.6	20.1/24.8	21.1/25.7	20.8/24.4
Change in L* (0-24 hr)	9.9	8.2	10.5	10.0	10.3	11.7	13.7
Parboiled Color at 0/24 hour: L*	77.0/77.5	77.3/77.6	77.8/77.9	78.0/77.9	78.2/78.9	76.2/76.2	75.8/75.8
a*	-1.5/-2.1	-1.4/-1.9	-1.6/-2.3	-0.6/-2.1	-2.6/-3.1	-1.5/-2.0	-1.4/-1.8
b*	29.5/28.4	28.8/27.9	30.7/28.9	28.8/27.7	33.2/32.1	30.1/29.2	29.5/28.8
Cooking Yield (1.5 min, %)	63	61	76	68	72	68	63
Uncooked Color Stability Score	6.3	6.3	7.0	7.0	7.0	6.3	5.5
Parboiled Color Stability Score	6.3	6.5	7.0	7.4	7.0	6.5	6.0
Instrumental Texture:							
Firmness (g)	906	767	635	797	718	963	884
Springiness (%)	95.8	94.7	93.6	94.7	93.7	93.3	94.9
Cohesiveness	0.65	0.67	0.66	0.69	0.70	0.61	0.66
Chewiness (g)	564	484	390	517	467	549	550
Asian-Type Steamed Bread Evaluation:							
Specific Volume (ml/g)	2.8	2.3	2.8	3.0	2.7	2.9	3.0
Total Score	68.8	66.5	68.3	70.4	68.3	68.7	67.8

Protein Range: Low, less than 11.5%; Medium, 11.5 to 12.5%; High, 12.6 to 13.5%; Very High, greater than 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.



NORTHERN GREAT PLAINS

Weather and Harvest: The 2015 Montana and North Dakota durum crop is nearly 50% larger than 2014's crop because of higher planted area and record yields across North Dakota. Low winter snowfall and warm, dry spring conditions allowed planting to begin in early April, two weeks ahead of normal and one month ahead of 2014. Progress was steady, and most of the crop was planted by the end of May.

Early growing conditions were nearly ideal. Moderate temperatures and timely rains through June and July enabled the crop to develop rapidly and boosted yield potential in most areas. However, warm, dry mid-season conditions reduced yield potential in some western areas. Disease pressure was minimal and more isolated than in recent years.

Harvest began in early August, about two weeks ahead of average. Favorable weather allowed steady progress, and harvest was 80% complete by early September. Sporadic rains hampered the final portion, but most of the sound, high quality crop was harvested by late September.

Survey Methods: State offices of the National Agricultural Statistics Service collected 204 samples (148 from North Dakota and 56 from Montana) from producers in the field, farm bins and local elevators. The Durum Quality Lab, North Dakota State University, Fargo, ND, conducted analyses.

Wheat and Grade Data: The average grade is No. 1 Hard Amber Durum (HAD) with notable improvements in kernel attributes over 2014. Sixty percent of the samples graded No. 1 HAD, and 90% of them were No. 2 or better, a significant improvement over the grade profile of the 2014 crop. Average test weight is a high 60.6 lbs/bu (78.9 kg/hl), damaged kernels are just 0.3% and average vitreous kernel (HVAC) content is 91%. Nearly two-thirds of test weights are above 60 lbs/bu (78.1 kg/hl), compared with just 28% last year, and two-thirds of HVAC values are above 90%, compared with 24% in 2014.

Average kernel moisture is just 11.2%, down from 2014's 12.4%, and average falling number is 414 sec, well above 2014's 276 sec. Nearly three-fourths of the samples had falling numbers above 400 sec and only 2% below 300 sec. Average protein of 13.9% (12% mb) is higher than both 2014 and the 5-year average; three-fourths of the samples were above 13%. Drought increased protein in western areas.

Disease pressures were lower and more isolated in 2015 compared with recent years. The vast majority of the samples

analyzed had no detectable DON. Average DON is 0.8 ppm, well below 2014's 2.1 ppm and the 5-year average of 1.3 ppm.

Semolina and Processing Data: Functional performance is also somewhat improved over 2014. Milling performance, based on a Buhler laboratory mill, reflects similar overall extraction compared to 2014 at 70.6%, but higher semolina extraction of 65.1%, 0.6 points higher than 2014 and higher than the 5-year average. The milled product has reduced ash of 0.64%, compared to 0.74% in 2014, and a lower speck count. The semolina b* value of 30.1, the highest ever reported, indicates improved yellow color, a result of varietal improvements and the excellent 2015 growing conditions. The average wet gluten value is 37.0%, well above 2014's 32.8% and the 5-year average of 35.1%. The average gluten index is 50%, up slightly from 2014 but below the 5-year average.

Semolina mixing and pasta processing and cooking properties are slightly weaker than both 2014 and the 5-year average, but color is improved and cooked firmness is slightly greater. Color scores are high across the region, while cooked firmness tends to increase from east to west.

Summary: Buyers will be pleased with the improved quality of the 2015 crop, especially on factors routinely valued in contract specifications. The crop boasts high test weights, high protein, very high vitreous kernel contents and falling numbers, improved semolina color and a much lower incidence of DON compared with recent years. End-use performance factors indicate a high quality crop, although mixing properties are a bit weaker than recent years. While quality is relatively uniform in the 2015 crop, diligent contract specifications are still encouraged to ensure the best value.

DESERT DURUM®

Desert Durum®, a trademark of the Arizona Grain Research and Promotion Council and the California Wheat Commission, refers to durum wheat produced under irrigation in Arizona and California. Desert Durum® is often delivered "identity preserved" to domestic and export markets, which allows buyers to buy varieties with quality traits specific to their needs. Annual production requirements can be precontracted with grain merchandisers who provide certified seed of specific varieties to experienced growers. Handlers can store grain by varietal identity for season-long shipment on the buyers' preferred delivery schedules.

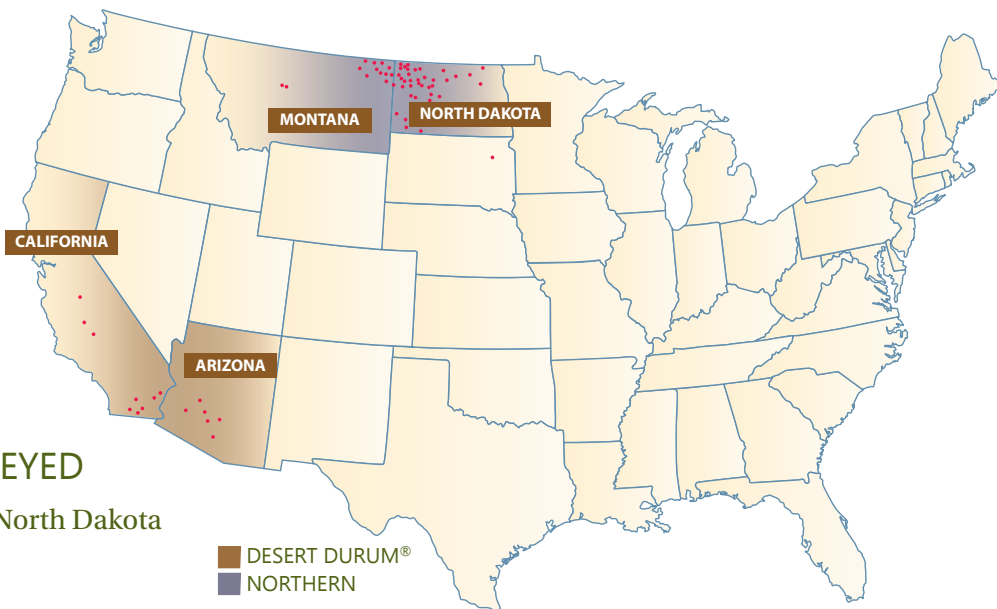
Due to high prices at planting time, Desert Durum® acreage increased substantially in 2015 over the previous year. On average, yields were somewhat lower due to a weather-related shorter growing season. New crop grain still exhibits consistently large kernel size and low moisture, traits that contribute to high extraction rates. Overall, grain quality characteristics meet expectations. In summary, the 2015 Desert Durum® crop will deliver the valuable milling, semolina and pasta quality traits that customers have learned to expect and appreciate.

ABOUT DURUM WHEAT

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

EXPORT CARGO SURVEY

The durum export cargo data represents 51 individual subplot samples provided by USDA's Federal Grain Inspection Service for crop year 2014 (collected from October 2014 through June 2015) and 18 samples for 2013. Grade data are the actual official grades on the individual subplots. Processing analysis was conducted by North Dakota State University.

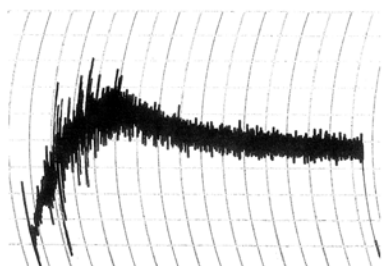


FOUR STATES SURVEYED

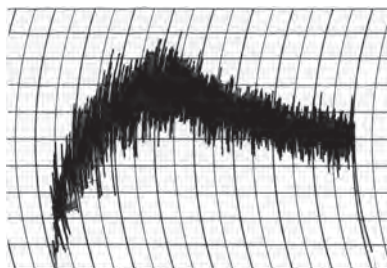
Arizona • California • Montana • North Dakota

MIXOGRAMS

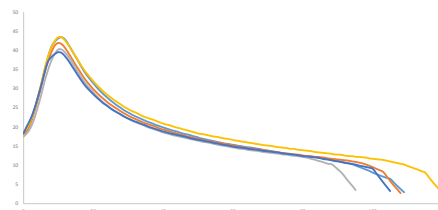
NORTHERN DURUM
REGIONAL AVERAGE



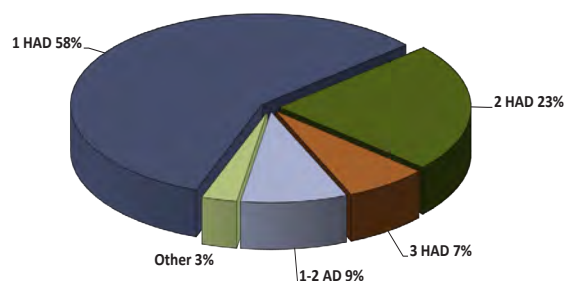
DESERT DURUM
REGIONAL AVERAGE



ALVEOGRAMS



NORTHERN DURUM GRADE DISTRIBUTION



Durum	Harvest Data						Export Cargo Data			
	Northern Durum			Desert Durum®			Northern Durum		Desert Durum®	
	2015	2014	5-Year Avg	2015	2014	5-Year Avg	2014	2013	2014	2013
Wheat Grade Data:										
Test Weight (lb/bu)	60.6	59.0	60.0	62.4	63.2	62.8	60.0	60.6	62.1	62.3
(kg/hl)	78.9	76.8	78.2	81.3	82.3	81.7	78.1	79.0	80.8	81.1
Damaged Kernels (%)	0.3	0.8	0.6	0.4	0.2	0.3	4.3	2.2	1.3	0.2
Foreign Material (%)	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.2	0.1	0.1
Shrunken and Broken (%)	1.0	0.9	1.0	0.7	0.4	0.5	1.4	1.3	0.7	0.8
Total Defects (%)	1.3	1.7	1.7	1.1	0.6	0.8	5.7	3.6	2.0	1.1
Contrasting Classes (%)	0.0	0.0	0.2	0.0	0.0	0.0	2.8	0.9	0.3	0.1
Vitreous Kernels (%)	91	74	84	92	97	97	62	71	90	96
Grade	1 HAD	2 AD	1 HAD	1 HAD	1 HAD	1 HAD	3 AD	2 AD	1 HAD	1 HAD
Wheat Non-Grade Data:										
Dockage (%)	0.9	0.7	1.0	0.5	0.3	0.4	0.5	0.6	0.5	0.4
Moisture (%)	11.2	12.4	11.6	7.7	6.4	6.4	12.3	12.7	6.8	6.9
Protein (%) 12%/0% moisture basis	13.9/15.8	13.2/15.0	13.5/15.4	14.0/15.9	13.3/15.1	13.4/15.2	13.2/15.0	13.3/15.1	13.7/15.6	13.3/15.1
Ash (%) 14%/0% moisture basis	1.57/1.83	1.64/1.91	1.62/1.89	1.71/1.99	1.72/2.00	1.74/2.00	1.63/1.90	1.70/1.97	1.67/1.95	1.63/1.90
1000 Kernel Weight (g)	38.5	38.0	39.2	53.0	47.8	48.0	39.9	40.5	48.4	45.6
Kernel Size (%) lg/md/sm	46/51/3	52/46/2	51/45/4	92/8/0	91/9/0	90/10/0	47/51/2	47/48/5	77/22/1	70/28/2
Falling Number (sec)	414	276	354	565	402	445	275	391	1211	1623
Sedimentation (cc)	62	60	48	64	64	64				
DON (ppm)	0.8	2.1	1.3					<0.5		<0.5
Semolina Data:										
Lab Mill Extraction (%)	70.6	70.4	70.6	75.8	71.0	74.6	70.6	70.8	71.8	72.2
Semolina Extraction (%) ¹	65.1	64.5	64.8	62.6	62.0	62.1	63.7	64.4	66.3	66.7
Ash (%) 14%/0% moisture basis	0.64/0.74	0.74/0.86	0.68/0.79	0.86/1.00	0.81/0.94	0.86/1.00	0.69/0.81	0.68/0.79	0.66/0.76	0.71/0.82
Specks (no/10 sq in)	24	26	29	24	21	12	28	27	24	21
Protein (%) 14%/0% moisture basis	12.7/14.8	12.5/14.5	12.54/14.6	13.0/15.1	12.3/14.4	12.3/14.4	12.0/14.0	11.9/13.8	12.4/14.4	12.1/14.0
Wet Gluten (%)	37.0	32.8	35.1	34.6	33.2	32.5				
Gluten Index	50	45	54	75	76	82	48	40	78	79
Mixograph: Classification	5.1	5.5	5.5	8.0			5.4	5.3	7.6	7.5
Peak Time (min)	2.2			2.7						
Peak Height (mu)	5.9			7.2						
Alveograph: P (mm)	49	45	45	104	114	98				
L (mm)	91	120	111	55	60	61				
P/L Ratio	0.56	0.39	0.41	1.87	1.90	1.60				
W (10 ⁻⁴ joules)	129	135	124	223	247	208				
Color: L*	84.4	84.9	84.7	87.5	88.7	88.0	84.4	85.2	84.4	84.9
a*	-3.1	-4.0	-3.0	-1.5	-2.1	-0.6	-2.8	-3.4	-2.9	-3.4
b*	30.1	27.9	28.5	25.6	26.1	25.9	26.8	26.1	27.7	26.5
Spaghetti Processing Data:										
Color Score	8.9	8.8	8.9	7.6	9.1	8.6	8.0	8.5	8.7	9.1
Cooked Weight (gm)	31.0	31.9	31.6	29.0	29.3	29.8	31.4	32.0	30.5	31.3
Cooking Loss (%)	5.8	6.8	6.3	5.8	5.8	7.1	6.3	6.7	5.9	6.6
Cooked Firmness (g cm)	4.4	4.2	4.6	6.8	6.3	7.4	3.9	4.2	4.7	4.9
Sample Count:							36	7	15	11

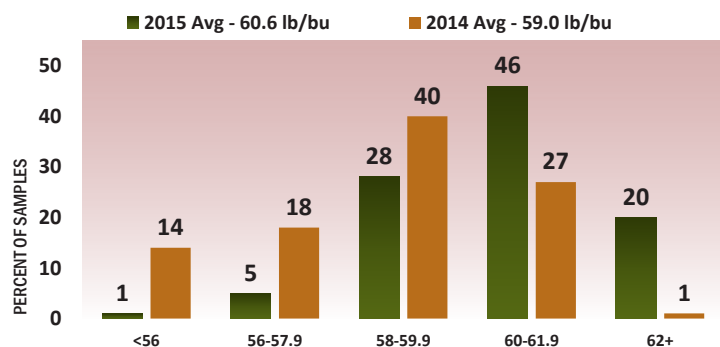
NOTE: Semolina extraction values for Desert Durum® and Northern Durum cannot be compared since they were milled using different laboratory mills. In contrast, milling data for the Durum Export Cargo samples can be compared since these samples were milled on the same mill.

NORTHERN DURUM DISTRIBUTIONS



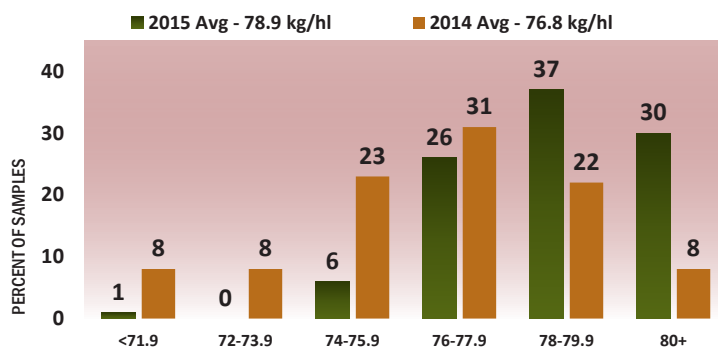
TEST WEIGHT

Pounds/Bushel



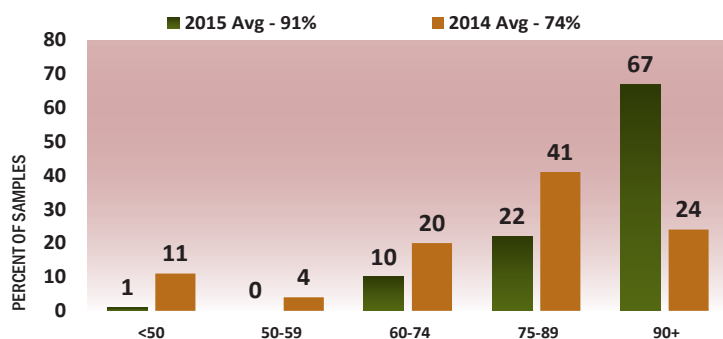
HECTOLITER WEIGHT

Kilograms/Hectoliter



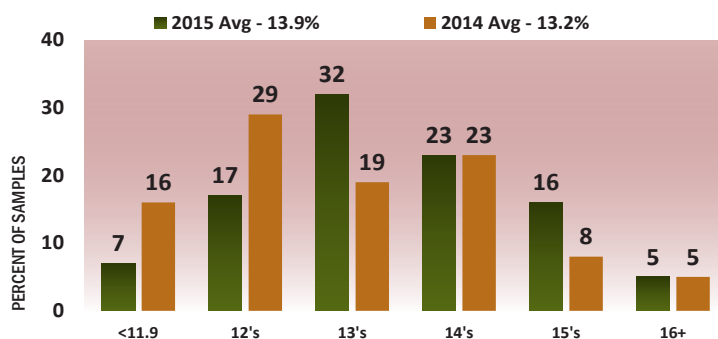
VITREOUS KERNELS

Percent



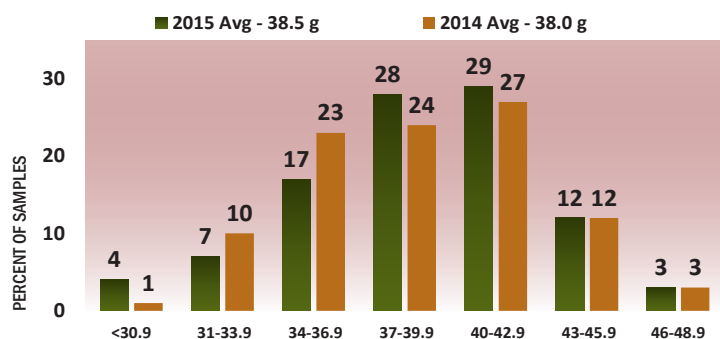
PROTEIN (12% MB)

Percent



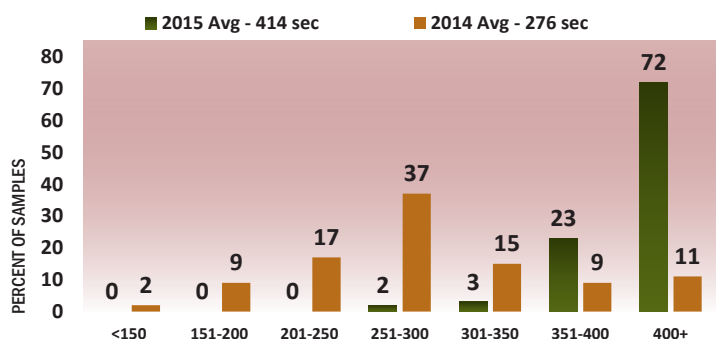
1000 KERNEL WEIGHT

Grams



FALLING NUMBER

Seconds



Durum Production

for the major producing states (million metric tons)

	2015	2014	2013	2012	2011
Arizona	0.4	0.2	0.2	0.3	0.2
California	0.2	0.1	0.2	0.4	0.3
Montana	0.5	0.4	0.5	0.4	0.3
North Dakota	1.2	0.8	0.8	1.2	0.5
Total Durum Production	2.2	1.5	1.7	2.2	1.4

Based on USDA crop estimates of September 30, 2015.

HARVEST SURVEY

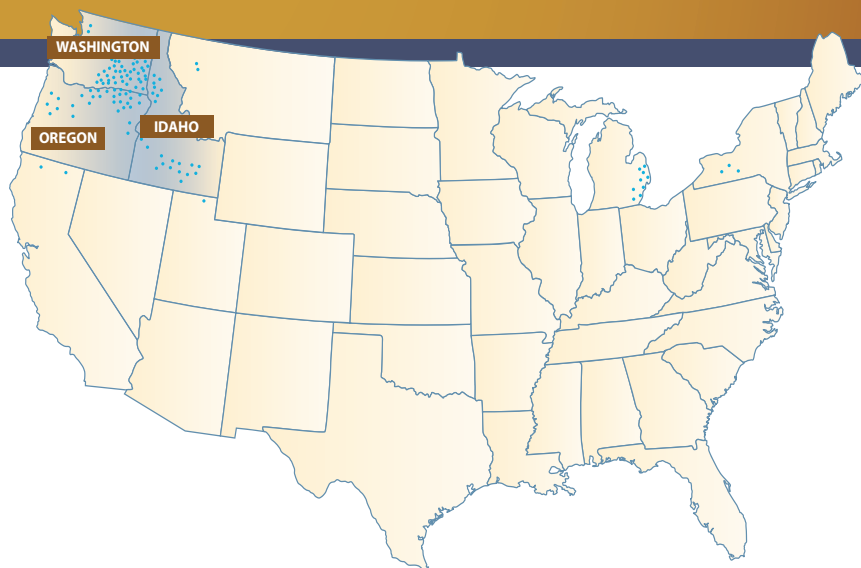
Weather and Harvest: The Pacific Northwest (PNW) had limited to adequate soil moisture at planting. Rainfall was short to adequate during the late winter and early spring, and generally dry, warm conditions were reported in the later spring. Some timely rains occurred in early summer, but conditions were hot and dry from the beginning of grain filling through wheat kernel development and during harvest.

Survey and Analysis Methods: A total of 448 soft white (SW) and 111 white club (WC) wheat samples were collected from state and private grain inspection agencies and commercial handling operations. Grade and protein were determined on individual samples. Three composite SW samples were made by protein content (low <9.0%, medium 9.0-10.5%, and high >10.5%); WC samples formed one composite. Wheat and flour quality analyses were conducted by the Wheat Marketing Center, Portland, OR, using the methods in the Analysis Methods section of this booklet. The wheat commissions of Idaho, Oregon and Washington, U.S. Wheat Associates, and many areas of the wheat industry supported this program.

Wheat and Grade Data: The average grade for both SW and WC is No. 2 SW because of lower test weight. The SW and WC test weights of 59.3 lbs/bu (78.0 kg/hl) and 58.3 lbs/bu (76.8 kg/hl), respectively, are both well below past averages. Shrunken and broken kernels are higher for SW and WC than 2014 and 5-year averages. SW and WC dockage averages are higher than 2014 but similar to 5-year averages, while moisture contents for both are below 2014 and 5-year averages.

SW protein (12% mb) of 10.9% is the same as last year and higher than the 5-year average of 10.0%. WC protein (12% mb) of 11.7% is higher than last year's 11.1% and the 5-year average of 10.2%. SW and WC wheat ash contents are higher than last year and the 5-year averages. SW and WC thousand kernel weights are lighter and kernel diameters are smaller than last year and 5-year averages. SW and WC falling numbers (14% mb) are 354 and 363 seconds, respectively.

Flour, Dough and Baking Data: The Buhler Laboratory Mill flour extraction for SW of 72.6% is less than 2014 and the 5-year average; WC flour extraction of 70.8% is much lower than last year's 75.9%. SW and WC flour protein contents (14% mb) are 9.5% and 10.2%, respectively. Flour ash contents for both SW and WC are lower than 2014 and similar to the 5-year averages. SW and WC flour falling numbers are 397 and 417 seconds, and amylograph peak viscosity values are 629 and 647 BU, respectively. SW SRC sucrose and lactic acid values are similar to 2014 and higher than the 5-year averages; the sodium carbonate value is lower than 2014 but similar to the 5-year average; GPI is slightly higher than 2014 and the 5-year



THREE STATES SURVEYED

Idaho • Oregon • Washington

average. WC SRC for all solvents and GPI is similar to last year and 5-year averages. SW farinograph peak and stability times show slightly stronger gluten properties than 2014 and the 5-year averages. WC farinograph shows similar gluten characteristics to last year. SW and WC have shorter alveograph L values than 2014 and the 5-year averages. SW extensograph extensibility is shorter than 2014, but longer than the 5-year average. WC extensibility is longer than 2014 but similar to the 5-year average. SW and WC sponge cake volumes of 1266 cc and 1267 cc, respectively, are bigger than last year and 5-year averages. SW cookie diameter is slightly larger than last year and similar to the 5-year average. WC cookie diameter is the same as last year and slightly smaller than the 5-year average. SW and WC cookie spread factors are greater than last year, but smaller than 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 than last year, but slightly higher than 5-year averages. SW total score is slightly lower than last year and similar to the 5-year average. WC total score is higher than last year and similar to the 5-year average.

Summary: The 2015 PNW SW crop is characterized by less than average test weight, higher than average protein content, less than average kernel size and weight and acceptable finished product characteristics. The high protein segment of the SW crop provides opportunities in blends for Asian noodles, crackers, steamed breads and various bread products.

EXPORT CARGO SURVEY

The PNW SW export cargo data show the results of analyses of individual subplot samples including 60 drawn from the 2014 crop and 90 from the 2013 crop (August 2014 through May 2015). Representative samples are selected from official FGIS samples. Grade data are the actual grades on the individual subplots. WMC conducted milling and processing analyses.

Pacific Northwest Soft White Wheat Production

in major producing states (million metric tons)

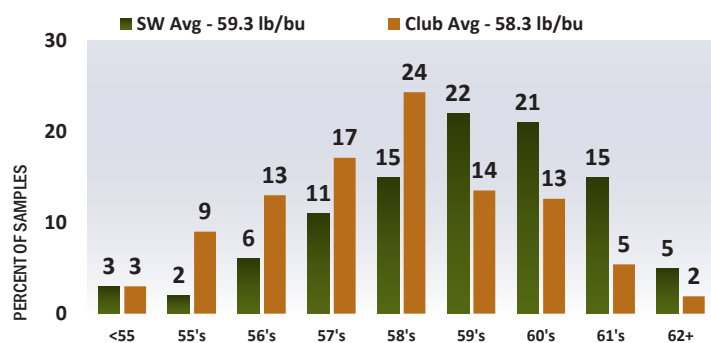
	2015		2014		2013		2012		2011	
	SW	CLUB	SW	CLUB	SW	CLUB	SW	CLUB	SW	CLUB
Washington	2.3	0.2	2.2	0.2	2.9	0.3	2.5	0.4	3.1	0.4
Oregon	1.0	0.0	1.1	0.0	1.3	0.0	1.4	0.0	1.8	0.0
Idaho	1.5	0.0	1.6	0.0	1.7	0.0	1.5	0.0	1.8	0.1
Three-State Total	4.7	0.3	4.9	0.2	5.9	0.3	5.4	0.5	6.7	0.5
Three-State Total Soft White Wheat	4.9		5.1		6.2		5.9		7.2	
Total US Soft White Wheat	5.4		5.5		6.7		6.5		7.9	

Based on USDA crop estimates of September 30, 2015.



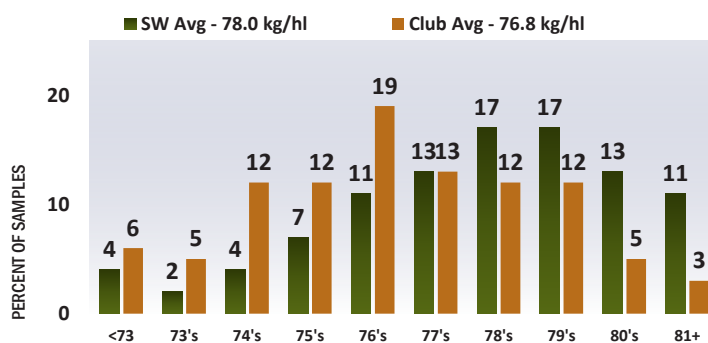
TEST WEIGHT

Pounds/Bushel



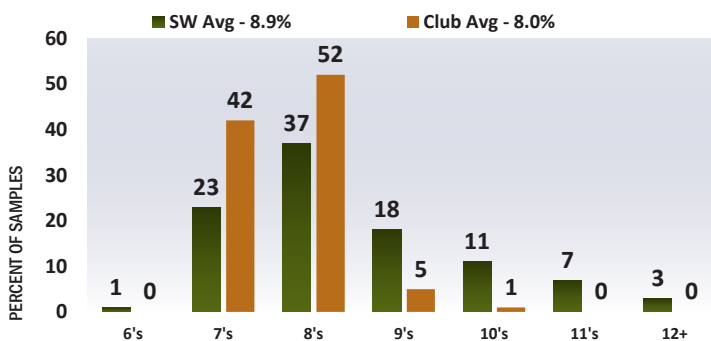
HECTOLITER WEIGHT

Kilograms/Hectoliter



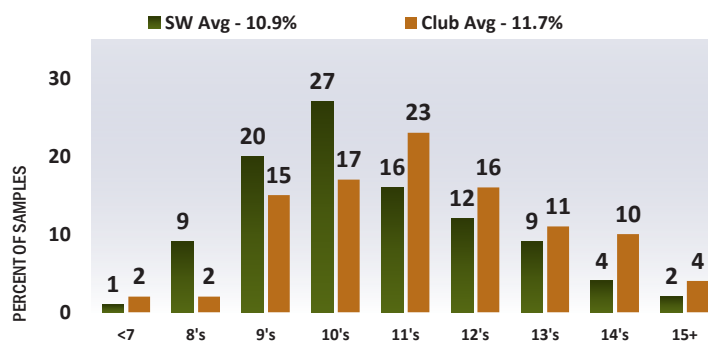
WHEAT MOISTURE

Percent



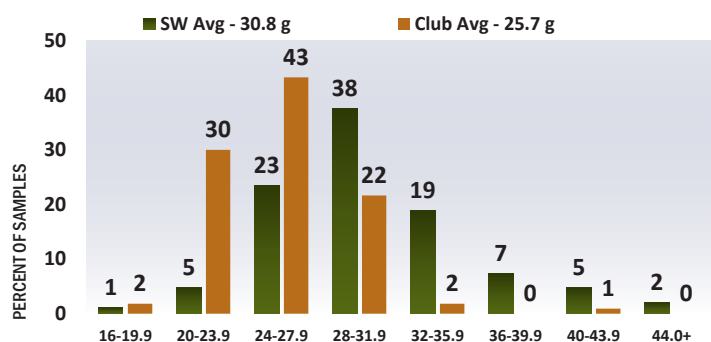
PROTEIN (12% MB)

Percent



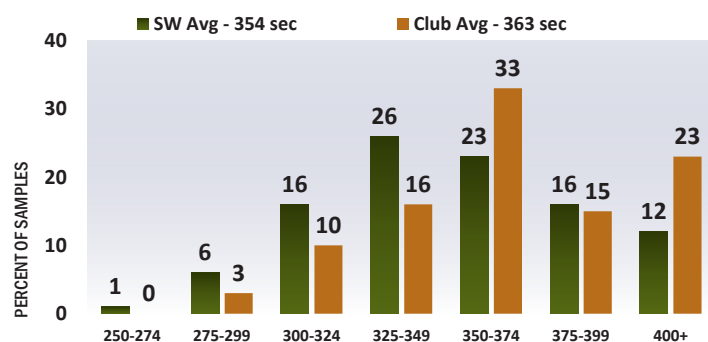
1000 KERNEL WEIGHT

Grams



FALLING NUMBER

Seconds

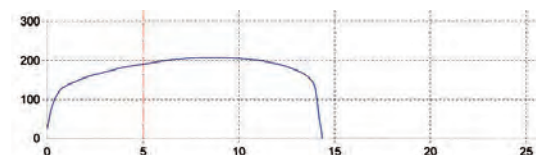
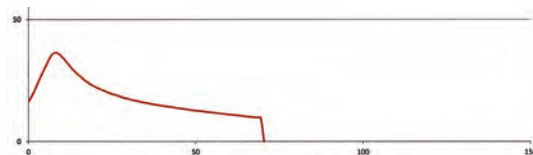
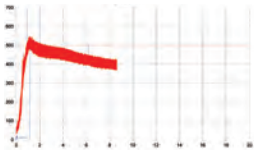


FARINOGRAMS

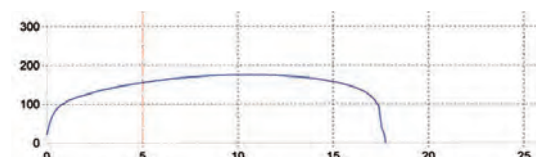
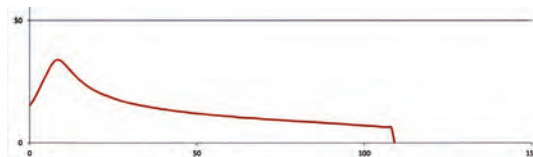
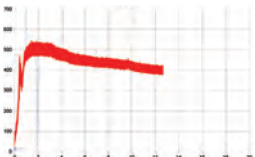
ALVEOGRAMS

EXTENSOGRAMS

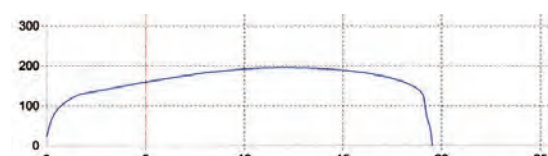
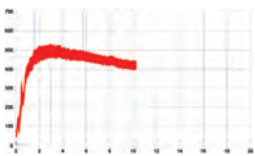
LOW PROTEIN



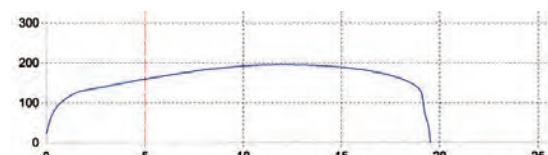
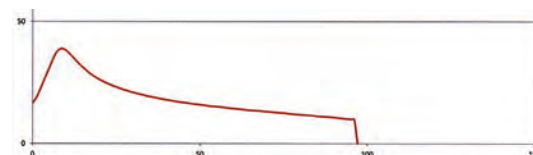
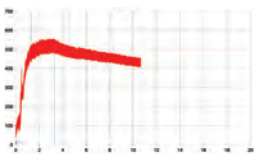
MEDIUM PROTEIN



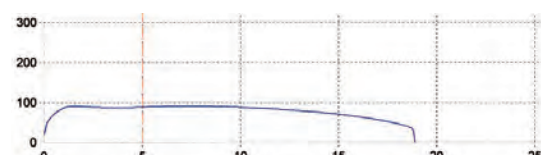
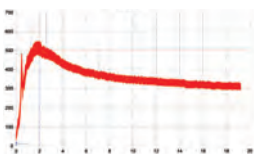
HIGH PROTEIN



AVERAGE PROTEIN



CLUB



PNW SOFT WHITE | HARVEST DATA

Soft White	2015					2014		5-Year Average	
	Soft White By Protein				Club				
	Low	Med	High	Overall	Average	SW	Club	SW	Club
Wheat Grade Data:									
Test Weight (lb/bu)	59.9	59.7	59.0	59.3	58.3	60.6	61.7	60.6	60.6
(kg/hl)	78.8	78.6	77.6	78.0	76.8	79.7	81.1	79.8	79.7
Damaged Kernels (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Foreign Material (%)	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
Shrunken & Broken (%)	0.6	0.8	1.1	1.0	2.3	0.7	1.1	0.6	0.9
Total Defects (%)	0.7	0.8	1.2	1.1	2.4	0.8	1.2	0.7	1.0
Grade	2 SW	2 SW	2 SW	2 SW	1 WC	1 SW	1 WC	1 SW	1 WC
Wheat Non-Grade Data:									
Dockage (%)	0.6	0.7	0.6	0.6	0.8	0.4	0.2	0.5	0.7
Moisture (%)	9.0	9.3	8.7	8.9	8.0	9.2	8.7	9.4	9.1
Protein (%) 12%/0% moisture basis	8.3/9.4	9.8/11.1	12.2/13.9	10.9/12.3	11.7/13.3	10.9/12.4	11.1/12.6	10.0/11.3	10.2/11.5
Ash (%) 14%/0% moisture basis	1.31/1.52	1.40/1.62	1.44/1.68	1.41/1.64	1.39/1.61	1.32/1.53	1.25/1.46	1.35/1.57	1.27/1.47
1000 Kernel Weight (g)	31.4	32.5	29.4	30.8	25.7	32.7	31.1	35.3	33.0
Kernel Size (%) lg/md/sm	83/17/0	82/17/1	67/32/1	74/25/1	54/44/2	79/20/1	74/25/1	84/15/1	80/19/1
Single Kernel: Hardness	32.1	30.2	34.3	32.4	37.0	27.4	33.3	33.5	33.7
Weight (mg)	34.6	36.0	32.9	34.3	29.1	36.7	31.9	38.3	35.0
Diameter (mm)	2.68	2.68	2.58	2.63	2.40	2.70	2.51	2.78	2.62
Sedimentation (cc)	14.3	15.0	20.9	17.9	13.7	17.7	10.7	15.9	11.1
Falling Number (sec)	314	341	365	354	363	353	336	333	322
Flour Data:									
Lab Mill Extraction (%)	72.2	74.5	71.3	72.6	70.8	75.7	75.9	74.7	75.3
Color: L*	92.6	92.4	92.2	92.3	92.2	92.2	92.1	92.0	91.9
a*	-2.6	-2.4	-2.3	-2.4	-2.2	-2.4	-2.3	-2.5	-2.4
b*	8.0	7.9	7.6	7.7	7.3	8.1	7.8	8.1	7.7
Protein (%) 14%/0% moisture basis	7.2/8.4	8.5/9.9	10.7/12.4	9.5/11.0	10.1/11.7	10.2/11.9	10.1/11.7	9.0/10.5	9.1/10.5
Ash (%) 14%/0% moisture basis	0.42/0.49	0.51/0.59	0.50/0.58	0.50/0.58	0.49/0.57	0.54/0.63	0.55/0.64	0.51/0.59	0.49/0.57
Wet Gluten (%)	14.1	24.5	29.7	26.0	25.1	28.7	30.2	22.6	21.4
Gluten Index	86	65	57	63	41	52	28	65	47
Falling Number (sec)	329	371	432	397	417	369	368	360	341
Amylograph Viscosity 65 g (BU)	661	559	675	629	647	523	435	491	472
Starch Damage (%)	4.6	5.0	4.3	4.6	4.2	5.0	4.4	4.3	3.8
SRC: GPI	0.58	0.57	0.65	0.61	0.49	0.57	0.47	0.56	0.49
Water/50% Sucrose	58/104	59/106	60/115	59/110	53/100	56/112	54/99	55/99	52/92
5% Lactic Acid/5% Na2CO3	108/81	108/83	122/71	115/77	85/75	113/85	83/75	99/80	80/73
Dough Properties:									
Farinograph: Peak Time (min)	1.2	1.9	3.0	3.3	2.0	3.0	1.8	1.8	1.6
Stability (min)	1.1	3.2	4.2	3.1	1.3	2.5	1.1	2.9	1.6
Absorption (%)	51.9	53.0	54.8	54.2	53.6	55.3	53.8	53.5	52.0
Alveograph: P (mm)	40	37	40	43	31	41	28	40	27
L (mm)	70	109	119	97	65	119	82	112	91
P/L Ratio	0.57	0.34	0.34	0.44	0.48	0.34	0.34	0.36	0.30
W (10 ⁻⁴ joules)	83	99	126	118	53	108	48	98	50
Extensograph: Resistance (BU)	207	175	191	195	90	152	80	175	93
(45 min) Extensibility (cm)	14.3	17.8	20.9	19.5	18.9	21.3	18.6	17.4	17.5
Area (cm²)	45	47	59	57	26	48	20	46	24
Baking Evaluation:									
Sponge Cake: Volume (cc)	1304	1281	1247	1266	1267	1194	1192	1217	1225
Score	52	50	38	44	39	39	44	48	50
Cookie: Diameter (cm)	9.0	8.8	8.5	8.6	8.8	8.4	8.8	8.7	9.0
Spread Ratio (width/height)	11.2	10.2	9.3	9.9	11.0	9.1	10.2	10.1	11.7
Pan Bread: Bake Absorbtion (%) ¹			58.1						
Crumb Grain and Texture (1-10) ¹			4.0						
Loaf Volume (cc) ¹			748						
Chinese Southern-Type Steamed Bread Evaluation:									
Specific Volume (ml/g)	1.9	2.1	2.5	2.2	2.4	2.5	2.7	2.1	2.3
Total Score	64.8	68.0	68.2	67.8	65.8	68.7	64.8	68.2	66.1
% of Area Production:	11	38	51	100	100	100	100	100	100

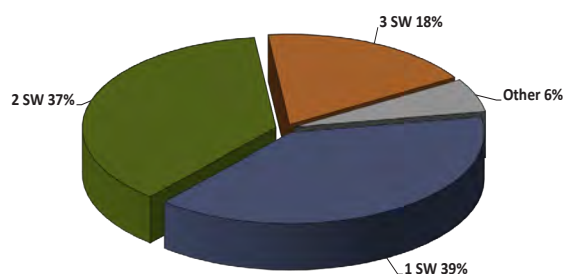
Protein Range: Low, less than 9.0%; Medium, 9.0 - 10.5%; High, Greater than 10.5%.

¹Bread Bake for High Protein SW only

Soft White	Export Cargo Data	
	2014	2013
Wheat Grade Data:		
Test Weight (lb/bu)	61.4	61.7
(kg/hl)	80.7	81.1
Damaged Kernels (%)	0.2	0.1
Foreign Material (%)	0.0	0.1
Shrunken & Broken (%)	0.9	0.8
Total Defects (%)	1.1	1.0
Grade	1 SW	1 SW
Wheat Non-Grade Data:		
Dockage (%)	0.3	0.3
Moisture (%)	8.9	8.8
Protein (%) 12%/0% moisture basis	10.4/11.8	10.3/11.7
Ash (%) 14%/0% moisture basis	1.32/1.54	1.35/1.57
1000 Kernel Weight (g)	37.5	38.2
Kernel Size (%) lg/md/sm	83/17/0	85/15/0
Single Kernel: Hardness		32.2
Weight (mg)		36.7
Diameter (mm)		2.74
Sedimentation (cc)	15.6	15.1
Falling Number (sec)	362	348
Flour Data:		
Lab Mill Extraction (%)	72.4	73.3
Color: L*	92.7	92.3
a*	-2.3	-2.3
b*	7.3	7.5
Protein (%) 14%/0% moisture basis	8.9/10.4	8.9/10.3
Ash (%) 14%/0% moisture basis	0.42/0.49	0.42/0.49
Wet Gluten (%)	24.1	24.3
Gluten Index	62	66
Falling Number (sec)	380	363
Amylograph Viscosity 65 g (BU)	435	453
Starch Damage (%)		
SRC: GPI		
Water/50% Sucrose		
5% Lactic Acid/5% Na ₂ CO ₃		
Dough Properties:		
Farinograph: Peak Time (min)	2.6	2.1
Stability (min)	3.2	2.8
Absorption (%)	53.1	54.1
Alveograph: P (mm)	42	45
L (mm)	86	103
P/L Ratio	0.49	0.43
W (10 ⁻⁴ joules)	102	111
Extensograph: Resistance (BU)		
(45 min) Extensibility (cm)		
Area (cm ²)		
Baking Evaluation:		
Sponge Cake: Volume (cc)	1163	1183
Score	46	43
Cookie: Diameter (cm)	8.6	8.4
Spread Factor (width/height)		
Pan Bread: Bake Absorbtion (%) ¹		
Crumb Grain and Texture (1-10) ¹		
Loaf Volume (cc) ¹		
Chinese Southern-Type Steamed Bread Evaluation		
Specific Volume (ml/g)		
Total Score		
Sample Count:	60	90



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.



HARVEST SURVEY

Weather and Harvest: Soft red winter wheat (SRW) is widely grown in the eastern United States. The area seeded to SRW in fall 2014 was estimated by USDA at 7.6 million acres (3.0 million hectares), down from 8.5 million acres (3.4 million hectares) the previous year and below the 5-year average. The 2015 SRW production, estimated at 9.8 MMT, is down nearly 3 MMT from 2014 and is the smallest since 2010. Much of the SRW growing area received excessive moisture throughout the spring, and rain caused lengthy harvest delays in many areas. Rains encouraged development of diseases and reduced harvest quality. Drier weather in mid-June allowed harvest to progress in a more timely fashion in the East Coast states.

Survey Methods: Great Plains Analytical Laboratory, Kansas City, MO, conducted sample collection and analysis. For 2015, 519 samples were collected from elevators in 18 areas of nine states at two different times, reflecting early and late harvest. Test weight, moisture, protein, thousand kernel weight, wheat ash and falling number were determined on all individual samples; the remaining tests were determined on 36 composite samples. The results were weighted by 5-year average production for the 18 reporting areas and combined into “Composite Average,” “East Coast” and “Gulf Port” values. Gulf Port states surveyed include Arkansas, Illinois, Indiana, Kentucky, Missouri, and Ohio and account for about 81% of the surveyed production. East Coast states surveyed include Maryland, North Carolina and Virginia and represent the remaining 19% of surveyed production. The states surveyed typically account for 60 to 65% of total SRW production.

Wheat and Grade Data: The overall average grade is U.S. No. 3. Average test weight is below the 58 lbs/bu limit for No. 2 in both Gulf Port and East Coast states, and total damage is above the No. 2 limit in Gulf Port states. Falling numbers in the Gulf Port states are well below normal. Average protein is higher than last year and similar to the 5-year average. Average dockage is above last year and the 5-year average. The samples from Gulf Port states show the adverse effects of excessive moisture during growing and harvest while the East Coast states had somewhat better harvest conditions.

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.

NINE OF SIXTEEN STATES SURVEYED

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

The overall average test weight of 56.9 lbs/bu (75.0 kg/hl) is 1.1 lbs/bu (1.3 kg/hl) below 2014 and 1.8 lbs/bu (2.2 kg/hl) below the 5-year average. Average total defects of 4.3% is more than double last year and the 5-year average. Higher damage values are mainly in Gulf Port states; East Coast damage and total defects are above 2014 but below the 5-year averages.

Average wheat protein content of 10.0% is slightly above last year and similar to the 5-year average. Sedimentation and wet gluten are slightly above last year and the 5-year averages. The overall average falling number of 265 is the lowest value reported since USW started SRW surveys in 1998. Low falling numbers are found mainly in the Gulf Port states; the East Coast average of 324 is below last year but above the 5-year average. The DON average of 2.2 ppm is similar to 2014 but above the 5-year average. Gulf states DON average of 2.6 ppm is nearly 1 ppm above the 5-year average; the East Coast average of 0.7 ppm is slightly below the 5-year average.

Flour and Baking Data: Buhler laboratory mill flour extraction is above the 5-year average overall and for both East Coast and Gulf Port states, although flour ash values are also higher. Dough properties are nearly all similar to 5-year averages. Farinograph peak, stability and absorption values are somewhat higher than 2014 and similar to 5-year averages. Alveograph P and L are also higher than last year, but the overall W is similar to last year and below the 5-year average. The overall cookie spread ratio is below last year but similar to the 5-year average, while the overall average loaf volume is below last year and the 5-year average.

Summary: The wet growing season affected the entire SRW growing area. Harvest rain delays more severely affected the six Gulf Port states, resulting in areas with reduced test weight, reduced falling numbers and increased DON values. Buyers are encouraged to review their quality specifications to ensure that their purchases meet their expectations.

EXPORT CARGO SURVEY

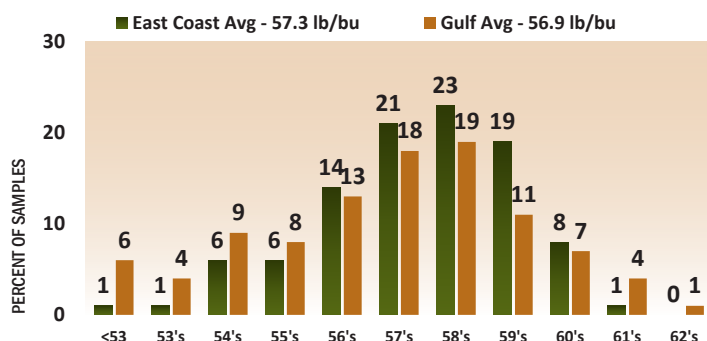
Export data represents 160 subplot samples for crop years 2015 and 2014 from Gulf of Mexico and East Coast ports. The Federal Grain Inspection Service selected the samples and reported grades on the subplots. Great Plains Analytical Laboratory conducted the milling and baking analyses.





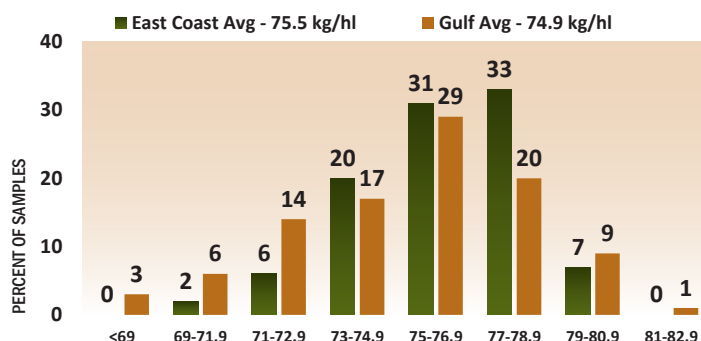
TEST WEIGHT

Pounds/Bushel



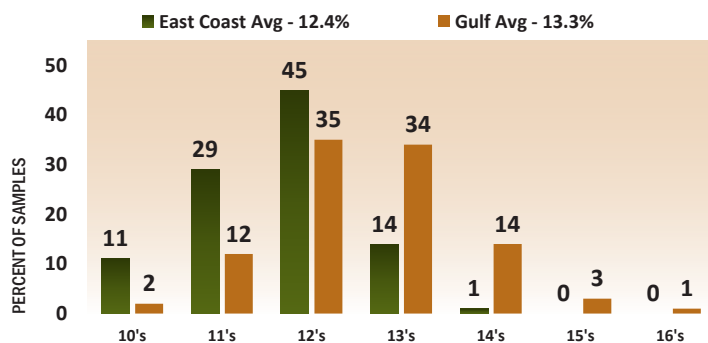
HECTOLITER WEIGHT

Kilograms/Hectoliter



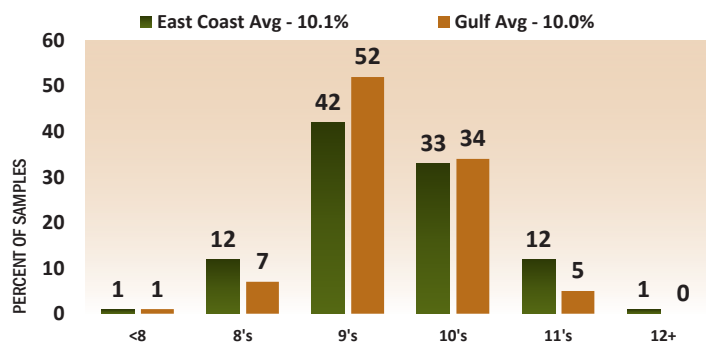
WHEAT MOISTURE

Percent



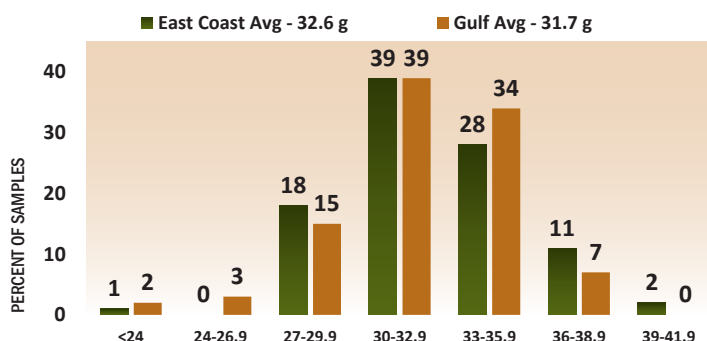
PROTEIN (12% MB)

Percent



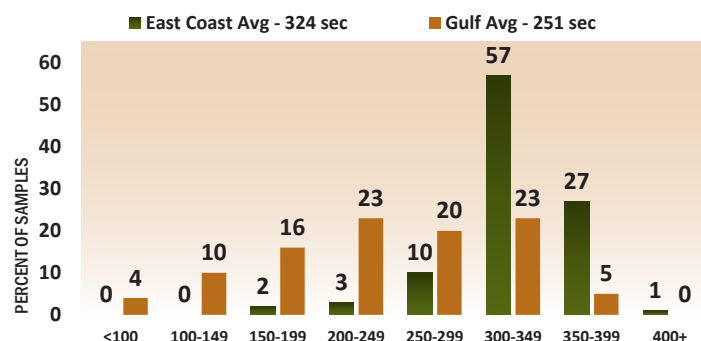
1000 KERNEL WEIGHT

Grams

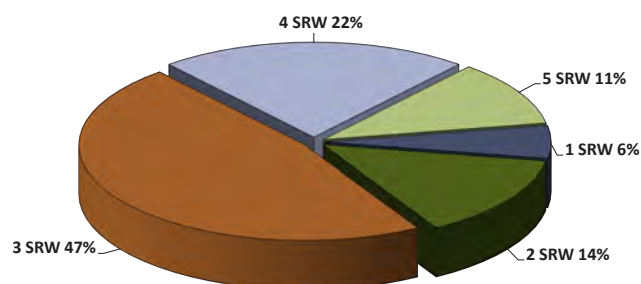


FALLING NUMBER

Seconds



GRADE DISTRIBUTION*



*Based on 36 composite samples.

SOFT RED WINTER | HARVEST DATA

Soft Red Winter	Composite Average			East Coast			Gulf Ports		
	2015	2014	5-Year Avg	2015	2014	5-Year Avg	2015	2014	5-Year Avg
Wheat Grade Data:									
Test Weight (lb/bu)	56.9	58.0	58.7	57.3	58.7	58.9	56.9	57.8	58.6
(kg/hl)	75.0	76.3	77.2	75.5	77.3	77.5	74.9	76.1	77.2
Damaged Kernels (%)	3.7	1.0	1.3	1.0	0.5	1.6	4.3	1.1	1.2
Foreign Material (%)	0.1	0.2	0.2	0.1	0.1	0.2	0.1	0.2	0.2
Shrunken & Broken (%)	0.5	0.6	0.5	0.5	0.5	0.5	0.6	0.6	0.5
Total Defects (%)	4.3	1.8	2.0	1.6	1.1	2.2	4.9	2.0	1.9
Grade	3 SRW	2 SRW	2 SRW	3 SRW	2 SRW	2 SRW	3 SRW	3 SRW	2 SRW
Wheat Non-Grade Data:									
Dockage (%)	0.7	0.4	0.6	0.8	0.4	0.7	0.7	0.4	0.6
Moisture (%)	13.2	13.0	13.0	12.4	12.7	12.9	13.3	13.0	13.0
Protein (%) 12%/0% moisture basis	10.0/11.3	9.8/11.1	10.0/11.4	10.1/11.5	9.7/11.0	10.2/11.6	10.0/11.3	9.8/11.1	10.0/11.3
Ash (%) 14%/0% moisture basis	1.43/1.66	1.52/1.77	1.52/1.77	1.39/1.61	1.51/1.76	1.49/1.73	1.43/1.67	1.52/1.77	1.53/1.77
1000 Kernel Weight (g)	31.9	31.3	32.6	32.6	33.4	33.9	31.7	30.8	32.2
Kernel Size (%) lg/md/sm	82/17/1	84/16/0	83/16/1	83/16/1	87/13/0	84/15/1	82/17/1	84/16/0	83/16/1
Single Kernel: Hardness	18.5	22.5	23.5	15.7	20.3	22.0	19.2	22.9	23.8
Weight (mg)	32.9	31.1	32.4	33.2	32.1	33.3	32.8	30.9	32.3
Diameter (mm)	2.68	2.57	2.55	2.66	2.59	2.56	2.69	2.57	2.55
Sedimentation (cc)	13.2	12.2	12.2	13.6	12.5	13.6	13.1	12.2	11.9
Falling Number (sec)	265	311	319	324	340	318	251	304	319
DON (ppm)	2.2	2.2	1.4	0.7	0.6	0.8	2.6	2.5	1.5
Flour Data:									
Lab Mill Extraction (%)	72.9	70.5	71.1	74.0	70.7	70.6	72.6	70.4	71.2
Color: L*	91.5	91.3	92.9	91.8	92.7	93.1	91.4	91.0	92.8
a*	-3.0	-2.9	-3.0	-3.1	-3.0	-3.0	-3.0	-2.9	-3.0
b*	8.1	8.2	8.1	8.2	8.7	8.3	8.0	8.1	8.1
Protein (%) 14%/0% moisture basis	8.5/9.9	8.3/9.7	8.4/9.8	8.6/10.0	8.2/9.5	8.7/10.1	8.5/9.8	8.3/9.7	8.4/9.8
Ash (%) 14%/0% moisture basis	0.50/0.59	0.43/0.50	0.44/0.51	0.48/0.56	0.42/0.49	0.43/0.50	0.51/0.59	0.43/0.50	0.44/0.51
Wet Gluten (%)	22.6	22.2	22.4	22.9	21.3	23.1	22.5	22.5	22.2
Gluten Index	86	80	81	88	79	81	86	80	81
Falling Number (sec)	261	311	325	321	340	324	247	304	325
Amylograph Viscosity 65 g (BU)	218	497	547	322	553	515	193	485	555
Starch Damage (%)	5.4	4.7	4.5	4.7	4.4	4.5	5.6	4.7	4.5
SRC: GPI	0.51	0.62	0.61	0.49	0.59	0.61	0.50	0.62	0.61
Water / 50% Sucrose	57/111	54/103	55/106	59/111	56/107	56/107	58/108	54/103	55/104
5% Lactic Acid / 5% Na ₂ CO ₃	99/85	111/77	113/80	97/85	109/79	114/81	95/83	112/78	112/80
Dough Properties:									
Farinograph: Peak Time (min)	1.5	1.3	1.5	1.6	1.4	1.7	1.4	1.3	1.5
Stability (min)	2.6	2.4	2.8	2.7	2.7	2.8	2.6	2.3	2.7
Absorption (%)	53.4	52.0	52.6	53.3	52.9	53.0	53.5	51.8	52.5
Alveograph: P (mm)	35	32	36	35	35	36	35	32	36
L (mm)	88	79	88	86	75	94	88	80	86
P/L Ratio	0.40	0.41	0.41	0.41	0.47	0.39	0.40	0.40	0.41
W (10 ⁻⁴ joules)	73	72	82	73	75	87	73	71	81
Extensograph: Resistance (BU)	146			168			141		
(45 min) Extensibility (cm)	17.7			17.3			17.8		
Area (cm ²)	44			50			43		
Baking Evaluation:									
Cookie: Diameter (cm)	10.5			10.5			10.6		
Spread Ratio (width/height)	9.3	9.6	9.2	9.2	9.4	8.9	9.3	9.6	9.2
Pan Bread: Bake Absorption (%)	55.3			54.4			55.6		
Crumb Grain and Texture (1-10)	5.1			5.4			5.1		
Loaf Volume (cc)	704	724	714	726	729	726	699	723	711
% of Area Sampled:	100%			19%			81%		

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

Soft Red Winter	Export Cargo Data	
	2015	2014
Wheat Grade Data:		
Test Weight (lb/bu)	58.3	58.3
(kg/hl)	76.8	76.8
Damaged Kernels (%)	3.1	3.1
Foreign Material (%)	0.1	0.1
Shrunken & Broken (%)	1.0	0.9
Total Defects (%)	4.2	4.1
Grade	2 SRW	2 SRW
Wheat Non-Grade Data:		
Dockage (%)	0.7	0.7
Moisture (%)	12.6	12.4
Protein (%) 12%/0% moisture basis	10.0/11.4	9.7/11.1
Ash (%) 14%/0% moisture basis	1.49/1.73	1.45/1.69
1000 Kernel Weight (g)	30.1	30.9
Kernel Size (%) lg/md/sm	80/19/1	82/17/1
Single Kernel: Hardness		
Weight (mg)		
Diameter (mm)		
Sedimentation (cc)	11.8	11.4
Falling Number (sec)	295	299
DON (ppm)		2.1
Flour Data:		
Lab Mill Extraction (%)	69.4	71.8
Color: L*	91.6	91.8
a*	-2.3	-3.0
b*	8.5	8.4
Protein (%) 14%/0% moisture basis	8.3/9.6	8.3/9.7
Ash (%) 14%/0% moisture basis	0.43/0.50	0.45/0.53
Wet Gluten (%)	22.1	21.7
Gluten Index	91	88
Falling Number (sec)	296	315
Amylograph Viscosity 65 g (BU)	352	403
Starch Damage (%)		
SRC: GPI		
Water / 50% Sucrose		
5% Lactic Acid/5% Na ₂ CO ₃		
Dough Properties:		
Farinograph: Peak Time (min)	1.3	1.2
Stability (min)	2.8	2.5
Absorption (%)	52.6	52.6
Alveograph: P (mm)	38	39
L (mm)	99	79
P/L Ratio	0.39	0.49
W (10 ⁻⁴ joules)	99	90
Extensograph: Resistance (BU)		
W (10 ⁻⁴ joules)		
Area (cm ²)		
Baking Evaluation:		
Cookie: Diameter (cm)		
Spread Ratio (width/height)	9.6	9.4
Pan Bread: Bake Absorption (%)		
Crumb Grain and Texture (1-10)	5.1	5.0
Loaf Volume (cc)	706	700
Sample Count:	45	115

Soft Red Winter Production

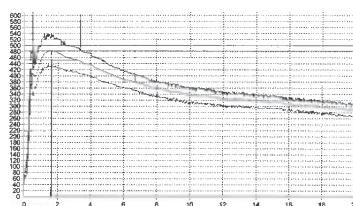
in major producing states (million metric tons)

	2015	2014	2013	2012	2011
Alabama	0.4	0.4	0.5	0.3	0.4
Arkansas	0.4	0.7	1.0	0.7	0.8
Georgia	0.2	0.3	0.6	0.3	0.3
Illinois	0.9	1.2	1.5	1.1	1.3
Indiana	0.5	0.7	0.9	0.5	0.7
Kentucky	0.9	1.0	1.2	0.8	0.8
Louisiana	0.1	0.3	0.4	0.4	0.4
Maryland	0.5	0.5	0.5	0.4	0.3
Michigan	0.7	0.7	0.8	0.7	0.9
Mississippi	0.2	0.3	0.6	0.5	0.6
Missouri	0.9	1.2	1.5	1.0	0.9
North Carolina	0.8	1.2	1.4	1.2	1.1
Ohio	0.9	1.1	1.2	0.8	1.3
South Carolina	0.2	0.3	0.4	0.3	0.3
Tennessee	0.7	0.9	1.1	0.6	0.6
Virginia	0.4	0.5	0.5	0.4	0.5
Sixteen-State Total	8.5	11.2	14.2	10.1	11.2
Total SRW Production	9.8	12.4	15.5	11.4	12.5

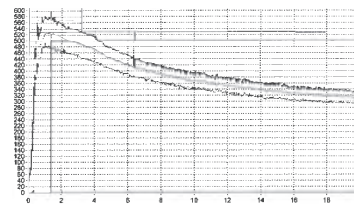
Based on USDA crop estimates of September 30, 2015.

FARINOGRAMS

EAST COAST

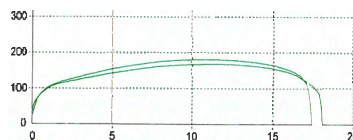


GULF

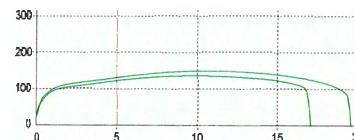


EXTENSOGRAMS

EAST COAST

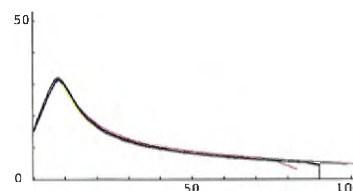


GULF



ALVEOGRAM

EAST COAST & GULF



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 mathematically converted to hectoliter weight: for durum - $\text{kg/hl} = \text{lb/bu} \times 1.292 + 0.630$, for other classes - $\text{kg/hl} = \text{lb/bu} \times 1.292 + 1.419$.

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

Single Kernel Characterization: AACC 54-31.01 using Perten SKCS 4100.

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

1000 Kernel Weight: HRS, Durum, SRW – based on a 10-gram sample of clean wheat 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.

Vitreous Kernels: HRS and durum only – percentage by weight of vitreous kernels hand-picked from a 15-gram sample of clean wheat.

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 California (CA) HRW 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. CA HRW 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), SRW – Minolta method using

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

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

Wet Gluten and Gluten Index: HRW, HRS, SRW, HW – AACC 38-12.02; SW – AACC 38-12.02 (water reduced from 4.8 to 4.2 ml).

Falling Number: AACC 56-81.03; average value is a simple mean of sample results.

Farinograph: AACC 54-21.02 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 laboratory mill with identical settings and equipped with Miag laboratory purifiers, as described by Vasiljevic and Banasik 1980: *Quality Testing Methods for Durum Wheat and its Products*, pp. 64-72, Dept. of Cereal Chemistry and Technology, NDSU, Fargo, ND. Roll gaps are modified to (in mm): B1-0.762; B2-0.305; B3-0.254; R1-0.102; B4-0.076; B5-0.038. Extraction rates are calculated against total products on an “as is” moisture basis. Procedure is derived from AACC 26-41.02 based on research showing improved correlation between laboratory and commercially milled semolina quality. Pacific Southwest samples are milled on a Modified Chopin CD2 mill.

Ash: AACC 08-01.01 on 14.0% mb.

Color: Minolta Method using Minolta Chroma Meter CR-310 (Northern) or CR-210 (Pacific Southwest).

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: Ten grams of semolina are mixed in a 10-g (Northern) or 35-g (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 100-g pin mixer with head speed of 100-125 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 scale of 0 to 6, which for this booklet is mathematically converted to a scale of 1-10.

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 200-g Swanson pin mixer with head speed of 100-120 rpm, and 120-min fermentation. Loaf volume is measured after 1 hour baking. Grain and texture are scored on a scale of 1-10 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 scale of 1-10 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) is added to semolina and mixed in a Hobart mixing bowl 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 Debbouze, 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 1-12) are preferred. Cooked weight, cooking loss and firmness are determined by AACC 16-50.01.

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

HW Noodle: Two noodle types are prepared from each HW flour: Chinese raw noodles and Chinese wet noodles. Raw noodle formula: flour 100%, salt 1.2%, and distilled water 28%; wet noodle formula: flour 100%, salt 2%, K_2CO_3 0.45%, Na_2CO_3 0.45%, and distilled water 32%. Noodle sheet color is measured by stacking three dough sheets and taking two readings from each side of two dough sheets (a total of eight readings) 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 26°-27° C water and draining. Sensory noodle color stability score is a total score of noodle color rated at 2 and 24 hours against a control sample (an assigned score of 7) and is reported based on a scale of 1-10; 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.

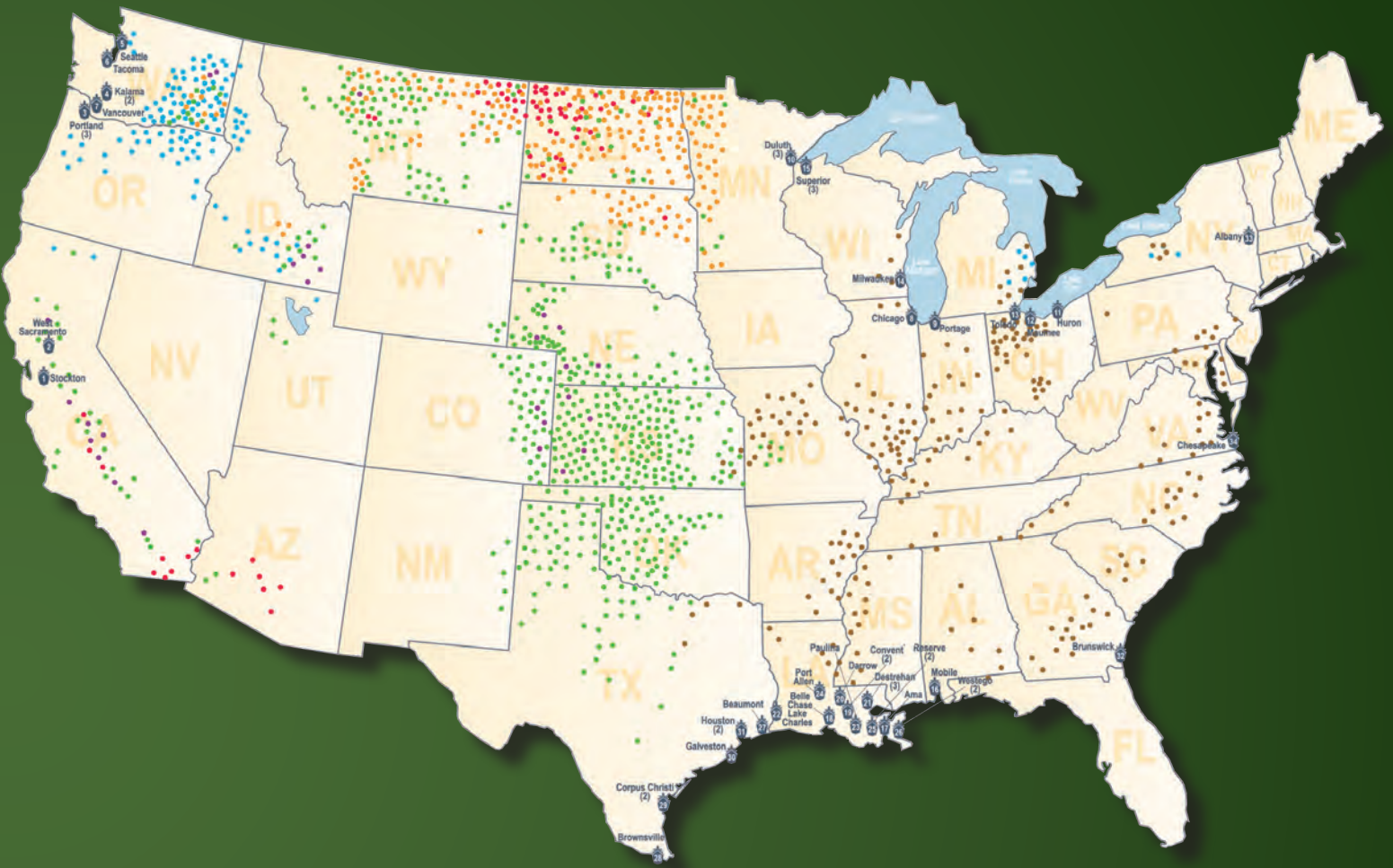
Chinese Steamed Bread: Two types of steamed breads are prepared: Chinese southern-type steamed breads from each of the SW and club wheat flours and Asian-type steamed breads from each of the HW flours. Chinese southern-type formula: flour 100%, sugar 15%, shortening 4%, baking powder 1.2%, instant yeast 0.8%, nonfat dry milk powder 3% and water 39-43%; Asian-type formula: flour 100%, instant yeast 1.5%, sugar 12%, shortening 2%, and water 42.5-45%. Yeast is dissolved in water before use. All steamed breads are prepared using no-time dough methods (WMC 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).

Wheat Grades and Grade Requirements Table

Grading Factors	Grades U.S. Nos.				
	1	2	3	4	5
	Minimum limits:				
Test Weight (lbs/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.



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 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.



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.



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.



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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