U.S. WHEAT ASSOCIATES

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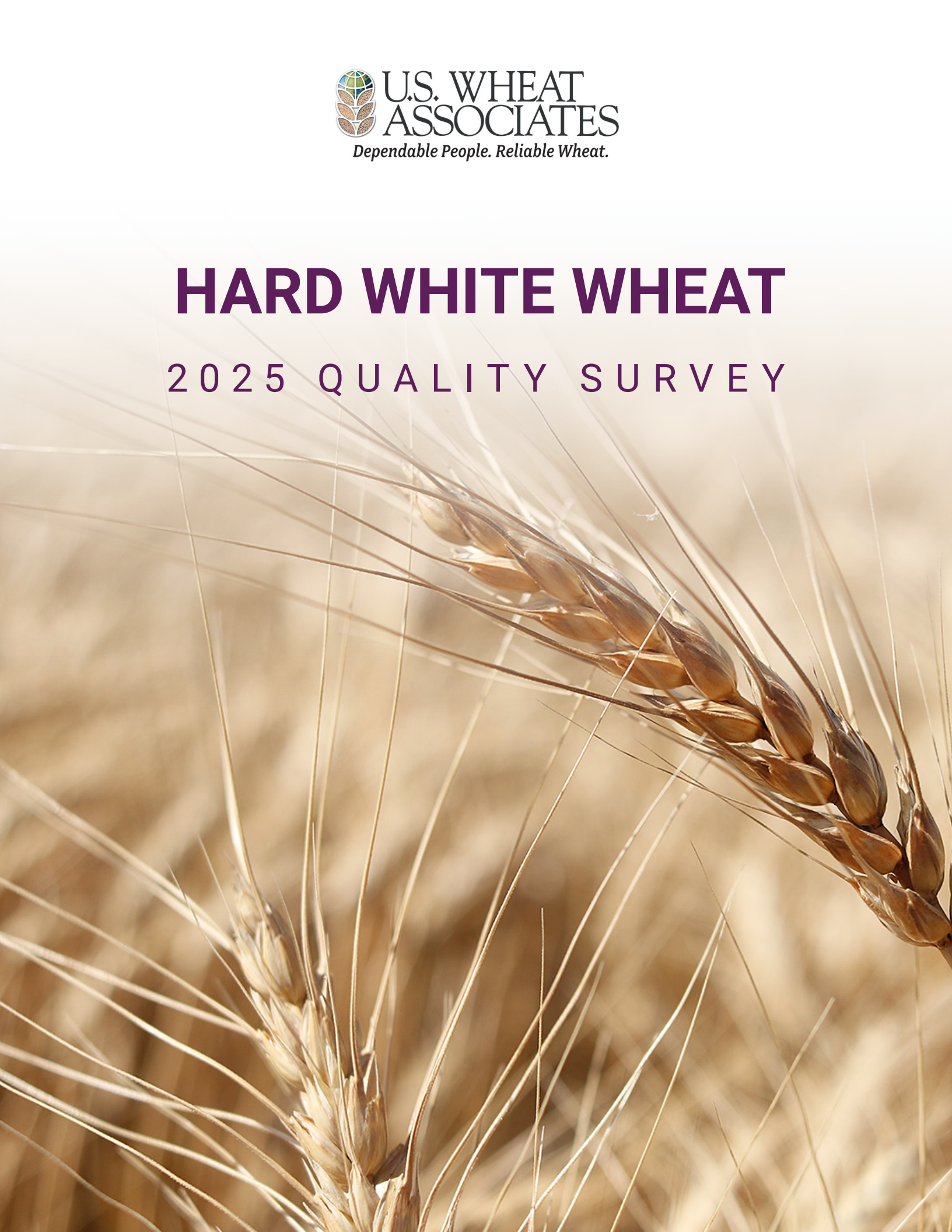
HARD WHITE WHEAT

2025 QUALITY SURVEY



HARD WHITE

The smallest class of wheat in the United States, hard white (HW) wheat is grown in the Southern Plains, Idaho and California, and when available for export, shipped via Pacific and Gulf ports. HW wheat has a hard endosperm, white bran and a medium to high protein content of 10.0 to 14.0% (12% mb). HW includes winter and spring varieties, increasing the protein range and functionality within the class.

For the miller, HW delivers whiter flour at higher extraction levels due to its lighter bran color. HW is a true hard wheat creating excellent granulation, maximizing coarse semolina production and low ash flour.

For the baker, the greatest advantage of HW wheat flour is the whiter end product color. Higher extraction rates generally improve water absorption. Using ultra fine, white whole wheat flour, whole wheat bread can be produced with the color and texture of bread from white flour. HW wheat flour is also lower in polyphenol oxidase (PPO), an enzyme that can cause dough browning. Lower PPO content improves the color of wet noodles and Asian steamed bread products.

APPLICATIONS

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

Applications include:

- Bulgur
- Flat breads
- Hard rolls
- High extraction applications
- Asian noodles
- Pan breads
- Tortillas
- Whole wheat breads
- Yeast raised products

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HARD WHITE PRODUCTION

FOR THE MAJOR PRODUCING STATES (MMT)

	2025	2024	2023	2022	2021
California	0.0	0.0	0.0	0.0	0.0
Colorado	0.1	0.1	0.1	0.0	0.1
Idaho	0.3	0.3	0.3	0.2	0.2
Kansas	0.2	0.3	0.2	0.2	0.4
Nebraska	0.1	0.1	0.1	0.0	0.1
Five-State Total	0.6	0.8	0.6	0.5	0.7
PNW-Exportable	0.3	0.3	0.3	0.2	0.2
Southern Plains-Exportable	0.4	0.5	0.4	0.3	0.5
Total HW Production	0.6	0.8	0.6	0.5	0.7

Based on USDA crop estimates as of September 30, 2025.

16

SAMPLES OF HARD WHITE

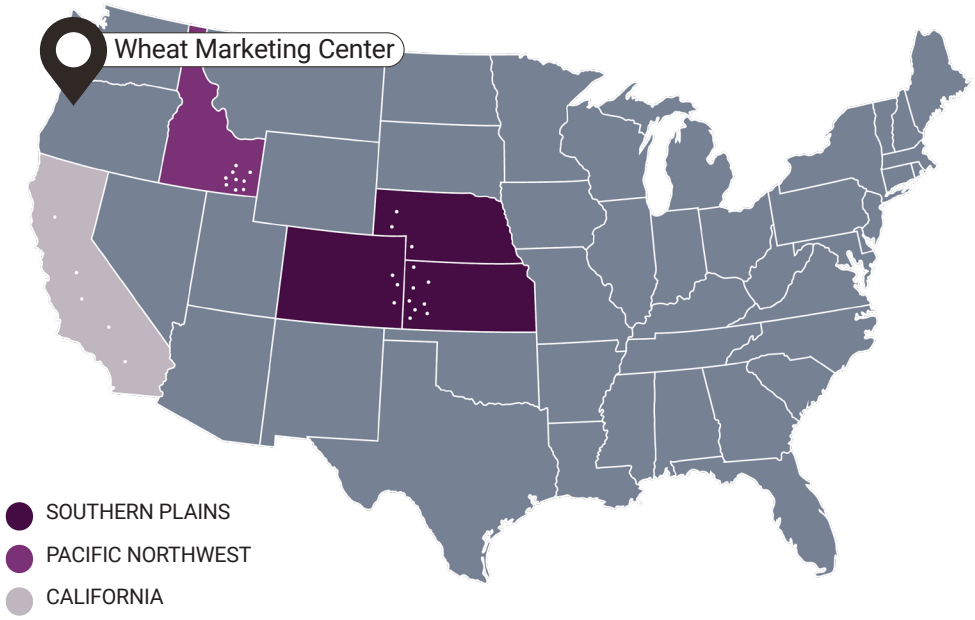
collected by state and private inspection agencies; commercial wheat handlers; Plains Grains, Inc.; and state wheat commissions.

5

STATES SURVEYED

99%

OF TOTAL HW PRODUCTION REPRESENTED



SURVEY METHODOLOGY

SAMPLE COLLECTION AND ANALYSIS

The Wheat Marketing Center (WMC) conducted the quality analyses. The USDA's Federal Grain Inspection Service (FGIS) graded and ran wheat proteins on the samples.

SAMPLE TESTING

Official grade factors were determined on each sample. Non-grade factors and functionality tests were conducted on 6 composite samples categorized by growing region and protein ranges of <11.5%, 11.5 to12.5%, 12.6 to 13.5% and >13.5%. The methods are described in the Analysis Methods section of this report.

HARVEST SURVEY

The 2025 HW samples show acceptable quality performance in milling, dough properties, and finished products, including pan breads, Asian noodles, and steamed breads. The Pacific Northwest (PNW), California and Southern Plains composites all show acceptable to good steamed and pan bread baking potential according to their respective protein contents. For Asian noodle applications, using 60% extraction patent flour is recommended to improve noodle color and texture.

CROP HIGHLIGHTS

GRADE: All composites grade as U.S. No. 1 across all growing regions.

TEST WEIGHTS: Values were above 60 lb/bu (78.9 kg/hl) for all composites.

WHEAT PROTEIN: Values are both similar to or slightly higher than last year across all growing regions. The PNW offers a narrower range of protein composites compared to last year.

WHEAT MOISTURE: Values are both similar to or slightly higher than last year across all growing regions.

1000 KERNEL WEIGHTS: Values are similar to or better than last year for the California medium and Southern Plains medium protein composites. PNW medium and Southern Plains high composites are lighter this year, likely due to lack of moisture at critical points in the growing season.

FALLING NUMBER: Values are sound for all composites and comparable to last year.

BUHLER LABORATORY MILL: Straight-grade flour extractions are generally lower than last year with lower L* values (whiteness). Flour ash values are lower for PNW and California composites compared to 2024 while Southern Plains composites are slightly higher. Commercial mills should see better extractions, although some adjustments may be necessary for portions of the crop with lower 1000 kernel weights.

WET GLUTEN: Contents are appropriate for the protein content of each composite.

STARCH PASTING PROPERTIES: Amylograph and RVA (Rapid Visco Analyser) peak viscosities are slightly lower than last year for California and Southern Plains composites and slightly higher for the PNW composite. All viscosities are still suitable for producing noodles with acceptable texture if mill stream selections are made appropriately.

DOUGH PROPERTIES: Results indicate this year's crop has slightly higher Farinograph water absorption values and stronger mixing properties compared to last year. Both Alveograph and Extensograph characteristics show this increase dough strength with Alveograph L values (biaxial extensibility) being slightly impaired by the strength.

BAKING EVALUATION: All composites show fair to acceptable baking performance relative to a commercial HRW straight grade control flour. The texture for all composites is similar to the control. All composites had lower specific volumes than the control, likely a reflection of stronger dough properties combined with shorter Alveograph L values this year.

CHINESE WHITE SALTED NOODLE: L* values after 24 hours of storage at room temperature are similar to or better than the control for all composites except the California high protein composite. The sensory color stability scores are good for the PNW medium protein composite with all other composites rating as acceptable to poor. Cooked noodle texture is comparable to or lower than the HRW long patent control for all composites.

CHINESE YELLOW ALKALINE NOODLE: Parboiled L* values after 24 hours of storage at room temperature are better than the hard red winter (HRW) long patent control for parboiled noodles for all composites. Sensory color stability scores are good for the PNW medium protein composite, acceptable for the Southern Plains composites, and poor for the California composites. Cooked noodle texture is comparable to or better than the control for all composites except the California low protein composite.

Overall, this year's HW samples will produce noodles with acceptable color and texture if low ash patent flour is used along with appropriate water adjustments at the mixer.

STEAMED BREAD: Results show most composites have acceptable to good specific volumes compared to a HRW long patent control. Textures for all composites were generally comparable to the control. California composites had a brighter, whiter appearance, while Southern Plains composites were darker. Selecting appropriate long patent streams should improve performance.

HARVEST DATA

	2025 DATA BY GROWING REGION AND PROTEIN[1]				
	PNW	CALIFORNIA		SOUTHERN PLAINS	
	Med	Med	High	Med	High
WHEAT GRADE DATA:					
Test Weight (lb/bu)	62.2	64.8	62.2	60.7	61.3
(kg/hl)	81.8	85.1	81.8	79.8	80.6
Damaged Kernels (%)	0.0	0.0	0.0	0.3	0.0
Foreign Material (%)	0.0	0.0	0.1	0.0	0.0
Shrunken & Broken (%)	0.0	0.4	1.0	0.6	0.7
Total Defects (%)	0.0	0.4	1.1	0.9	0.7
Grade	1 HW	1 HW	1 HW	1 HW	1 HW
WHEAT NON-GRADE DATA:					
Dockage (%)	0.8	0.0	0.0	0.3	0.1
Moisture (%)	11.5	10.6	9.5	11.2	11.2
Protein (%) 12%/0% mb	12.3/14.0	11.8/13.4	13.5/15.3	12.0/13.6	12.6/14.3
Ash (%) 14%/0% mb	1.44/1.67	1.23/1.43	1.63/1.89	1.51/1.75	1.63/1.89
1000 Kernel Weight (g)	34.7	45.2	30.7	31.0	28.1
Kernel Size (%) lg/md/sm	81/18/01	92/08/00	64/35/01	74/25/01	64/35/01
Single Kernel: Hardness	73	75	78	60	71
Weight (mg)	36.6	47.1	33.7	32.2	29.7
Diameter (mm)	2.76	3.00	2.62	2.63	2.52
Sedimentation (cc)	36.1	32.8	32.5	35.5	38.0
Falling Number (sec)	315	362	364	417	414
FLOUR DATA:					
Lab Mill Extraction (%)	71.6	70.3	67.5	69.4	68.5
Color: L*	91.3	91.7	92.1	91.4	91.6
a*	-2.0	-1.1	-1.5	-2.0	-2.1
b*	9.3	5.2	6.8	8.7	9.3
Protein (%) 14%/0% mb	10.8/12.6	9.9/11.5	11.9/13.8	10.4/12.1	11.4/13.3
Ash (%) 14%/0% mb	0.46/0.54	0.41/0.47	0.45/0.52	0.44/0.51	0.48/0.56
Wet Gluten (%)	29.3	24.4	32.4	25.6	27.3
Falling Number (sec)	355	377	495	420	417
Amylograph Viscosity: 65g (BU)	744	869	989	693	792
RVA: Pasting Temp. (°C)/Peak Viscosity (cP)	66.8/2573	66.1/2904	66.0/3082	67.7/2732	67.0/2605
Hot Paste Viscosity (cP)/Final Viscosity (cP)	1576/2821	1607/2726	1857/3091	1907/3180	1875/3191
Damaged Starch (%)	6.2	8.8	8.0	6.4	6.7
SRC: Water/50% Sucrose	61/105	77/114	74/121	66/110	67/110
5% Lactic Acid/5% Na_2CO_3	137/84	161/109	165/106	146/89	144/87
Gluten Performance Index (GPI)	0.73	0.72	0.73	0.73	0.73
DOUGH PROPERTIES:					
Farinograph: Peak Time (min)	9.1	6.4	9.5	7.4	6.5
Stability (min)	17.5	22.1	33.1	25.0	19.0
Absorption (%)	59.2	65.4	64.2	58.5	58.8
Alveograph: P (mm)	107	200	168	127	121
L (mm)	90	47	88	71	81
P/L Ratio	1.19	4.26	1.91	1.79	1.49
W (10^{-4} J)	331	391	527	345	350
Extensograph (45/135 min): $Resistance_{50}$ (BU)	360/1093	364/1013	441/1134	393/1104	437/1165
Resistance Max (BU)	558/1241	504/1013	512/1169	562/1105	650/1234
Extensibility (cm)	16.1/10.0	13.5/08.0	13.8/08.1	14.6/07.8	14.0/09.4
Area (cm^2)	114/140	88/87	97/100	103/94	113/135
R_{50}/E Ratio	2.2/11.0	2.7/12.7	3.2/14.0	2.7/14.1	3.1/12.4
Rmax/E Ratio	3.5/12.5	3.7/12.7	3.7/14.5	3.9/14.2	4.6/13.2
% OF SAMPLES:					

[1]Protein Range: Low, <11.5%; Med, 11.5 - 12.5%; High, 12.6 - 13.5%; Very high, >13.5%.

HARVEST DATA

	2025 DATA BY GROWING REGION AND PROTEIN[1]				
	PNW	CALIFORNIA		SOUTHERN PLAINS	
	Med	Med	High	Med	High
PAN BREAD EVALUATION:					
Bake Absorption (%)	64.4	70.4	69.4	63.6	63.9
Loaf Volume (cc)	841.0	719.0	813.0	781.0	811.0
Specific Volume (cc/g)	6.1	5.2	5.9	5.6	5.8
WHITE SALTED (RAW) NOODLE EVALUATION:					
Color at 0-24 hr: L*	83.7/74.2	86.4/76.5	83.5/71.1	85.4/75.7	83.8/73.7
a*	-0.5/0.1	0.6/0.7	0.5/0.6	-0.4/-0.1	-0.5/0.0
b*	21.7/25.9	11.5/14.9	18.3/20.5	17.9/23.0	20.3/25.5
Change in L* (0-24 hr)	9.4	9.9	12.4	9.6	10.1
Cooking Yield (5 min, %)	121.9	126.4	116.3	124.3	119.1
Sensory Color Stability Score	7	6	4	6	4
Instrumental Texture:					
Firmness (g)	797	691	795	810	894
Springiness (%)	93.2	94.2	93.9	93.0	94.5
Cohesiveness (%)	0.69	0.72	0.72	0.67	0.69
Chewiness (g)	513	469	538	505	584
YELLOW ALKALINE (WET) NOODLE EVALUATION:					
Uncooked Color at 0-24 hr: L*	82.0/73.0	83.0/73.4	80.9/68.2	82.3/71.9	81.1/70.1
a*	-1.8/-1.4	-1.4/-0.8	-1.4/-0.7	-1.6/-1.1	-1.7/-1.0
b*	24.4/25.9	15.6/18.0	19.7/20.9	20.3/22.5	22.8/24.8
Change in L* (0-24 hr)	9.0	9.7	12.7	10.3	11.0
Parboiled Color at 0-24 hr: L*	76.8/78.1	77.3/77.7	78.3/77.7	77.5/78.3	77.1/77.7
a*	-3.0/-3.3	-2.5/-2.5	-1.7/-2.4	-2.3/-3.1	-2.5/-3.3
b*	30.7/29.8	26.0/24.0	27.4/25.4	31.0/29.4	31.9/30.3
Cooking Yield (1.5 min, %)	75.1	84.1	75.5	72.4	84.9
Uncooked Color Stability Score	7	4	5	5	4
Parboiled Color Stability Score	7	4	4	6	5
Instrumental Texture:					
Firmness (g)	744	628	751	780	795
Springiness (%)	85.5	89.3	90.6	87.8	81.6
Cohesiveness (%)	0.68	0.70	0.70	0.66	0.66
Chewiness (g)	432	392	474	449	424
NORTHERN-STYLE STEAMED BREAD EVALUATION:					
Specific Volume (cc/g)	2.2	2.1	2.5	2.5	2.3
Hardness (g)	2389	2602	1866	2295	2132

[1]Protein Range: Low, <11.5%; Med, 11.5 - 12.5%; High, 12.6 - 13.5%; Very high, >13.5%.

ANALYSIS METHOD

HARD WHITE LABORATORY TESTING

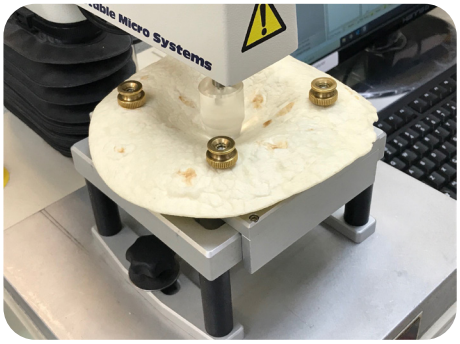
All quality data contained in this report is the result of testing and analysis conducted by Wheat Marketing Center in Portland, Oregon.

TEST:	METHODOLOGY:
WHEAT GRADE FACTORS	
Grade	Official U.S. Standards for Grain.
Test Weight	AACCI 55-10.01.
Damaged Kernels	Official U.S. Standards for Grain.
Foreign Material	Official U.S. Standards for Grain.
Shrunken and Broken	Official U.S. Standards for Grain.
Total Defects	Official U.S. Standards for Grain.
WHEAT NON-GRADE FACTORS	
Dockage	Official USDA procedures.
Moisture	Official USDA conductance method
Protein (12% mb)	AACCI 39-25.01 (NIR method)
Ash (14% mb)	AACCI 08-01.01, expressed on a 14% mb.
1000 Kernel Weight	Based on the average weight of three 100-kernel samples multiplied by 100, expressed on a 14% mb.
Kernel Size	Wheat is sifted with a RoTap sifter using Tyler No. 7 (2.82 mm) and No. 9 (2.00 mm) screens.
Single Kernel Characterization System (SKCS)	AACCI 54-31.01 using Perten SKCS 4100.
Sedimentation	AACCI 56-61.02.
Falling Number	AACCI 56-81.04; 2019 FGIS barometric pressure correction procedure; average value is a simple mean of sample results.
DON	Neogen ELISA.
FLOUR FACTORS	
Laboratory Milling Extraction	AACCI 26-21.02. All extraction rates are calculated against total products on an “as is” mb. Samples are milled on a Buhler Laboratory mill (MLU 202) using a 183-micron (µ) sieve.
Color	CIE 1976 L*a*b* color system. Minolta Chroma Meter with Granular-Materials attachment CR-A50 and CR-410 colorimeter.
Protein (14% mb)	AACCI 46-30.01 (Dumas CNA method).
Ash (14% mb)	AACCI 08-01.01, expressed on a 14% mb.
Wet Gluten	AACCI 38-12.02, expressed on a 14% mb.
Falling Number	AACCI 56-81.04; 2019 FGIS barometric pressure correction procedure; average value is a simple mean of sample results.

ANALYSIS METHOD

HARD WHITE LABORATORY TESTING

TEST:	METHODOLOGY:
FLOUR FACTORS	
Wet Gluten	AACCI 38-12.02.
Gluten Index	AACCI 38-12.02.
Falling Number	AACCI 56-81.04; 2019 FGIS barometric pressure correction procedure; average value is a simple mean of sample results.
Amylograph Viscosity	AACCI 22-10.01 modified to use 65 g flour (14% mb) and 450 ml distilled water with pins.
Damaged Starch	AACCI 76-33.01 (SDmatic).
Solvent Retention Capacity	AACCI 56-11.02 modified rocker shaker (SRC Multi-Tube Automatic Shaker) by Poolphol.
DOUGH PROPERTY FACTORS	
Farinograph	AACCI 54-21.02 (constant flour weight method) with 50 g bowl.
Alveograph	Constant hydration method.
Extensograph	AACCI 54-10.01; modified 45 and 135-min rest.
EVALUATION OF END-PRODUCTS	
Bread	AACCI 10-10.03 (“pup loaf” method) with 180 min fermentation.*
Steamed Bread	Steamed bread is prepared using no-time dough method (WMC procedures): HW flour; flour 100%, instant yeast 1.5%, sugar 12%, shortening 2% and water is calculated based on the Farinograph. Yeast is dissolved in water before use.
Chinese Noodles	Noodle texture is determined on five strands of cooked noodles with a strand cross- cut dimension of 2.5 x 1.2 mm for raw noodles, W x T (Width x Thickness); 1.7 x 1.7 mm for wet noodles (Wheat Marketing Center (WMC) procedures), W x T using a Stable Micro Systems TA.XTPlus Texture Analyzer. Two noodle types are prepared from each HW flour: **WHITE SALTED NOODLE FORMULA:** HW flour 100%, salt 1.2% and deionized water 28%. Noodle sheet color is measured once on both sides of a dough sheet that is resting atop two other dough sheets to ensure color consistency. This is done for three dough sheets (six readings total) using a Minolta CR-410 Chroma Meter; the mean value is reported. **YELLOW ALKALINE NOODLE FORMULA:** HW flour 100%, salt 2%, K2CO3 0.45%, Na2CO3 0.45% and deionized water 32%. 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 1.5 min, rinsing in 26 to 27°C (79 to 81°F) tap water and draining.



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Dependable People. Reliable Wheat.

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