



# HARD WHITE WHEAT

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## 2024 QUALITY SURVEY



# HARD WHITE



The smallest class of wheat in the United States, hard white (HW) 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.

**F**or 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)

	2024	2023	2022	2021	2020
California	0.0	0.0	0.0	0.0	0.0
Colorado	0.1	0.1	0.0	0.1	0.0
Idaho	0.3	0.3	0.2	0.2	0.3
Kansas	0.3	0.2	0.2	0.4	0.2
Nebraska	0.1	0.1	0.0	0.1	0.0
<b>Five-State Total</b>	<b>0.8</b>	<b>0.6</b>	<b>0.5</b>	<b>0.7</b>	<b>0.6</b>
PNW-Exportable	0.3	0.3	0.2	0.2	0.3
Southern Plains-Exportable	0.5	0.4	0.3	0.5	0.3
<b>Total SRW Production</b>	<b>0.8</b>	<b>0.6</b>	<b>0.5</b>	<b>0.7</b>	<b>0.6</b>

Based on USDA crop estimates as of September 30, 2024.

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SAMPLES OF  
HARD WHITE

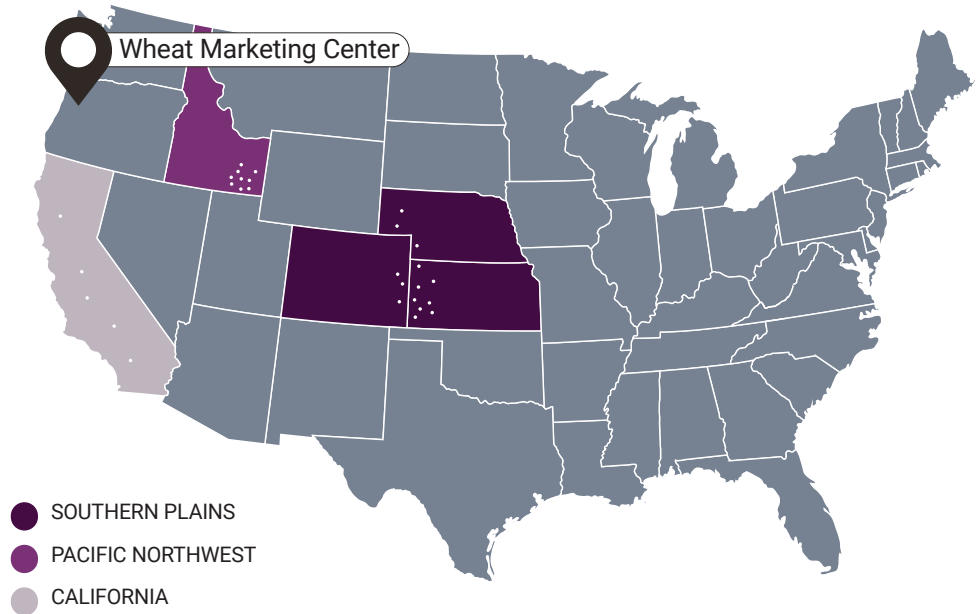
collected by state and private inspection agencies; commercial wheat handlers; Plains Grains, Inc.; and state wheat commissions.

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STATES SURVEYED

# 99%

OF TOTAL HRW PRODUCTION REPRESENTED



## SURVEY METHODOLOGY

### SAMPLE COLLECTION AND ANALYSIS

The Wheat Marketing Center (WMC) conducted the quality analyses. The Federal 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 to 12.5%, 12.6 to 13.5% and >13.5%. The methods are described in the Analysis Methods section of this booklet.



## HARVEST SURVEY

The 2024 hard white (HW) samples show acceptable quality performance in milling, dough properties, and such end-products as pan breads, Asian noodles, and steamed breads. The Pacific Northwest (PNW), California, and Southern Plains composites all show acceptable to excellent 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

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

**TEST WEIGHT** averages were above 60 lb/bu (78.9 kg/hl) for all composites.

**WHEAT PROTEIN** and **WHEAT MOISTURE** averages are comparable to 2023. The PNW offers a wider range of protein composites compared to last year with a narrower range from the Southern Plains.

**1000 KERNEL WEIGHT** averages are similar to or better than last year for the PNW and California composites. Southern Plains composites are lighter this year, likely due to dry conditions during the growing season.

**WHEAT FALLING NUMBER** values are sound for all composites and similar to last year.

Buhler **LABORATORY MILL** straight-grade flour extractions are better than last year with higher L\* values (whiteness). FLOUR ASH values are comparable to 2023.

Flour **WET GLUTEN** contents are appropriate for the protein content of each composite and similar to 2023.

**STARCH PASTING PROPERTIES** as shown by Amylograph and RVA peak viscosities are slightly higher than last year and indicate the crop will produce noodles with acceptable texture if mill stream selections are made appropriately.

**DOUGH PROPERTIES** show this year's crop has slightly higher water absorption values, stronger mixing properties, and greater extensibility for the PNW composites compared to last year.

**PAN BREAD** results for all composites shows acceptable to excellent baking performance relative to a commercial HRW straight grade control flour. The texture for all composites is similar to or softer than the control. Specific volumes for PNW and Southern Plains composites were similar to or better than the control and likely reflect improved dough properties.

**CHINESE WHITE SALTED NOODLE** L\* values after 24 hrs of storage at room temperature are acceptable for all composites except the PNW high and very high protein composites. The sensory color stability scores are good for the California 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 hrs of storage at room temperature and sensory color stability scores are similar or better than the HRW long patent control for parboiled noodles from the California and Southern Plains composites. Cooked noodle texture is comparable to or better than the control for the PNW and Southern Plains composites.

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

**STEAMED BREAD** results show most composites have good to excellent specific volumes compared to a HRW long patent control, likely due to improved dough properties. Textures for all composites were comparable to the control. All composites had smoother surfaces and whiter colors compared to last year.



# HARVEST DATA

## 2024 DATA BY GROWING REGION AND PROTEIN<sup>1</sup>

	PNW		CALIFORNIA			SOUTHERN PLAINS	
	Med	High	Very High	Low	Med	Med	High
<b>WHEAT GRADE DATA:</b>							
Test Weight (lb/bu)	62.9	63.3	61.7	65.2	65.2	60.9	60.8
(kg/hl)	82.7	83.2	81.1	85.7	85.7	80.1	80.0
Damaged Kernels (%)	0.0	0.0	0.1	0.0	0.0	0.1	0.6
Foreign Material (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shrunken & Broken (%)	0.3	0.1	0.3	0.1	0.1	0.9	0.4
Total Defects (%)	0.3	0.1	0.4	0.1	0.1	0.7	1.0
Grade	1 HW	1 HW	1 HW	1 HW	1 HW	1 HW	1 HW
<b>WHEAT NON-GRADE DATA:</b>							
Dockage (%)	0.0	0.1	0.1	0.0	0.0	0.2	0.4
Moisture (%)	11.1	10.9	11.0	9.6	9.7	10.8	11.9
Protein (%) 12%/0% mb	11.7/13.3	12.9/14.7	13.6/15.5	11.0/12.5	12.2/13.9	12.2/13.9	12.7/14.4
Ash (%) 14%/0% mb	1.52/1.77	1.54/1.79	1.57/1.82	1.51/1.76	1.42/1.66	1.37/1.59	1.29/1.50
1000 Kernel Weight (g)	37.4	39.3	35.1	38.7	44.1	29.2	29.0
Kernel Size (%) lg/md/sm	88/12/0	91/9/0	84/16/0	89/11/0	93/7/0	67/32/1	61/38/1
Single Kernel: Hardness	66.2	67.0	64.1	75.2	67.8	58.6	50.2
Weight (mg)	39.1	41.5	37.0	40.1	46.6	31.7	30.5
Diameter (mm)	2.82	2.91	2.75	2.86	2.98	2.59	2.54
Sedimentation (cc)	37.0	42.0	50.5	24.7	32.0	41.0	41.6
Falling Number (sec)	331	340	313	368	389	441	405
<b>FLOUR DATA:</b>							
Lab Mill Extraction (%)	72.0	71.3	70.2	69.5	71.5	69.0	70.5
Color: L*	92.5	92.3	92.7	92.5	92.6	93.0	92.5
a*	-1.8	-1.8	-1.8	-1.7	-1.3	-2.1	-2.0
b*	7.7	8.1	8.1	7.5	6.5	8.6	8.7
Protein (%) 14%/0% mb	10.0/11.7	11.5/13.4	12.6/14.7	9.6/11.2	10.5/12.2	10.6/12.4	11.2/13.0
Ash (%) 14%/0% mb	0.48/0.56	0.48/0.55	0.48/0.56	0.50/0.58	0.45/0.52	0.43/0.50	0.45/0.52
Wet Gluten (%)	26.4	31.6	33.0	24.8	28.1	26.2	30.6
Falling Number (sec)	355	349	359	388	461	413	399
Amylograph Viscosity: 65g (BU)	694	831	611	855	937	916	933
RVA: Pasting Temp. (°C)/Peak Viscosity (cP)	67.1/2498	66.9/3006	66.3/2552	66.2/3003	65.2/3112	67.8/2966	67.8/3108
Hot Paste Viscosity (cP)/Final Viscosity (cP)	1447/2526	1700/2812	1519/2659	1787/2906	1869/3109	2180/3501	2024/3252
Damaged Starch (%)	4.64	4.42	7.18	8.96	9.86	6.37	4.10
SRC: Water/50% Sucrose	64/114	64/119	65/123	73/117	76/121	64/114	61/108
5% Lactic Acid/5% Na <sub>2</sub> CO <sub>3</sub>	141/83	146/80	153/84	144/101	155/104	145/82	144/74
Gluten Performance Index (GPI)	0.72	0.73	0.74	0.66	0.69	0.74	0.79
<b>DOUGH PROPERTIES:</b>							
Farinograph: Peak Time (min)	11.5	13.5	14.5	10.3	22.5	23.1	12.5
Stability (min)	58.4	60.5	61.1	61.7	65.2	58.3	56.9
Absorption (%)	6.3	8.4	17.1	4.2	23.1	18.1	6.3
Alveograph: P (mm)	90	92	93	132	163	99	71
L (mm)	122	149	142	61	62	81	106
P/L Ratio	0.74	0.62	0.65	2.16	2.63	1.22	0.67
W (10 <sup>-4</sup> J)	323	410	428	302	395	302	244
Extensograph (45/135 min): Resistance (BU)	691/1265	525/1482	546/1538	338/585	458/845	429/932	518/1001
Extensibility (cm)	14.2/10.6	15.0/10.5	15.9/10.2	6.8/5.8	7.5/5.8	8.3/6.5	14.7/10.7
Area (cm <sup>2</sup> )	121/153	103/179	111/179	29/41	44/57	46/69	97/132
<b>% OF SAMPLES:</b>							

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

# HARVEST DATA

## 2024 DATA BY GROWING REGION AND PROTEIN<sup>1</sup>

	PNW		CALIFORNIA			SOUTHERN PLAINS	
	Med	High	Very High	Low	Med	Med	High
<b>PAN BREAD EVALUATION:</b>							
Bake Absorption (%)	63.2	65.4	66.0	66.8	70.1	63.4	61.8
Loaf Volume (cc)	898	997	965	746	771	848	909
Specific Volume (cc/g)	6.60	7.50	7.20	5.40	5.60	6.20	6.60
<b>WHITE SALTED (RAW) NOODLE EVALUATION:</b>							
Color at 0-24 hr: L*	84.3/73.7	82.8/70.6	82.5/71.4	85.2/74.7	85.1/74.4	83.2/73.7	82.2/73.3
a*	-0.4/0.0	-0.3/0.2	-0.2/0.2	-0.3/0.1	-0.2/0.6	-0.8/-0.4	-0.3/-0.3
b*	17.6/21.5	19.2/21.4	19.9/23.5	15.9/19.9	14.1/18.2	20.2/24.8	21.6/24.2
Change in L* (0-24 hr)	10.6	12.3	11.1	10.5	10.6	9.5	9.0
Cooking Yield (5 min, %)	125	124	124	120	116	114	119
Sensory Color Stability Score	6.0	4.0	4.0	7.0	8.0	6.0	4.0
Instrumental Texture:							
Firmness (g)	830	834	865	872	905	980	876
Springiness (%)	96.0	94.8	95.0	95.0	94.4	92.3	94.1
Cohesiveness (%)	0.69	0.70	0.70	0.69	0.69	0.66	0.66
Chewiness (g)	553	556	578	572	593	597	544
<b>YELLOW ALKALINE (WET) NOODLE EVALUATION:</b>							
Uncooked Color at 0-24 hr: L*	80.9/68.1	80.6/65.1	80.3/65.7	83.6/72.8	83.4/72.4	82.6/71.4	80.1/68.9
a*	-2.0/-1.0	-2.1/-0.7	-2.0/-1.1	-1.8/-1.2	-1.4/-0.9	-1.8/-1.2	-2.0/-0.9
b*	21.0/21.0	19.3/19.6	21.4/21.0	19.0/21.7	17.0/19.8	20.4/23.8	23.0/23.5
Change in L* (0-24 hr)	12.8	15.6	14.5	10.9	11.0	11.2	11.2
Parboiled Color at 0-24 hr: L*	77.6/77.6	77.1/76.8	76.7/76.5	79.8/79.3	79.1/79.0	80.0/78.4	78.1/78.0
a*	-1.6/-2.4	-2.1/-2.8	-1.8/-2.7	-2.4/-2.8	-2.1/-2.5	-2.0/-2.4	-2.8/-3.1
b*	27.4/25.6	27.7/25.8	28.1/26.4	27.2/25.6	25.5/24.1	27.6/26.0	28.4/27.2
Cooking Yield (1.5 min, %)	72	72	68	72	77	72	70
Uncooked Color Stability Score	4.0	3.0	4.0	7.0	6.0	6.0	4.0
Parboiled Color Stability Score	6.0	6.0	6.0	8.0	7.0	7.0	6.0
Instrumental Texture:							
Firmness (g)	893	951	967	809	879	915	938
Springiness (%)	87.2	87.6	86.7	86.9	90.0	80.7	84.9
Cohesiveness (%)	0.68	0.68	0.68	0.68	0.67	0.66	0.66
Chewiness (g)	546	566	554	469	553	490	523
<b>NORTHERN-STYLE STEAMED BREAD EVALUATION:</b>							
Specific Volume (cc/g)	2.60	2.50	2.80	2.50	2.40	2.80	2.80
Hardness (g)	1578	1428	1414	1539	1399	1314	1435

<sup>1</sup>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:
<b>WHEAT GRADE FACTORS</b>	
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.
<b>WHEAT NON-GRADE FACTORS</b>	
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.
<b>FLOUR FACTORS</b>	
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 ( $\mu$ ) 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.
Gluten Indexw	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.

# ANALYSIS METHOD

## HARD WHITE LABORATORY TESTING

TEST:	METHODOLOGY:
<b>FLOUR FACTORS</b>	
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.
<b>DOUGH PROPERTY FACTORS</b>	
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.
<b>EVALUATION OF END-PRODUCTS</b>	
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	<p>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.</p> <p>Two noodle types are prepared from each HW flour:</p> <p><b>WHITE SALTED NOODLE FORMULA:</b> 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.</p> <p><b>YELLOW ALKALINE NOODLE FORMULA:</b> HW flour 100%, salt 2%, K<sub>2</sub>CO<sub>3</sub> 0.45%, Na<sub>2</sub>CO<sub>3</sub> 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.</p>



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