

HARD WHITE WHEAT

2022 Quality Survey



U.S. WHEAT
ASSOCIATES

Dependable People. Reliable Wheat.



HARD WHITE



The smallest class of wheat in the United States, hard white (HW) is grown in the Central Plains, Montana, 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.



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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 course 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

Scan this QR code with the camera application on your smart phone to access more information about HW wheat on the USW website at www.uswheat.org/cropquality.



HARD WHITE PRODUCTION

FOR THE MAJOR PRODUCING STATES (MMT)

	2022	2021	2020	2019	2018
California	0.0	0.0	0.0	0.0	0.0
Colorado	0.1	0.1	0.0	0.2	0.2
Idaho	0.2	0.2	0.3	0.3	0.4
Kansas	0.4	0.4	0.2	0.3	0.2
Nebraska	0.1	0.1	0.0	0.1	0.1
Five-State Total	0.7	0.7	0.6	0.8	0.9
PNW-Tributary	0.2	0.2	0.3	0.3	0.4
Southern Plains-Tributary	0.5	0.5	0.3	0.5	0.5
Total HW Production	0.7	0.7	0.6	0.9	0.9

Based on USDA crop estimates as of September 30, 2022.

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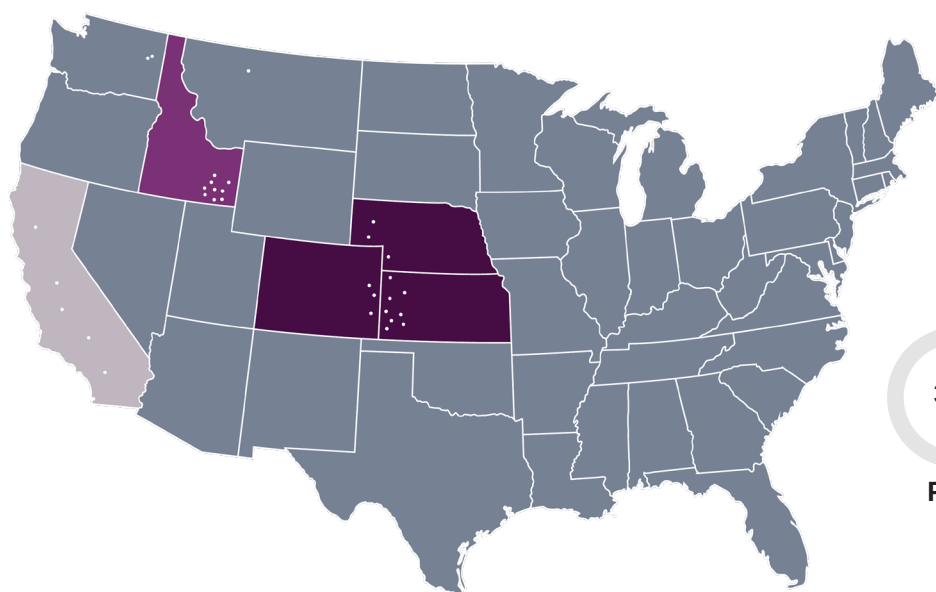
Samples collected by state and private inspection agencies; commercial wheat handlers; Plains Grains, Inc.; and state wheat commissions.

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.

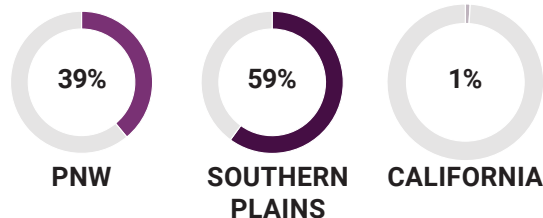
SAMPLE TESTING

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.



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STATES SURVEYED

99%
OF TOTAL HW PRODUCTION
REPRESENTED



PERCENTAGE OF TOTAL U.S. HW
PRODUCTION BY EXPORT TRIBUTARY

HARVEST SURVEY

The 2022 HW samples show good 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 excellent bread baking potential according to their respective protein contents. For Asian noodle applications, using 60% extraction patent flour is recommended to improve noodle color while maintaining noodle texture. For steamed breads, it is recommended that high protein HW flour be blended with a portion of soft white (SW) flour to improve product quality.

2022 CROP HIGHLIGHTS

PRODUCTION for the 2022 HW crop is 472,308 MT, down 33% compared to last year and the 5-year average. Much of the decrease is due to extreme drought conditions experienced across the Southern Plains. Seeded acres were also down for winter and spring planted hard white compared to 2021.

GRADE average for all composites is U.S. No. 1.

TEST WEIGHT averages range from 60.2 to 62.6 lb/bu (79.2 to 82.3 kg/hl).

WHEAT MOISTURE ranges are 8.4 to 10.5%; **WHEAT PROTEIN** 11.3 to 13.9% (12% mb).

1000 KERNEL WEIGHT for the Southern Plains very high-, Pacific Northwest very high- and California high-protein composites are 26.6, 27.8 and 28.2 g, respectively. All others are 30.0 g or higher.

KERNEL CHARACTERISTICS include kernel hardness averages of 50.6 to 78.7 and kernel diameters of 2.47 to 2.86 mm.

FALLING NUMBER averages 382 sec or higher for all composites.

LABORATORY MILL straight-grade flour extractions range 70.2 to 74.3%, L* values (whiteness) 92.2 to 92.9, flour protein 10.9 to 13.3% (14% mb) and flour ash 0.43 to 0.51% (14% mb).

Flour **WET GLUTEN** contents range 28.2 to 35.4% depending on flour protein content.

AMYLOGRAPH peak viscosities are between 759 and 1076 BU for all composites.

FARINOGRAPH water absorptions range 57.2 to 65.1% and stability times 8.0 to 40.3 min, exhibiting medium to strong dough characteristics. HW farinograph water absorption is usually similar to that of HRW, but historically stability time is longer, indicating more tolerance to overmixing.

EXTENSOGRAPH data at 135 min rest shows maximum resistance in the range of 462 to 1126 BU, extensibility from 6.5 to 17.9 cm and area of 69 to 206 cm². Maximum resistance for the California low- and Southern Plains medium-protein composites are 544 and 462 BU, respectively. All other composites are 717 BU or higher.

ALVEOGRAPH ranges are P (68 to 128 mm); L (81 to 130 mm); and W (227 to 389 (10-4 J)).

DAMAGED STARCH values are in the range of 4.3 to 8.3%.

Lactic acid **SRC** values range from 129 to 156%, indicating medium to strong gluten strength.

BAKING EVALUATION for all composites shows acceptable to excellent baking performance relative to protein content, with bake

absorptions in the range of 62.2 to 70.1%, loaf volumes of 728 to 985 cc, and crumb grain and texture scores that are similar to or better than a typical HRW flour.

CHINESE RAW NOODLES (white salted) L* values after 24 hr of storage at room temperature are acceptable for all composites except the PNW medium-protein composite. The sensory color stability scores are acceptable for all composites with the exception of the PNW medium- and California high-protein composites. Cooked noodle texture is acceptable for all composites.

CHINESE WET NOODLES (yellow alkaline) sensory color stability scores are similar to or better than the control for parboiled noodles from the California and Southern Plains composites. The cooked noodle texture is acceptable for all composites except the PNW medium-protein composite.

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

STEAMED BREAD results show most composites have good specific volumes with total scores similar to the control flour with the exception of the Southern Plains very high-protein composite. Blending 25% SW flour with high protein HW flour may improve overall steamed bread quality.

HARVEST DATA

	PNW		CALIFORNIA		SOUTHERN PLAINS	
	2022 BY PROTEIN ¹		2022 BY PROTEIN ¹		2022 BY PROTEIN ¹	
	Med	Very High	Low	High	Med	Very High
WHEAT GRADE DATA:						
Test Weight (lb/bu)	61.7	60.2	62.6	62.0	62.3	61.1
(kg/hl)	81.1	79.2	82.3	81.5	81.9	80.4
Damaged Kernels (%)	0.0	0.0	0.0	0.0	0.0	0.0
Foreign Material (%)	0.0	0.0	0.1	0.0	0.0	0.0
Shrunken & Broken (%)	0.2	0.7	1.0	0.9	0.8	0.6
Total Defects (%)	0.2	0.7	1.1	0.9	0.8	0.6
Grade	1 HW	1 HW	1 HW	1 HW	1 HW	1 HW
WHEAT NON-GRADE DATA:						
Dockage (%)	0.3	0.4	0.6	0.2	0.3	0.2
Moisture (%)	9.6	9.1	8.6	8.4	10.5	10.5
Protein (%) 12%/0% mb	12.2/13.9	13.6/15.5	11.3/12.8	13.0/14.8	12.1/13.8	13.9/15.8
Ash (%) 14%/0% mb	1.57/1.82	1.63/1.89	1.47/1.71	1.47/1.71	1.52/1.77	1.58/1.84
1000 Kernel Weight (g)	36.2	27.8	31.1	28.2	30.7	26.6
Kernel Size (%) lg/md/sm	86/14/0	75/24/1	69/30/1	66/33/1	63/36/1	55/45/0
Single Kernel: Hardness	50.6	59.1	79.1	78.7	64.1	73.7
Weight (mg)	39.4	31.7	34.4	33.3	32.9	29.2
Diameter (mm)	2.86	2.59	2.72	2.66	2.63	2.47
Sedimentation (cc)	34.0	30.5	44.9	37.4	32.3	43.4
Falling Number (sec)	384	382	424	502	415	490
FLOUR DATA:						
Lab Mill Extraction (%)	74.3	72.9	71.3	72.2	70.8	70.2
Color: L*	92.9	92.4	92.2	92.4	92.5	92.5
a*	-1.6	-1.8	-1.9	-1.8	-2.0	-2.0
b*	7.3	8.4	8.2	8.6	8.9	9.1
Protein (%) 14%/0% mb	11.5/13.4	13.3/15.4	10.9/12.7	12.6/14.6	11.1/13.0	12.8/14.8
Ash (%) 14%/0% mb	0.49/0.57	0.49/0.57	0.51/0.60	0.47/0.55	0.43/0.50	0.46/0.54
Wet Gluten (%)	28.2	35.0	29.4	35.4	29.6	33.0
Gluten Index	97	94	89	85	84	92
Falling Number (sec)	366	401	483	466	443	435
Amylograph Viscosity: 65g (BU)	1076	851	887	1017	855	759
Damaged Starch (%)	4.6	4.8	8.3	6.7	4.3	4.6
SRC: Water/50% Sucrose (%)	58/101	57/112	65/113	64/113	58/99	63/114
5% Lactic Acid/5% Na ₂ CO ₃ (%)	135/71	143/72	129/95	139/79	127/71	156/78
Gluten Performance Index (GPI) (%)	0.79	0.78	0.62	0.72	0.75	0.81
DOUGH PROPERTIES:						
Farinograph: Peak Time (min)	11.1	10.5	4.5	4.5	3.1	33.5
Stability (min)	10.0	19.1	8.5	8.4	8.0	40.3
Absorption (%)	58.3	60.0	64.2	65.1	57.2	60.4
Alveograph: P (mm)	68	82	128	112	68	105
L (mm)	119	130	81	114	113	86
P/L Ratio	0.57	0.63	1.58	0.98	0.60	1.22
W (10 ⁻⁴ J)	277	356	337	389	227	344
Extensograph (45/135 min): Resistance (BU)	380/1126	406/1109	311/544	318/717	319/462	617/890
Extensibility (cm)	16.7/12.7	16.2/11.8	20.1/17.9	18.1/12.2	16.8/14.7	7.9/6.5
Area (cm ²)	143/204	126/189	144/206	124/156	109/127	61/69
BAKING EVALUATION:						
Pan Bread: Bake Absorption (%)	63.3	65.1	69.3	70.1	62.2	65.2
Crumb Grain and Texture (1-10)	8.0	9.0	8.0	8.0	7.0	7.0
Loaf Volume (cc)	985	911	728	821	821	815

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

HARVEST DATA

	PNW		CALIFORNIA		SOUTHERN PLAINS	
	2022 BY PROTEIN ¹		2022 BY PROTEIN ¹		2022 BY PROTEIN ¹	
	Med	Very High	Low	High	Med	Very High
CHINESE RAW NOODLE-MAKING QUALITY:						
Color at 0-24 hr: L*	82.3/69.2	82.7/72.5	85.6/76.9	82.9/71.8	80.8/73.4	82.5/74.7
a*	0.1/0.5	0.1/0.7	-0.3/-0.2	0.0/0.2	-0.2/-0.1	-0.3/-0.3
b*	18.9/20.3	19.7/25.8	16.5/20.9	19.9/24.3	22.8/25.2	21.9/27.2
Change in L* (0-24 hr)	13.2	10.2	8.7	11.1	7.4	7.9
Cooking Yield (1.5 min, %)	108	117	127	116	116	112
Sensory Color Stability Score	4.5	6.0	7.5	5.5	6.0	6.5
Instrumental Texture:						
Firmness (g)	1365	1478	1336	1320	1417	1633
Springiness (%)	95.3	93.8	94.3	93.6	95.5	95.9
Cohesiveness (%)	0.60	0.62	0.63	0.65	0.58	0.57
Chewiness (g)	777	865	787	799	779	892
CHINESE WET NOODLE-MAKING QUALITY:						
Uncooked Color at 0-24 hr: L*	76.7/63.8	79.3/67.7	81.7/70.8	79.4/66.9	80.4/69.3	81.2/71.2
a*	-2.3/-0.3	-1.7/-0.7	-2/-1.4	-2.2/-1.3	-1.9/-0.7	-1.9/-1.1
b*	20.1/17.8	23.2/22.8	20.6/21.8	23.4/22.6	22.7/23.6	22.9/26.5
Change in L* (0-24 hr)	12.9	11.6	10.9	12.5	11.2	10.1
Parboiled Color at 0-24 hr: L*	75.4/72.8	76.5/75.5	79.3/78.6	76.2/73.7	78.2/78.0	78.7/79.0
a*	-1.4/-1.8	-1.1/-2.2	-2.4/-3.3	-1.2/-2.3	-1.9/-2.5	-2.1/-3.1
b*	23.9/20.6	26.8/23.9	28.8/26.1	27.2/23.8	28.4/26.1	29.2/27.7
Cooking Yield (1.5 min, %)	74	68	77	69	76	65
Uncooked Color Stability Score	4.5	5.5	6.0	5.5	6.0	7.5
Parboiled Color Stability Score	6.0	6.5	7.5	7.5	7.0	8.0
Instrumental Texture:						
Firmness (g)	1067	1312	1114	1283	1421	1326
Springiness (%)	77.7	86.9	80.4	86.2	87.2	82.2
Cohesiveness (%)	0.64	0.62	0.63	0.63	0.58	0.57
Chewiness (g)	527	709	563	694	721	622
ASIAN-TYPE STEAMED BREAD EVALUATION:						
Specific Volume (ml/g)	2.6	2.9	2.5	2.6	2.5	2.1
Total Score	61.0	63.0	68.0	64.0	63.0	56.0

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



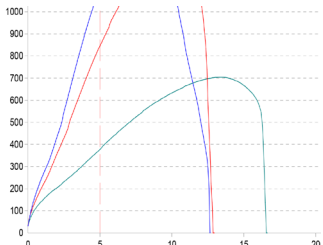
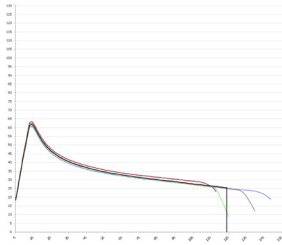
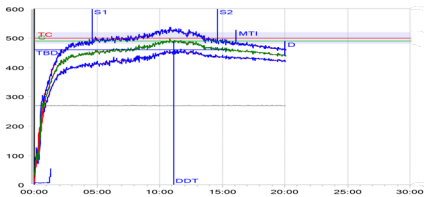
DOUGH PROPERTIES

FARINOGRAMS

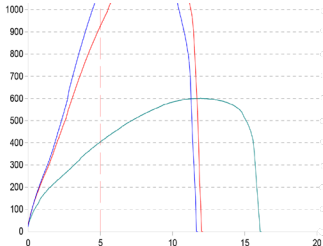
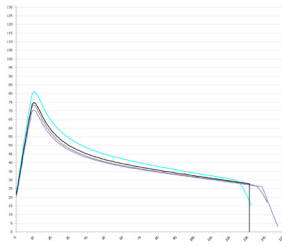
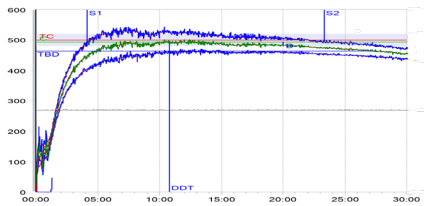
ALVEOGRAMS

EXTENSOGRAMS

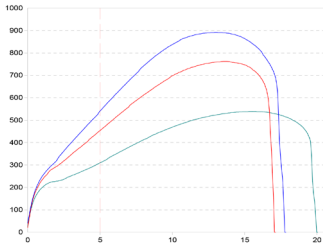
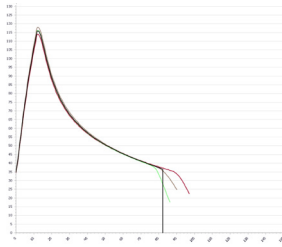
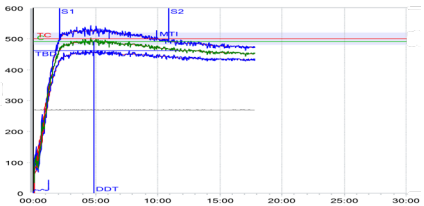
PNW MED



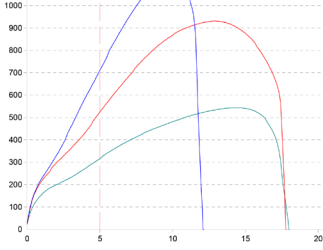
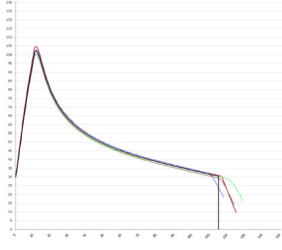
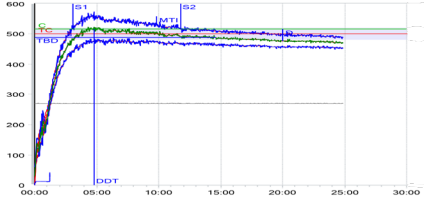
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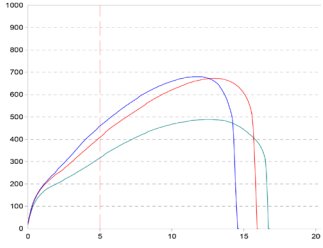
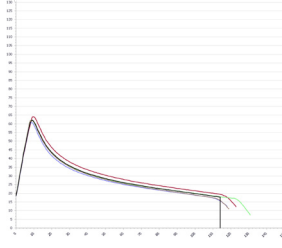
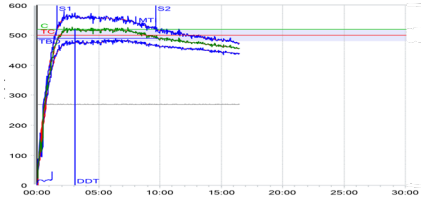
CALIFORNIA LOW



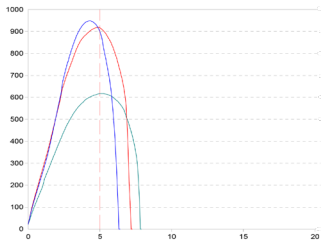
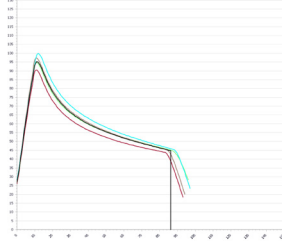
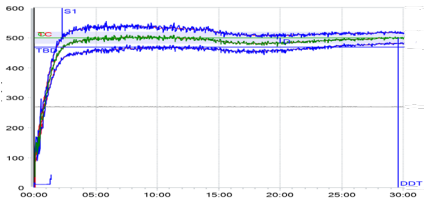
CALIFORNIA HIGH



SOUTHERN PLAINS MED



SOUTHERN PLAINS VERY HIGH



ANALYSIS METHODS

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.
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.

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	SRC machine (Chopin).
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 42.5 to 45.0%. 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> <ul style="list-style-type: none"> • RAW NOODLE FORMULA: HW flour 100%, salt 1.2% and deionized water 28%. Noodle sheet color is measured twice on each side of a dough sheet that is resting atop two other dough sheets to ensure color consistency. This is done for two dough sheets (eight readings total) using a Minolta CR-410 Chroma Meter; the mean value is reported. • WET 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.



For the full methodology, scan the QR code or visit the USW website at www.uswheat.org/working-with-buyers/wheat-glossary.



www.uswheat.org



About U.S. Wheat Associates: 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 and their customers." USW activities are funded by producer checkoff dollars managed by 17 state wheat commissions and through cost-share USDA Foreign Agricultural Service market development programs. For more information, visit www.uswheat.org or contact your state wheat commission.

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