2024

U.S. CROP QUALITY REPORT

High quality wheat for every need.

U.S. WHEAT ASSOCIATES

Dependable People. Reliable Wheat.

FROM THE PRESIDENT

Dear Friends:

After the past few challenging years, my U.S. Wheat Associates (USW) colleagues and the farmers we represent are glad to say that there is good production news about U.S. wheat supplies. Led by increases in hard red winter (HRW) and hard red spring (HRS) wheat, estimated 2024/25 U.S. production as of early September was 53.9 million metric tons. If realized, it would be the largest U.S. crop in 8 years.

More production has also sparked more demand for U.S. wheat. Still early in marketing year 2024/25, the U.S. commercial sales pace was up by 31% from the same time in 2023/24. USDA expects exports will reach their highest level since 2020/21.

With strong support from our state wheat commission members, public and private partners, and USDA's Foreign Agricultural Service, the comprehensive data shared in this 2024 Crop Quality Report shows the larger new crop offers our customers the milling and baking qualities needed to produce the highest quality wheat foods, and greater opportunity to thrive in the coming year.

If I may be allowed, I want to say how proud I am of my USW colleagues, of their work on behalf of farmers, and their commitment to helping our customers get the greatest value from versatile, high-quality U.S. wheat. Serving with them remains a privilege for me after more than 30 years. I do want to express special recognition to our Vice President of Programs Erica Oakley who diligently orchestrates the many players who have contributed to this report season after season.

Most important, I thank our customers for their loyalty and friendship. Together we are part of a rewarding industry and play a vital part in feeding the world.

We wish you much success.

Sincerely,

Vince Peterson
USW President

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
- 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

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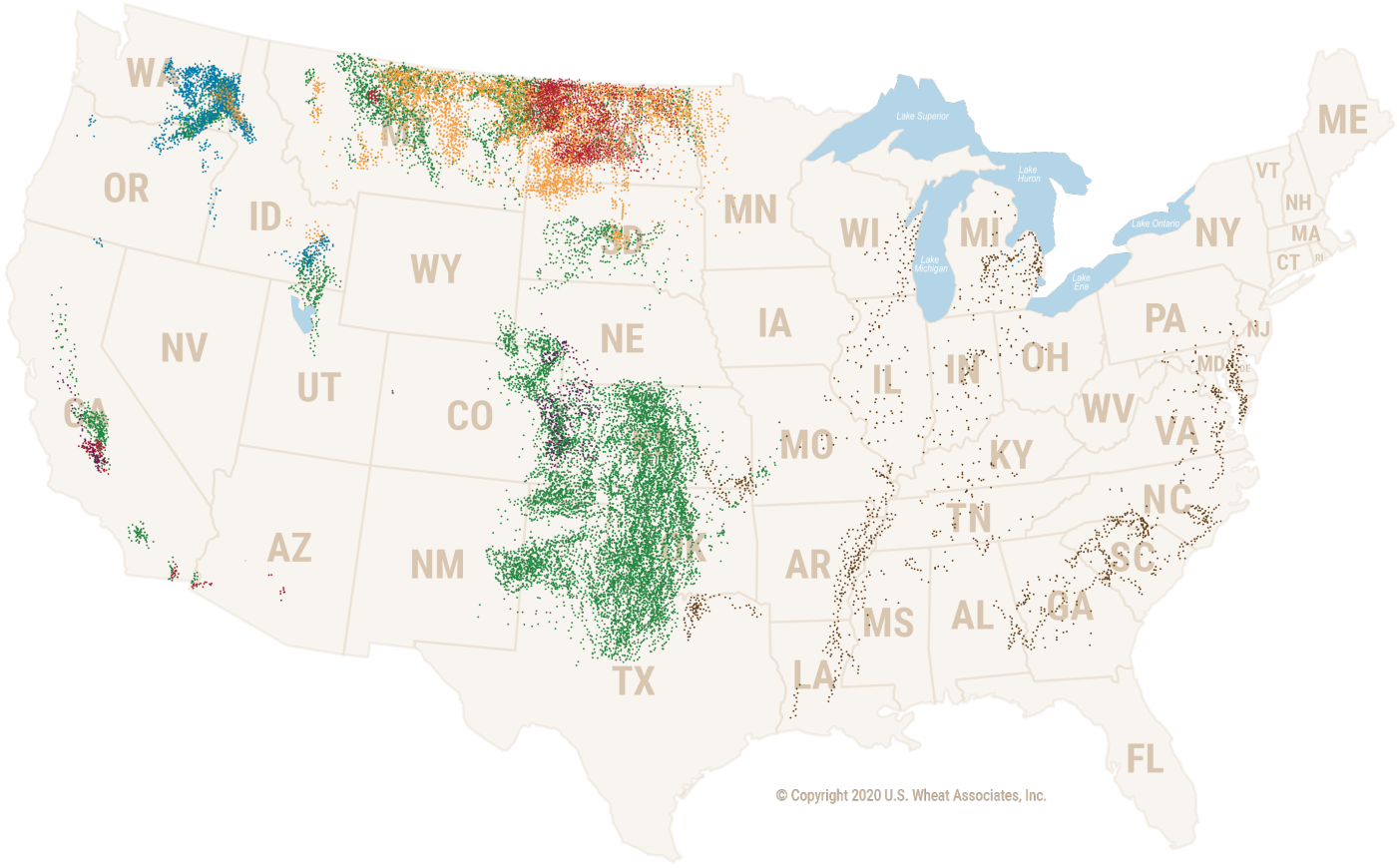
HARD WHITE REPORT

CALIFORNIA HARD RED WINTER REPORT

REGIONAL REPORTS

2024 CROP QUALITY OVERVIEW



Hard Red Winter | Hard Red Spring | Soft White | Soft Red Winter | Durum

PLANTING AND HARVEST DATES

	Wheat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HRW	Planting												
	Harvest												
HRS	Planting												
	Harvest												
Durum	Planting												
	Harvest												
SW	Planting												
	Harvest												
SRW	Planting												
	Harvest												

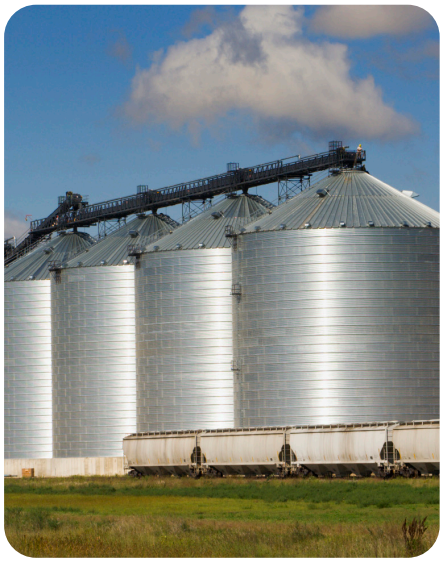
California-Arizona Planting | Other States Planting | California-Arizona Harvest | Other States Harvest

U.S. PRODUCTION BY CLASS

CROP YEAR (BEGINNING JUNE 1) (MMT)

	2024	2023	2022	2021	2020
Hard Red Winter	21.0	16.2	14.5	20.4	17.9
Hard Red Spring	13.7	12.7	12.2	8.1	14.4
Hard White	0.8	0.6	0.5	0.7	0.6
Durum	2.2	1.6	1.7	1.0	1.9
Soft White	6.7	5.8	6.9	4.8	7.6
Soft Red Winter	9.3	12.2	9.1	9.8	7.2
Total	**53.7**	**49.1**	**44.9**	**44.8**	**49.7**

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



U.S. SUPPLY AND DEMAND

ESTIMATED FOR 2024/25 (BEGINNING JUNE 1) (MMT)

	HRW	HRS	SRW	White[1]	Durum	Total
Beginning stocks	7.5	5.2	3.4	2.3	0.6	18.9
Production	21.0	13.7	9.3	7.5	2.2	53.6
Imports	0.1	1.5	0.1	0.1	1.2	3.1
Total Supply	**28.6**	**20.4**	**12.9**	**10.0**	**4.0**	**75.7**
Domestic Use	12.5	7.9	6.5	2.1	2.3	31.2
Exports	6.0	7.2	3.1	5.3	0.8	22.5
Total demand	**18.5**	**15.1**	**9.6**	**7.4**	**3.2**	**53.7**
Ending stocks	**10.1**	**5.3**	**3.3**	**2.6**	**0.8**	**22.1**
Stocks 5-year average	9.1	5.5	2.9	2.1	0.8	20.4

Based on USDA Supply/Demand estimates as of October 12, 2024.

[1]Includes both SW and HW.

SUMMARY OF CLASSES

	Hard Red Winter[1]		Hard Red Spring		Soft White		Soft Red Winter		Northern Durum[2]		Desert Durum®[2]	
	2024	5-Year Avg	2024	5-Year Avg	2024	5-Year Avg	2024	5-Year Avg	2024	5-Year Avg	2024	5-Year Avg
Test Weight (lb/bu)	61.4	60.4	61.1	61.4	60.9	60.8	59.2	59.6	60.8	61.3	63.1	63.3
(kg/hl)	80.7	79.5	80.4	80.8	80.0	80.0	78.0	78.4	79.2	79.8	82.2	82.4
Grade	1 HRW	1 HRW	1 NS	1 NS	1 SW	1 SW	2 SRW	2 SRW	1 HAD	1 HAD	1 HAD	1 HAD
Dockage (%)	0.5	0.6	0.6	0.6	0.4	0.5	0.3	0.3	0.8	1.0	0.4	0.3
Moisture (%)	10.7	10.9	12.2	12.0	9.0	9.2	12.9	13.3	12.2	11.2	7.1	7.2
Wheat Protein (%), 12% mb	11.9	12.9	14.1	14.5	9.2	10.3	9.8	9.4	14.3	14.1	13.7	13.8
Wheat Ash (%), 14% mb	1.44	1.58	1.54	1.54	1.40	1.41	1.41	1.38	1.58	1.57	1.66	1.66
1000 Kernel Weight (g)	30.1	30.6	32.0	31.3	35.7	33.8	32.7	33.8	35.3	42.7	50.0	48.2
Falling Number (sec)	358	358	414	371	339	332	316	310	463	404	646	662
Flour/Semolina Extraction (%)[2]	75.0	77.0	67.8	67.0	70.5	71.4	70.1	67.0	60.7	55.3	70.7	72.5
Flour/Semolina Ash (%)[2]	0.53	0.53	0.47	0.50	0.45	0.44	0.43	0.42	0.68	0.63	0.85	0.82
Wet Gluten (%) 14% mb	29.1	30.9	33.5	34.4	18.9	23.9	22.4	20.4	31.7	33.8	32.8	34.6
Farinograph:												
Peak Time (min)	5.4	5.3	7.2	8.2	1.3	1.9	1.2	1.2	–	–	–	–
Stability (min)	9.1	8.8	13.0	13.5	2.1	2.5	1.9	1.6	–	–	–	–
Absorption (%)	58.6	58.8	61.8	62.5	51.2	51.8	52.7	52.1	–	–	–	–
W (10^{-4} J)	231	242	399	387	79	85	98	84	–	–	–	–
Loaf Volume (cc)	849	930	971	974	635	–	634	629	–	–	–	–
Production (MMT)	21.0	18.0	13.7	12.2	6.7	6.4	9.3	9.6	1.4	0.9	0.1	0.1
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[1]HRW data does not include California.

[2]Durum extraction and ash values are for semolina.

GRADING, ABBREVIATIONS & CONVERSIONS

GRADES AND GRADE REQUIREMENTS

GRADING FACTORS:	GRADES U.S. NO.:				
	1	2	3	4	5
MINIMUM LIMITS:					
Test Weight (lb/bu)					
HRS 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)					
HRS 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 (1,000 g 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 g	31				

U.S. Sample Grade is 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);
(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, caster beans, crotalaria seeds, glass, stones, or unknown foreign substance.

ABBREVIATIONS

°C	Celsius	in	inch
°F	Fahrenheit	J	joules
AACC	American Association of Cereal Chemists	kg	kilogram
AD	Amber Durum	kg/hl	Kilograms/Hectoliter
α-amylase	alpha-amylase	lb	pound
bu	Winchester bushel	lb/bu	pounds/bushel
BU	Brabender Unit	mb	moisture basis
cc	cubic centimeter (also cm³, ccm)	mg	milligram
Club	White Club	min	minute
cm	centimeter	mL	milliliter
cm²	square centimeters	mm	millimeter
cwt	quintal or hundredweight	MMT	million metric tons
db	Dry basis	MT	metric tons
DNS	Dark Northern Spring	NS	Northern Spring
DON	Deoxynivalenol (Vomitoxin)	PGI	Plains Grains Inc.
Durum	Durum	PNW	Pacific Northwest
FGIS	Federal Grain Inspection Service	ppm	parts per million
g	gram	PPO	polyphenol oxidase
GIPSA	Grain Inspection, Packers and Stockyards Administration	sec	second
GPAL	Great Plains Analytical Lab	SKCS	Single Kernel Characterization System
GPI	Gluten Performance Index	SRC	Solvent Retention Capacity
Gulf	Gulf of Mexico	SRW	Soft Red Winter
HAD	Hard Amber Durum	SW	Soft White
hl	hectoliter	TKW	1000 kernel weight or thousand kernel weight
hr	hour	USDA	United States Department of Agriculture
HRS	Hard Red Spring	WMC	Wheat Marketing Center
HRW	Hard Red Winter	WW	Western White
HW	Hard White		

UNIT CONVERSION FACTORS

The weight units conversion matrix should be read from the top, left.
For example: **1 MT** is equal to **1,000 kg**.

	1 bu	1 lb	**1 MT**	1 long ton	1 short ton	1 cwt	1 kg
bu	1	0.017	36.74	37.33	33.33	3.674	0.037
lb	60	1	2,204	2,240	2,000	100	2.205
MT	0.0272	0.0005	1	1.016	0.907	22.05	0.0010
long ton	0.0268	0.0004	0.984	1	0.893	0.045	0.0010
short ton	0.030	0.0005	1.102	1.12	1	0.05	0.0011
cwt	0.600	0.01	22.05	22.40	20.37	1	0.022
kg	27.2	0.45	1,000	1,016	907.2	45.36	1

LEGEND:
bu (*Winchester* bushel)
lb (pound)
MT (metric ton)
cwt (quintal or hundredweight)
kg (kilogram)

LAND AREA:
1 hectare (ha) = 2.47 acres (ac)
1 acre (ac) = 0.40 hectare (ha)

TEST WEIGHT:
Durum wheat: kg/hl = lb/bu x 1.292 + 0.630
Common wheat: kg/hl = lb/bu x 1.292 + 1.419

SOLVENT RETENTION CAPACITY:
GPI = Lactic Acid/(Sodium Carbonate + Sucrose)

FLOUR PROTEIN:
14% mb to db = Protein (14% mb) / 0.86
db to 14% mb = Protein (14% mb) x 0.86

WHEAT PROTEIN:
12% mb to db = Protein (12% mb) / 0.88
db to 12% mb = Protein (12% mb) x 0.88

HARD RED WINTER

Grown in the Great Plains, Pacific Northwest (PNW) and California, hard red winter (HRW) is the most widely grown class in the United States. It is shipped via the Gulf and Pacific ports. It has medium to high protein of 10.0 to 13.0% (12% mb), medium hard endosperm, red bran, medium gluten content and mellow gluten.

For the miller, HRW brings consistency to the grist. A balanced mill optimizes flour extraction and helps maximize milling efficiency. Maintaining HRW as the foundation of the mill grist allows the miller to blend other U.S. classes, local wheat or wheat from other origins as cost advantages or product differentiation opportunities develop.

For the baker, HRW benefits include improved baking characteristics, including dough stability and water absorption, either alone or as part of a blend. HRW delivers consistency as it is always available and provides the most reliable foundational ingredient for most wheat-based products.

APPLICATIONS

With excellent milling and baking characteristics for wheat foods like pan breads, hard rolls, croissants and flat breads, HRW is an important and versatile wheat. It is also an ideal choice for some types of Asian noodles, general purpose flour and as an improver for blending.

Applications include:

- Baguettes
- Flatbreads, tortillas
- Pan breads
- Yeast breads and rolls
- Hard rolls
- Hearth breads
- Cereals
- Croissants
- Dumplings, Chinese
- Noodles, Asian-style
- Steamed bread (mushipan)
- Non-durum pasta
- Wide variety of other baked goods
- Flours (general-purpose, bread)
- Blending improver

SCAN THIS QR CODE for more information.

SURVEY METHODOLOGY

SAMPLE COLLECTION AND ANALYSIS

Plains Grains Inc. in Lincoln, Nebraska collaborated with USDA/ARS Hard Winter Wheat Quality Lab (HWWQL) in Manhattan, Kansas to collect samples and conduct quality analyses.

SAMPLE TESTING

Official grade and non-grade factors were determined on each sample. Functionality tests were conducted on 97 composite samples categorized by growing region and protein ranges of <11.5%, 11.5 to 12.5% and >12.5%. Production weighted results are presented as Overall, Gulf-exportable and Pacific Northwest (PNW)-exportable averages. The methods are described in the Analysis Methods section of this booklet.

575

SAMPLES OF HARD RED WINTER

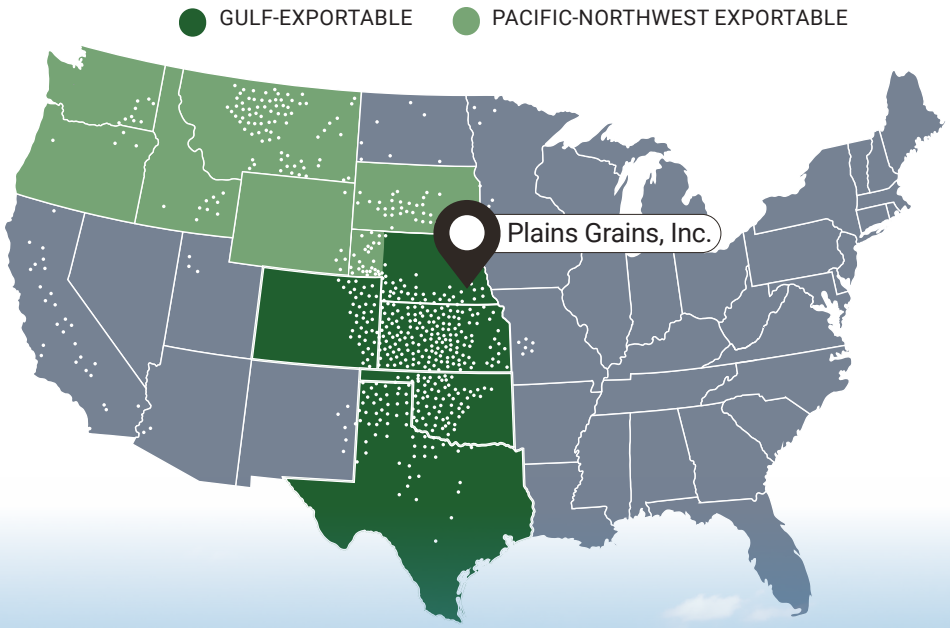
collected from grain elevators in 40 reporting areas after at least 30% of the local harvest was complete.

11

STATES SURVEYED

98%

OF TOTAL HRW PRODUCTION REPRESENTED



WEATHER AND HARVEST

PLANTED area for the 2024 HRW crop was estimated at 24.1 million acres (9.8 million hectares) seeded in fall 2023, marking a 4% increase over the previous year. The crop entered dormancy in better condition than the previous three years, as wheat producers in most areas had adequate moisture at planting for the 2024 HRW crop.

GROWING conditions varied among the HRW production regions but were overall much improved over the past few years. Conditions were generally dry over the winter and early spring throughout the Great Plains, while in the PNW there was plentiful winter moisture. In late May, rain greatly impacted yields and test weights at harvest in Texas and Oklahoma while mid-season moisture boosted yields and test weights in Kansas, Colorado and Nebraska. The northern plains and PNW experienced generally good growing conditions with the exception of excessive rainfall at harvest in South Dakota and drought conditions in Montana.

HARVEST was generally early for most of the HRW growing region, however, there were rain-related delays in Texas, Oklahoma, pockets of northwestern Kansas and South Dakota. Nebraska reported near record yields and the PNW reported strong yields after favorable growing conditions. Overall, disease and insect pressure were low.

PRODUCTION of the U.S. HRW crop, at 21.0 MMT, is up 28% from last year due to increased plantings and overall favorable growing conditions throughout the region.

HARD RED WINTER PRODUCTION

FOR THE MAJOR PRODUCING STATES (MMT)

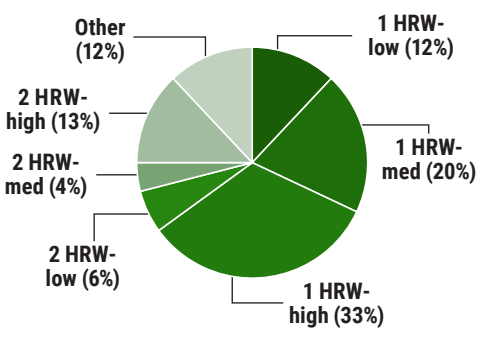
	2024	2023	2022	2021	2020
California	0.1	0.2	0.1	0.2	0.1
Colorado	1.7	1.9	0.9	1.8	1.1
Idaho	0.4	0.3	0.3	0.2	0.3
Kansas	7.9	5.1	6.2	9.3	7.3
Montana	2.5	2.3	1.6	1.5	2.1
Nebraska	1.2	0.9	0.7	1.1	0.9
Oklahoma	2.9	1.8	1.8	3.1	2.8
Oregon	0.1	0.1	0.1	0.1	0.1
South Dakota	1.3	0.9	1.0	0.7	0.9
Texas	2.1	2.1	1.0	1.9	1.6
Washington	0.3	0.3	0.3	0.2	0.3
Wyoming	0.1	0.1	0.0	0.1	0.1
Twelve-State Total	**20.6**	**15.8**	**14.1**	**20.1**	**17.7**
Gulf-Exportable	14.9	11.2	10.3	16.5	13.2
PNW-Exportable	5.5	4.5	3.8	3.5	4.4
Total HRW Production	**21.0**	**16.2**	**14.5**	**20.4**	**17.9**

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

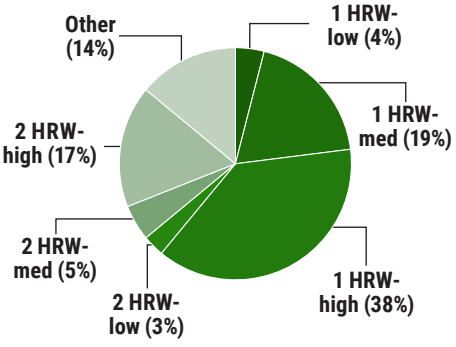
DISTRIBUTION BY GRADE

PROTEIN RANGE, 12% MB: LOW, <11.5%; MED, 11.5-12.5%; HIGH, >12.5%.

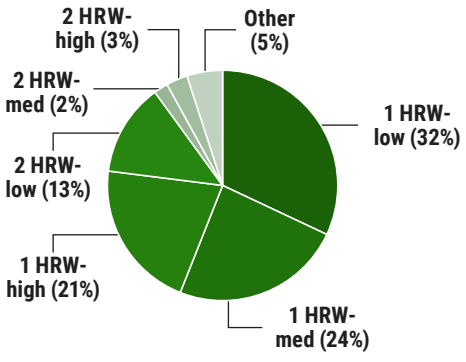
OVERALL



GULF



PACIFIC NORTHWEST



OVERALL HARVEST DATA

	2024 BY PROTEIN[1]			2024	2023	5-Year
	Low	Med	High	Avg	Avg	Avg
WHEAT GRADE DATA:						
Test Weight (lb/bu)	61.6	61.5	61.0	61.4	59.8	60.4
(kg/hl)	81.0	80.8	80.2	80.7	78.7	79.5
Damaged Kernels (%)	0.1	0.1	0.2	0.1	0.5	0.5
Foreign Material (%)	0.1	0.1	0.1	0.1	0.1	0.1
Shrunken & Broken (%)	0.8	0.8	0.7	0.8	0.9	1.0
Total Defects (%)	0.9	1.0	0.9	0.9	1.6	1.7
Grade	1 HRW	1 HRW	1 HRW	1 HRW	2 HRW	1 HRW
WHEAT NON-GRADE DATA:						
Dockage (%)	0.5	0.5	0.5	0.5	0.6	0.6
Moisture (%)	10.4	10.8	11.0	10.7	11.5	10.9
Protein (%) 12%/0% mb	10.7/12.2	12.1/13.7	13.2/15.0	11.9/13.5	12.7/14.4	12.9/14.6
Ash (%) 14%/0% mb	1.45/1.68	1.45/1.68	1.43/1.67	1.44/1.68	1.58/1.79	1.58/1.81
1000 Kernel Weight (g)	31.2	29.6	29.1	30.1	29.7	30.6
Kernel Size (%) lg/md/sm	69/30/1	67/32/1	61/38/1	66/33/1	69/30/1	63/35/2
Single Kernel: Hardness	59.1	61.7	64.3	61.4	59.3	62.9
Weight (mg)	34.5	31.7	30.0	32.3	32.0	31.7
Diameter (mm)	2.72	2.64	2.58	2.65	2.66	2.62
Sedimentation (cc)	43.2	49.0	57.9	49.1	52.5	54.8
Falling Number (sec)	349	357	373	358	355	358
DON (ppm)	0.1	0.1	0.1	0.1	0.1	0.2
FLOUR DATA:						
Lab Mill Extraction (%)[2]	75.2	75.0	74.6	75.0	75.9	77.0
Color: L*	91.1	90.9	90.8	91.0	90.6	90.5
a*	-1.6	-1.5	-1.5	-1.5	-1.5	-1.5
b*	10.7	10.6	10.6	10.7	10.1	10.1
Protein (%) 14%/0% mb	10.0/11.6	11.1/12.9	12.3/14.3	11.0/12.8	11.4/13.0	11.7/12.7
Ash (%) 14%/0% mb	0.52/0.61	0.53/0.62	0.53/0.62	0.53/0.61	0.53/0.61	0.53/0.61
Wet Gluten (%) 14% mb	26.1	29.5	33.1	29.1	29.5	30.9
Falling Number (sec)	391	396	406	397	389	396
Amylograph Viscosity: 65g (BU)	803	793	847	811	662	716
Damaged Starch (%)	6.6	6.3	6.3	6.4	5.8	6.2
SRC: Water/50% Sucrose (%)	67/112	67/113	68/118	67/114	65/118	65/115
5% Lactic Acid/5% Na_2CO_3 (%)	131/90	136/88	144/89	137/89	1.61	138/87
Gluten Performance Index (GPI)	0.65	0.68	0.70	0.67	0.68	0.68
DOUGH PROPERTIES:						
Farinograph: Peak Time (min)	4.6	5.4	6.6	5.4	4.8	5.3
Stability (min)	7.4	9.2	11.6	9.1	8.7	8.8
Absorption (%)	57.7	58.5	59.9	58.6	57.9	58.8
Alveograph: P (mm)	82	82	83	82	80	86
L (mm)	76	88	101	87	106	86
P/L Ratio	1.08	0.92	0.82	0.94	0.75	1.00
W (10^{-4} J)	203	233	271	231	268	242
Extensograph (45/135 min): Resistance (BU)	334/566	330/545	338/576	334/561	365/683	412/756
Extensibility (cm)	14.3/13.1	14.8/13.5	15.5/14.2	14.8/13.5	14.4/12.5	14.6/13.0
Area (cm^2)	82/118	88/123	97/138	88/125	92/131	91/132
BAKING EVALUATION:						
Pan Bread: Bake Absorption (%)	60.1	61.9	64.1	61.8	64.7	65.0
Loaf Volume (cc)	791	862	914	849	920	930
Specific Volume (cc/g)	5.32	5.74	6.06	5.66	—	—
% OF SAMPLES:	24	22	53	100		

[1] Protein Range: Low, <11.5%; Med, 11.5 - 12.5%; High, >12.5%.
[2] The lab mill extraction calculation changed in 2023; values are not comparable to the 5-year average. See analysis methods.

GULF-EXPORTABLE HARVEST SURVEY

The 2024 Gulf-exportable U.S. hard red winter (HRW) crop experienced variable conditions. Rain at harvest greatly impacted yields in Texas and Oklahoma. In Kansas, Colorado and Nebraska persistent early dryness resulted in slightly smaller kernels while mid-season moisture boosted yields and test weights. Overall, the growing conditions for this year's crop were greatly improved over the previous drought-stressed years, resulting in a more balanced, typical HRW crop. This year's wheat crop offers a balance of protein, strong grade characteristics and good milling properties. Flour and baking data indicate protein offers good processing characteristics, with appropriate absorptions and strength characteristics for protein content. Overall, this crop meets or exceeds typical HRW contract specifications and should provide high value to customers.

GULF-EXPORTABLE CROP HIGHLIGHTS

The average **GRADE** for the 2024 Gulf-exportable crop is U.S. No. 1 HRW. The Gulf grade data reflect improved growing conditions.

Gulf **TEST WEIGHT** averages trended higher than last year and the 5-year average, indicating a sound crop.

WHEAT MOISTURE in this year's Gulf crop is lower than last year, reflecting overall drier harvest conditions.

WHEAT PROTEIN (12% MB) averages are lower compared to last year's crop the 5-year average, reflecting a less stressed and higher yielding crop compared to the previous few drought-stressed years.

1000 KERNEL WEIGHT Gulf average is lower than last year and the 5-year average, reflecting smaller kernels due to dry conditions early in the season.

KERNELS are slightly smaller than last year due to early season dryness but ideal conditions during grain filling resulted in higher test weights.

WHEAT FALLING NUMBER Gulf average is notably higher than last year and 5-year average, and indicates the crop is sound.

Tandem **LABORATORY MILL** average extraction is lower than last year. Commercial mills should see better extractions. In 2023, flour extraction calculations shifted from a total product weight basis to a tempered wheat weight, therefore, they should not be compared to the 5-year average.

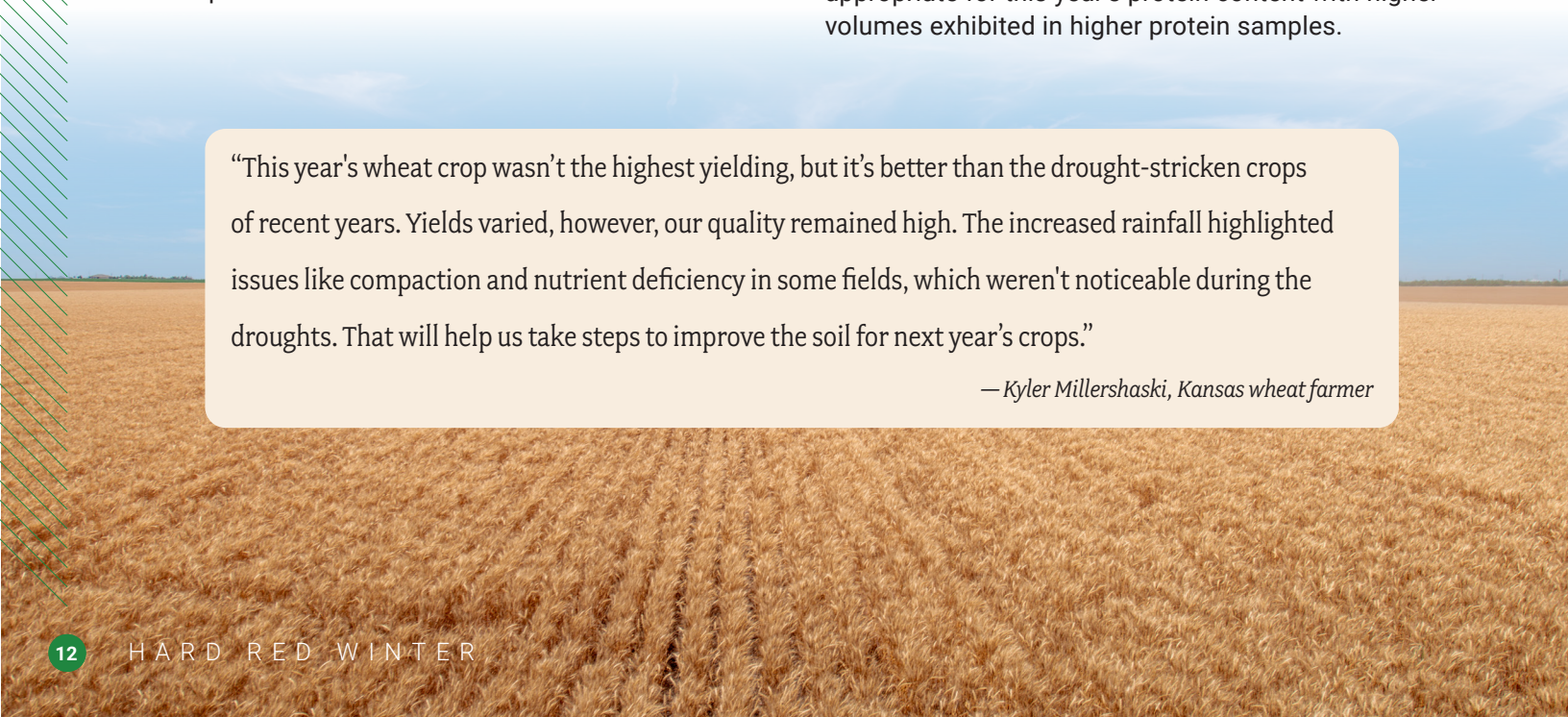
SOLVENT RETENTION CAPACITY values for the Gulf crop indicate good flour performance in baking applications.

FARINOGRAPH values indicate a similar peak time, slightly longer stability and similar absorption compared to last year.

EXTENSOGRAPH values indicate similar/greater extensibility compared to last year, indicating a more balanced gluten profile.

Overall, Gulf **DOUGH PROPERTIES** demonstrate typical dough mixing properties and water absorptions with more balanced gluten properties that can be modified with formula or blend adjustments.

Gulf **LOAF VOLUME** and **BAKE ABSORPTION** values, while lower than previous high protein years, are appropriate for this year's protein content with higher volumes exhibited in higher protein samples.



"This year's wheat crop wasn't the highest yielding, but it's better than the drought-stricken crops of recent years. Yields varied, however, our quality remained high. The increased rainfall highlighted issues like compaction and nutrient deficiency in some fields, which weren't noticeable during the droughts. That will help us take steps to improve the soil for next year's crops."

— Kyler Millershaski, Kansas wheat farmer

GULF-EXPORTABLE HARVEST DATA

	2024 BY PROTEIN[1]			2024	2023	5-Year
	Low	Med	High	Avg	Avg	Avg
WHEAT GRADE DATA:						
Test Weight (lb/bu)	60.9	61.1	60.7	60.9	59.7	60.0
(kg/hl)	80.2	80.3	79.9	80.1	78.6	79.0
Damaged Kernels (%)	0.1	0.1	0.2	0.2	0.5	0.7
Foreign Material (%)	0.1	0.1	0.1	0.1	0.2	0.2
Shrunken & Broken (%)	0.7	0.7	0.6	0.7	0.9	1.0
Total Defects (%)	0.9	0.9	0.9	0.9	1.6	1.9
Grade	1 HRW	1 HRW	1 HRW	1 HRW	2 HRW	1 HRW
WHEAT NON-GRADE DATA:						
Dockage (%)	0.7	0.5	0.4	0.5	0.6	0.6
Moisture (%)	11.5	11.3	11.3	11.4	11.7	11.2
Protein (%) 12%/0% mb	10.8/12.3	12.1/13.8	13.2/15.0	12.1/13.8	12.9/14.6	13.0/14.7
Ash (%) 14%/0% mb	1.47/1.71	1.45/1.69	1.43/1.67	1.45/1.69	1.59/1.81	1.58/1.82
1000 Kernel Weight (g)	30.5	29.4	29.1	29.6	29.8	30.1
Kernel Size (%) lg/md/sm	70/29/1	67/32/1	61/38/1	66/33/1	69/30/1	63/35/2
Single Kernel: Hardness	58.0	60.6	63.8	61.0	57.2	61.1
Weight (mg)	30.8	30.0	29.6	30.1	31.5	30.9
Diameter (mm)	2.63	2.59	2.57	2.60	2.64	2.60
Sedimentation (cc)	43.0	48.6	58.2	50.4	52.5	53.0
Falling Number (sec)	369	367	377	371	342	339
DON (ppm)	0.2	0.1	0.2	0.1	0.1	0.2
FLOUR DATA:						
Lab Mill Extraction (%)[2]	75.2	75.1	74.8	75.0	76.0	77.0
Color: L*	91.1	91.0	90.8	91.0	90.6	90.6
a*	-1.6	-1.5	-1.5	-1.5	-1.5	-1.5
b*	10.5	10.5	10.6	10.5	9.9	9.9
Protein (%) 14%/0% mb	9.9/11.5	11.1/12.9	12.3/14.3	11.2/13.0	11.3/13.2	11.7/13.6
Ash (%) 14%/0% mb	0.52/0.61	0.53/0.62	0.53/0.62	0.53/0.61	0.54/0.62	0.54/0.62
Wet Gluten (%) 14% mb	25.4	29.6	33.0	29.6	29.5	30.3
Falling Number (sec)	401	403	409	405	385	388
Amylograph Viscosity: 65g (BU)	857	813	871	845	633	633
Damaged Starch (%)	6.2	6.2	6.3	6.3	5.7	6.1
SRC: Water/50% Sucrose (%)	64/107	66/112	68/118	66/113	65/118	66/116
5% Lactic Acid/5% Na_2CO_3 (%)	125/84	133/85	144/88	135/86	140/86	138/86
Gluten Performance Index (GPI)	0.66	0.68	0.70	0.68	0.69	0.68
DOUGH PROPERTIES:						
Farinograph: Peak Time (min)	4.8	5.6	6.7	5.7	4.9	5.3
Stability (min)	8.1	9.6	11.9	10.0	8.9	9.0
Absorption (%)	56.8	58.3	59.7	58.4	57.5	58.5
Alveograph: P (mm)	75	79	81	79	75	82
L (mm)	84	93	103	94	110	90
P/L Ratio	0.89	0.85	0.79	0.84	0.68	0.91
W (10^{-4} J)	203	235	273	239	260	238
Extensograph (45/135 min): Resistance (BU)	339/591	327/548	342/587	336/574	366/675	413/752
Extensibility (cm)	14.1/12.9	14.8/13.6	15.5/14.2	14.8/13.6	14.6/12.7	14.7/13.1
Area (cm^2)	84/123	88/125	98/141	90/130	93/133	90/125
BAKING EVALUATION:						
Pan Bread: Bake Absorption (%)	59.8	62.0	64.1	62.1	64.6	64.8
Loaf Volume (cc)	808	875	919	872	936	938
Specific Volume (cc/g)	5.43	5.84	6.09	5.81	—	—
% OF SAMPLES:	14	15	46	75		

[1] Protein Range: Low, <11.5%; Med, 11.5 - 12.5%; High, >12.5%.
[2] The lab mill extraction calculation changed in 2023; values are not comparable to the 5-year average. See analysis methods.

PNW-EXPORTABLE HARVEST SURVEY

The 2024 PNW-exportable U.S. hard red winter (HRW) crop experienced variable conditions. Nebraska and Wyoming had timely rains, mild temperatures and near-record yields. South Dakota had excellent growing conditions, but rainfall delayed harvest, impacting quality. Montana had dry, hot weather resulting in lower yields, while in the PNW, cool temperatures with adequate moisture supported strong yields. These conditions resulted in a lower protein crop compared to recent years. This year's wheat crop offers great grade and kernel characteristics after minimal disease pressure and a cool kernel fill period. Flour and baking data indicate protein offers good processing characteristics, especially for tortillas, flatbreads and pan breads. Overall, this crop meets or exceeds typical HRW contract specifications and should provide high value to customers.

PNW-EXPORTABLE CROP HIGHLIGHTS

The average **GRADE** for the 2024 PNW-exportable crop is U.S. No. 1 HRW.

PNW **TEST WEIGHT** averages are significantly higher than last year indicating a sound crop with dense, heavy kernels.

WHEAT MOISTURE in this year's PNW crop is lower than last year, reflecting overall drier harvest conditions.

WHEAT PROTEIN (12% MB) averages are slightly lower compared to last year, reflecting a less stressed and higher yielding crop.

1000 KERNEL WEIGHT PNW average is higher than last year and the 5-year average.

KERNELS are slightly softer, heavier and larger than last year and 5-year average.

WHEAT FALLING NUMBER PNW average is lower than last year and 5-year average, but well above industry standards and indicates the crop is sound.

Tandem **LABORATORY MILL** average extraction is lower than last year, likely due to humidity levels and moisture loss at time of milling PNW samples; commercial mills should see better extractions. In 2023, flour extraction calculations shifted from a total product weight basis to a tempered wheat weight, therefore, they should not be compared to the 5-year average.

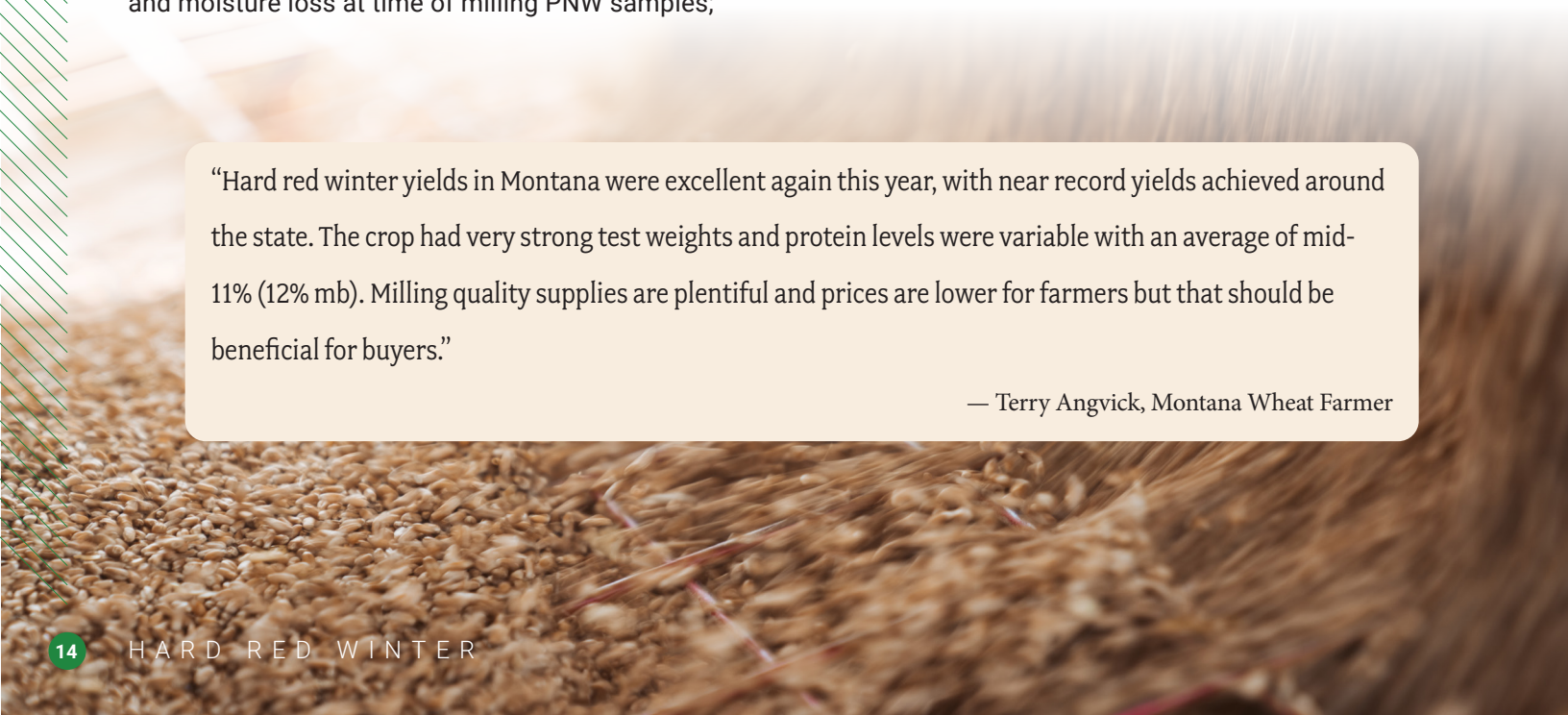
SOLVENT RETENTION CAPACITY values for the PNW crop indicate good flour performance in baking applications.

FARINOGRAPH values indicate a similar peak time, slightly shorter stability and similar absorption compared to last year.

EXTENSOGRAPH values indicate similar/greater extensibility compared to last year, indicating a more balanced gluten profile.

Overall, PNW **DOUGH PROPERTIES** demonstrate typical dough mixing properties and water absorptions with more balanced gluten properties that can be modified with formula or blend adjustments.

Average **LOAF VOLUME** and **BAKE ABSORPTION** values, while lower than previous high protein years, are appropriate for this year's protein content with higher volumes exhibited in higher protein samples.



"Hard red winter yields in Montana were excellent again this year, with near record yields achieved around the state. The crop had very strong test weights and protein levels were variable with an average of mid-11% (12% mb). Milling quality supplies are plentiful and prices are lower for farmers but that should be beneficial for buyers."

— Terry Angvick, Montana Wheat Farmer

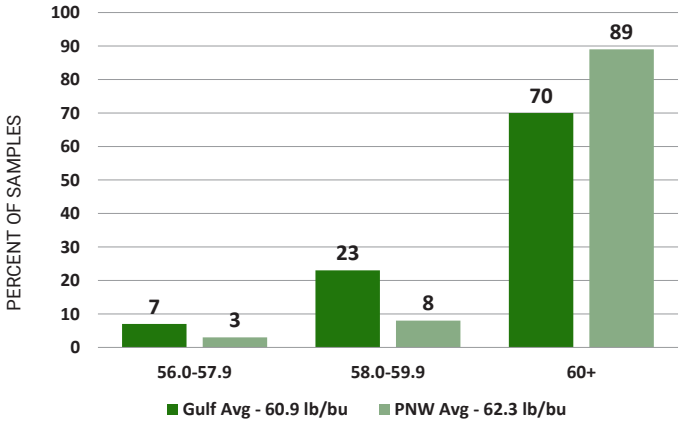
PNW-EXPORTABLE HARVEST DATA

	2024 BY PROTEIN[1]			2024	2023	5-Year
	Low	Med	High	Avg	Avg	Avg
WHEAT GRADE DATA:						
Test Weight (lb/bu)	62.2	62.3	62.5	62.3	60.7	61.0
(kg/hl)	81.8	82.0	82.2	81.9	79.8	80.2
Damaged Kernels (%)	0.0	0.1	0.1	0.0	0.2	0.3
Foreign Material (%)	0.0	0.0	0.0	0.0	0.1	0.1
Shrunken & Broken (%)	0.9	0.9	1.0	0.9	1.2	1.1
Total Defects (%)	0.9	1.0	1.0	1.0	1.5	1.5
Grade	1 HRW	1 HRW	1 HRW	1 HRW	1 HRW	1 HRW
WHEAT NON-GRADE DATA:						
Dockage (%)	0.4	0.5	0.5	0.4	0.6	0.6
Moisture (%)	9.4	9.6	9.6	9.5	10.4	10.2
Protein (%) 12%/0% mb	10.6/12.1	11.9/13.5	13.1/14.9	11.3/12.8	11.8/13.4	12.3/14.0
Ash (%) 14%/0% mb	1.42/1.65	1.44/1.68	1.43/1.66	1.43/1.66	1.49/1.70	1.54/1.77
1000 Kernel Weight (g)	31.8	30.1	29.4	31.1	29.4	30.6
Kernel Size (%) lg/md/sm	68/31/1	67/32/1	60/39/1	67/32/1	69/30/1	64/35/1
Single Kernel: Hardness	60.1	64.5	67.5	62.3	65.8	66.4
Weight (mg)	38.2	35.9	32.0	36.8	33.5	32.6
Diameter (mm)	2.81	2.76	2.63	2.77	2.70	2.65
Sedimentation (cc)	43.4	49.8	55.6	46.7	52.8	55.6
Falling Number (sec)	331	334	346	333	396	383
DON (ppm)	0.1	0.0	0.1	0.1	0.0	0.1
FLOUR DATA:						
Lab Mill Extraction (%)[2]	75.0	74.5	74.1	74.8	75.7	76.9
Color: L*	91.0	90.8	90.7	90.9	90.9	90.6
a*	-1.4	-1.4	-1.3	-1.4	-1.6	-1.6
b*	10.9	10.9	10.7	10.9	10.6	10.4
Protein (%) 14%/0% mb	10.1/11.7	11.0/12.8	12.2/14.2	10.6/12.3	11.0/12.8	11.7/13.5
Ash (%) 14%/0% mb	0.53/0.61	0.53/0.61	0.53/0.62	0.53/0.61	0.50/0.58	0.51/0.60
Wet Gluten (%) 14% mb	26.7	29.1	33.6	28.2	29.3	31.0
Falling Number (sec)	382	378	384	381	405	406
Amylograph Viscosity: 65g (BU)	750	746	696	743	755	788
Damaged Starch (%)	6.9	6.5	6.5	6.8	6.1	6.4
SRC: Water/50% Sucrose (%)	69/116	70/117	70/118	69/117	67/118	66/114
5% Lactic Acid/5% Na_2CO_3 (%)	137/95	144/96	149/97	140/96	140/91	138/88
Gluten Performance Index (GPI)	0.65	0.67	0.69	0.66	0.67	0.68
DOUGH PROPERTIES:						
Farinograph: Peak Time (min)	4.4	5.1	5.8	4.8	4.7	5.2
Stability (min)	6.6	8.3	9.6	7.5	8.3	8.6
Absorption (%)	58.5	59.0	61.2	59.0	59.1	59.5
Alveograph: P (mm)	90	89	91	90	96	94
L (mm)	70	77	87	74	95	79
P/L Ratio	1.29	1.15	1.04	1.22	1.01	1.19
W (10^{-4} J)	203	227	257	216	296	256
Extensograph (45/135 min): Resistance (BU)	330/542	337/536	314/510	331/537	361/710	409/769
Extensibility (cm)	14.5/13.3	14.7/13.4	15.6/14.4	14.7/13.4	14.0/11.9	14.5/12.6
Area (cm^2)	81/113	88/116	87/123	84/115	86/122	96/132
BAKING EVALUATION:						
Pan Bread: Bake Absorption (%)	60.3	61.8	63.9	61.2	64.7	65.1
Loaf Volume (cc)	776	829	884	804	868	904
Specific Volume (cc/g)	5.21	5.51	5.84	5.37	—	—
% OF SAMPLES:	10	8	7	25		

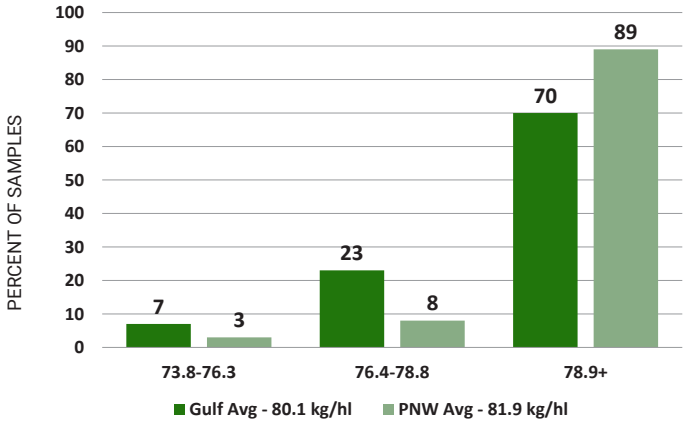
[1] Protein Range: Low, <11.5%; Med, 11.5 - 12.5%; High, >12.5%.
[2] The lab mill extraction calculation changed in 2023; values are not comparable to the 5-year average. See analysis methods.

DISTRIBUTIONS

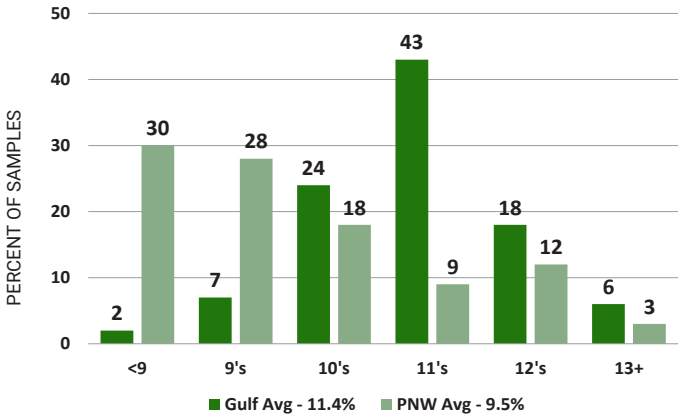
TEST WEIGHT | Pounds/Bushel



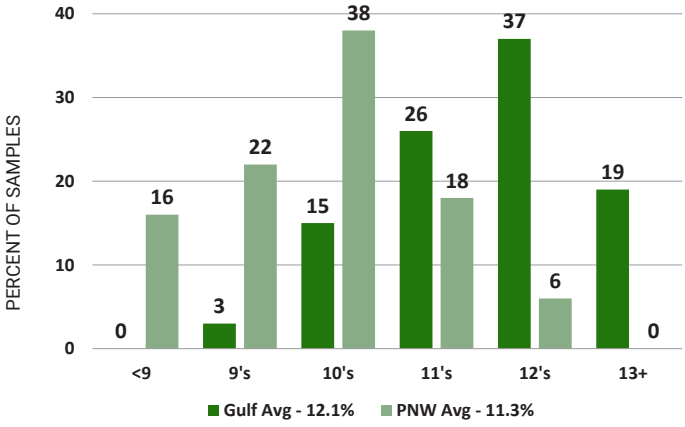
TEST WEIGHT | Kilograms/Hectoliter



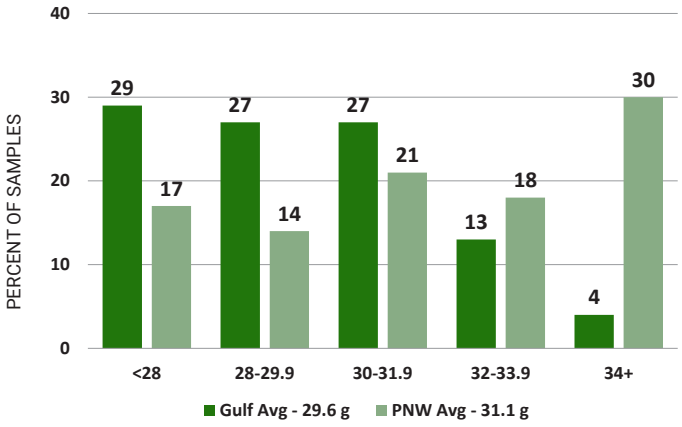
WHEAT MOISTURE | Percent



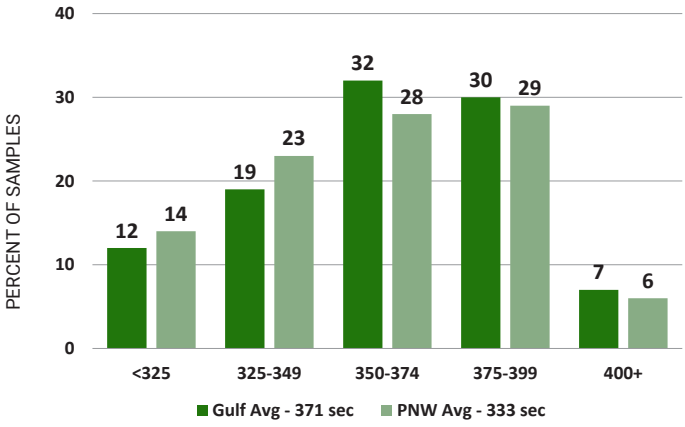
PROTEIN (12% MB) | Percent



THOUSAND KERNEL WEIGHT | Grams



FALLING NUMBER | Seconds



HARD RED SPRING

Grown primarily in the North Central region and shipped via the Pacific, Gulf and Great Lakes ports, hard red spring (HRS) wheat is the second largest class of U.S. wheat. It has high protein of 12.0 to 15.0% (12% mb), hard endosperm, red bran, strong gluten and high water absorption.

For the miller, the reward for incorporating HRS into the grist includes a higher-than-average flour yield from its harder, more compact endosperm. This creates excellent granulation through the break system, providing an abundance of stock to the purifiers producing the maximum amount of low ash, bright color flour.

For the baker, HRS delivers strong dough characteristics used alone or as part of a blend to improve the overall performance of the desired dough. In markets where consumers are demanding a "clean label," HRS flour blended with HRW or other wheat flour can create better water absorption and loaf volume while reducing or eliminating the use of chemical improvers. And many pasta makers around the world know that when traditional durum wheat semolina is not needed, HRS wheat flour or semolina is a very acceptable alternative.

APPLICATIONS

The aristocrat of wheat when it comes to "designer" wheat foods like bagels, artisan hearth breads, pizza crust and other strong dough applications, HRS also has excellent milling and baking characteristics and is a valued improver in flour blends.

Applications include:

- Bagels
- Buns
- Croissants
- Frozen doughs
- Hard rolls
- Ramen noodles
- Pan breads
- Pizza crust
- Specialty/artisan breads
- Yeast breads and rolls
- Wide variety of other baked goods
- Blending improver
- Flours (general-purpose, bread)

SCAN THIS QR CODE for more information.

SURVEY METHODOLOGY

SAMPLE COLLECTION AND ANALYSIS

The HRS Wheat Quality Lab Department of Plant Sciences, North Dakota State University (NDSU) in Fargo, North Dakota, collected samples and conducted quality analyses.

SAMPLE TESTING

Official grade and non-grade factors were determined on 60% of samples. Functionality tests were conducted on 6 composite samples categorized by export region and protein ranges of <13.5%, 13.5 to 14.5% and >14.5%. Production-weighted results are presented as Overall, Gulf/Great Lakes-exportable and Pacific Northwest (PNW)-exportable averages based on composite samples. The methods are described in the Analysis Methods section of this booklet.

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SAMPLES OF HARD RED SPRING

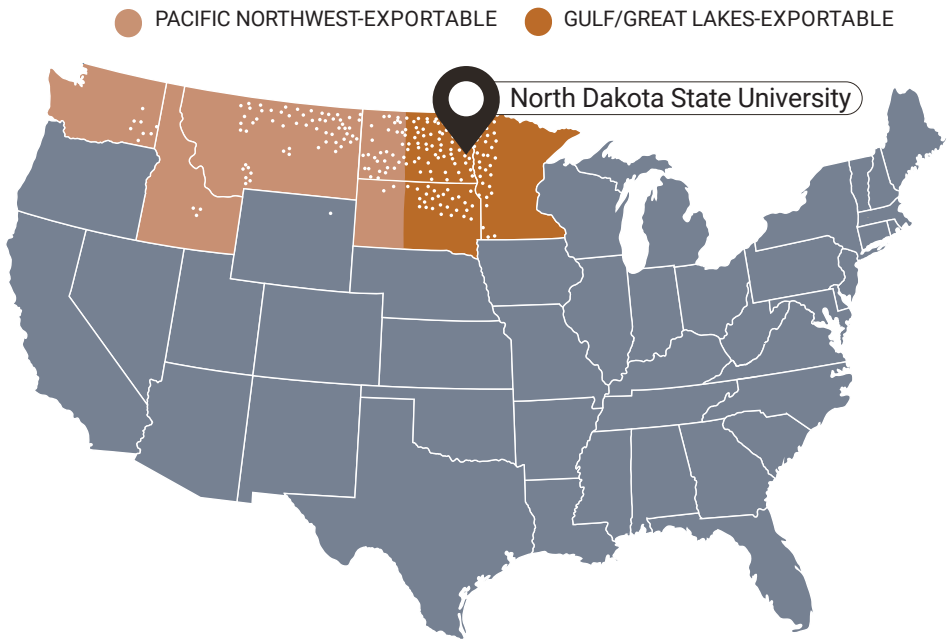
collected from fields, on-farm bins sites or elevators, and separated by export region.

6

STATES SURVEYED

100%

OF TOTAL HRS PRODUCTION REPRESENTED



SUBCLASSES

Under the Official United States Standards for Grain, hard red spring wheat is divided into the three subclasses based on vitreous kernel content:

DARK NORTHERN SPRING (DNS)

- Contains at least 75% or more dark, hard, vitreous kernels.

NORTHERN SPRING (NS)

- Contains between 25-74% dark, hard, vitreous kernels.

RED SPRING (RS)

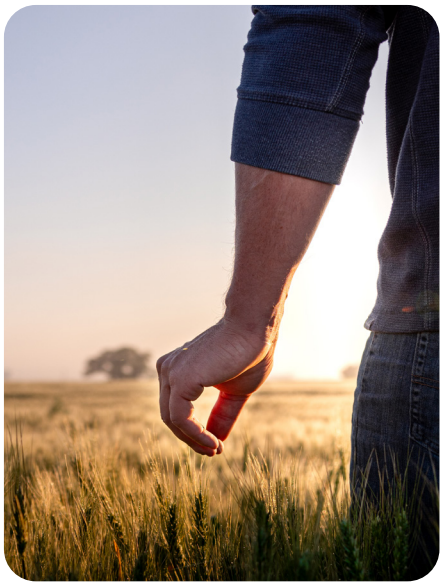
- Contains less than 25% dark, hard, vitreous kernels.

HARD RED SPRING PRODUCTION

FOR THE MAJOR PRODUCING STATES (MMT)

	2024	2023	2022	2021	2020
Idaho	0.4	0.3	0.3	0.3	0.4
Minnesota	2.2	2.1	2.0	1.5	2.0
Montana	1.7	2.1	1.7	1.0	3.4
North Dakota	8.4	7.2	7.2	4.8	7.5
South Dakota	0.8	0.8	0.9	0.5	1.0
Washington	0.1	0.1	0.1	0.1	0.2
Six-State Total	**13.7**	**12.7**	**12.2**	**8.1**	**14.4**
PNW-Exportable	6.6	6.3	5.8	3.6	6.9
Gulf/Great Lakes-Exportable	7.1	6.4	6.3	4.5	7.5
Total HRS Production	**13.7**	**12.7**	**12.2**	**8.1**	**14.4**

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



WEATHER AND HARVEST

PLANTING of the 2024 HRS crop was slightly ahead of average due to milder weather. Moisture conditions at planting were mostly adequate, though some dryness persisted in western areas. Planting finished in early June.

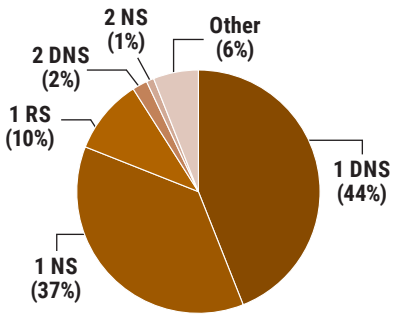
The crop **EMERGED** under mostly good conditions with adequate moisture and cool temperatures. Most of the eastern area had a humid, wet growing season with higher disease pressure and higher yields, while western areas were hot and dry, with minimal disease pressure and reduced yields.

HARVEST started in early August. In eastern areas, the early crop was harvested in mostly dry weather, while rain and cooler temperatures delayed the middle portion. The final part of the harvest occurred under dry conditions. In western areas, conditions were mostly dry throughout harvest. Harvest was finished by mid-September.

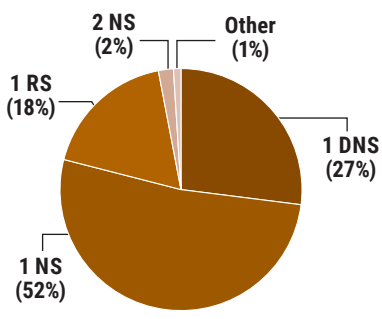
PRODUCTION of the U.S. HRS crop is 8% higher than last year at 13.7 MMT.

GRADE DISTRIBUTION

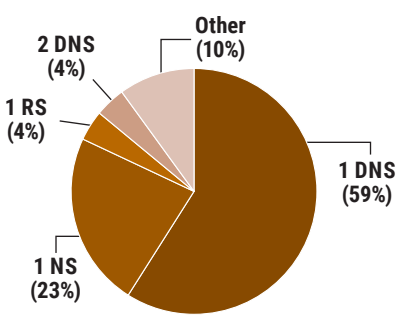
OVERALL



GULF/GREAT LAKES



PACIFIC NORTHWEST



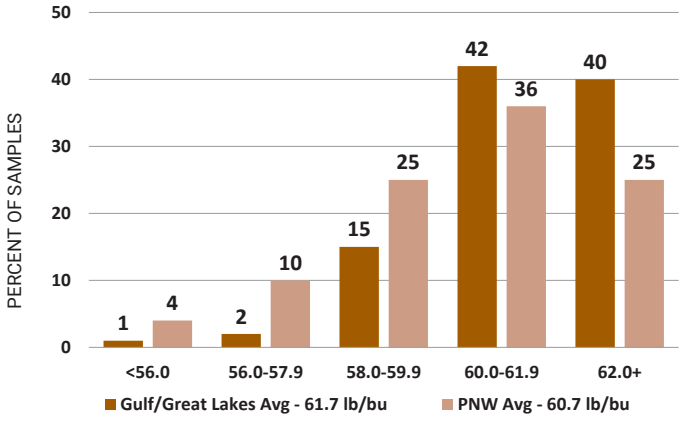
OVERALL HARVEST DATA

	2024 BY PROTEIN[1]			2024	2023	5-Year
	Low	Med	High	Avg	Avg	Avg
WHEAT GRADE DATA:						
Test Weight (lb/bu)	61.8	61.5	60.1	61.1	61.2	61.4
(kg/hl)	81.3	80.9	79.0	80.4	80.5	80.8
Damaged Kernels (%)	0.7	1.2	0.3	0.7	0.3	0.3
Foreign Material (%)	0.0	0.0	0.0	0.0	0.0	0.0
Shrunken & Broken (%)	0.6	0.5	1.3	0.8	0.8	0.9
Total Defects (%)	1.3	1.7	1.6	1.5	1.1	1.2
Vitreous kernels (%)	57	60	83	67	52	66
Grade	1 NS	1 NS	1 DNS	1 NS	1 NS	1 NS
WHEAT NON-GRADE DATA:						
Dockage (%)	0.6	0.6	0.6	0.6	0.7	0.6
Moisture (%)	12.7	12.3	11.7	12.2	12.2	12.0
Protein (%) 12%/0% mb	12.7/14.4	14.0/16.0	15.4/17.5	14.1/16.0	14.2/16.2	14.5/16.5
Ash (%) 14%/0% mb	1.52/1.76	1.53/1.78	1.58/1.84	1.54/1.80	1.48/1.73	1.54/1.79
1000 Kernel Weight (g)	34.0	32.9	29.0	32.0	34.3	31.3
Kernel Size (%) lg/md/sm	56/42/2	52/46/2	32/61/6	47/50/3	51/47/2	44/52/3
Sedimentation (cc)	63.3	66.0	68.5	66.0	68.0	65.8
Falling Number (sec)	380	411	450	414	379	371
DON (ppm)	0.9	0.8	0.7	0.8	0.0	0.2
FLOUR DATA:						
Lab Mill Extraction (%)	67.7	68.5	67.0	67.8	66.7	67.0
Color: L*	90.3	90.0	90.0	90.1	90.0	90.3
a*	-2.2	-2.1	-2.0	-2.1	-1.2	-1.4
b*	9.7	9.7	9.7	9.7	9.5	9.5
Protein (%) 14%/0% mb	11.4/13.2	12.7/14.7	13.8/16.0	12.6/14.7	12.8/14.9	13.3/15.5
Ash (%) 14%/0% mb	0.46/0.53	0.47/0.55	0.48/0.55	0.47/0.55	0.48/0.55	0.50/0.58
Wet Gluten (%) 14% mb	29.6	33.4	37.2	33.5	32.8	34.4
Falling Number (sec)	382	395	403	394	386	386
Amylograph Viscosity: 65g (BU)	547	582	699	609	603	622
RVA: Pasting Temp. (°C)/Peak Visc. (cP)	88.1/2211	88.0/2251	87.3/2323	87.8/2262	91.2/1997	78.3/2165
Hot Paste Visc. (cP)/Final Visc. (cP)	1437/2294	1545/2430	1575/2525	1521/2418	1533/2369	1678/2519
Damaged Starch (%)	7.1	6.6	6.2	6.6	6.4	6.7
SRC: Water/50% Sucrose (%)	67/111	68/112	69/116	68/113	71/118	72/120
5% Lactic Acid/5% Na_2CO_3 (%)	151/94	152/93	160/93	154/93	153/99	149/102
Gluten Performance Index (GPI)	0.73	0.74	0.77	0.75	0.70	0.67
DOUGH PROPERTIES:						
Farinograph: Peak Time (min)	4.8	7.5	9.2	7.2	7.9	8.2
Stability (min)	11.5	12.6	14.9	13.0	14.1	13.5
Absorption (%)	60.9	61.9	62.6	61.8	62.5	62.5
Alveograph: P (mm)	96	91	88	92	91	87
L (mm)	97	131	143	124	126	133
P/L Ratio	0.99	0.69	0.62	0.74	0.72	0.65
W (10^{-4} J)	342	411	441	399	397	387
Extensograph (45/135 min): Resistance (BU)	456/794	504/812	543/986	502/863	606/1084	552/953
Extensibility (cm)	17.7/15.9	17.5/15.9	17.8/13.7	17.6/15.2	16.6/13.7	16.4/13.7
Area (cm^2)	99/146	107/156	117/159	108/154	131/176	117/162
BAKING EVALUATION:						
Pan Bread: Bake Absorption (%)	64.8	66.1	68.1	66.3	64.6	67.5
Loaf Volume (cc)	931	974	1006	971	983	974
Specific Volume (cc/g)	7.56	7.91	8.23	7.90	—	—
SPAGHETTI EVALUATION:						
Color: L*	59.7	58.8	58.4	59.0	56.3	58.2
a*	3.6	3.8	4.1	3.8	5.3	4.9
b*	28.4	28.3	29.0	28.5	26.8	27.6
Cooked Weight (g)	30.0	29.7	28.3	29.4	32.0	31.5
Cooking Loss (%)	5.4	5.0	5.0	5.1	7.0	6.8
Cooked Firmness (g cm)	5.5	5.7	6.4	5.9	3.5	3.5
% OF SAMPLES:	**31**	**37**	**32**	**100**		

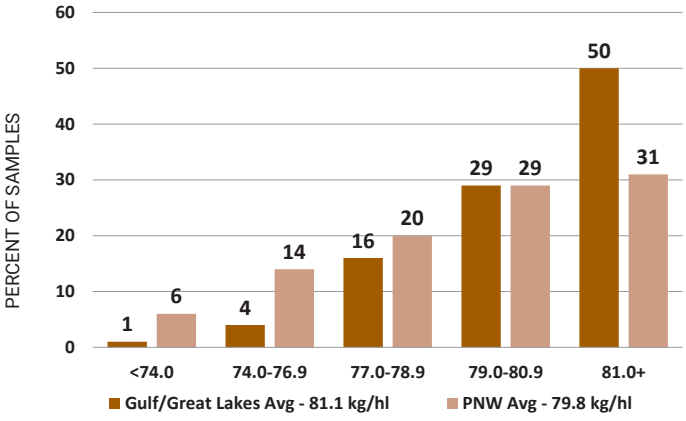
[1]Protein Range: Low, <13.5%; Med, 13.5 - 14.5%; High, >14.5%.

DISTRIBUTIONS

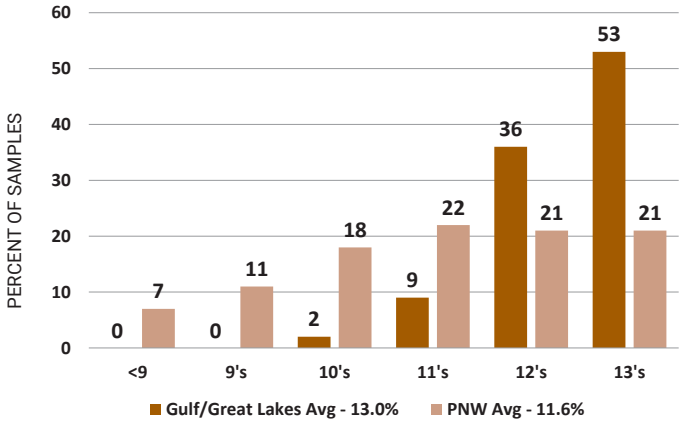
TEST WEIGHT | Pounds/Bushel



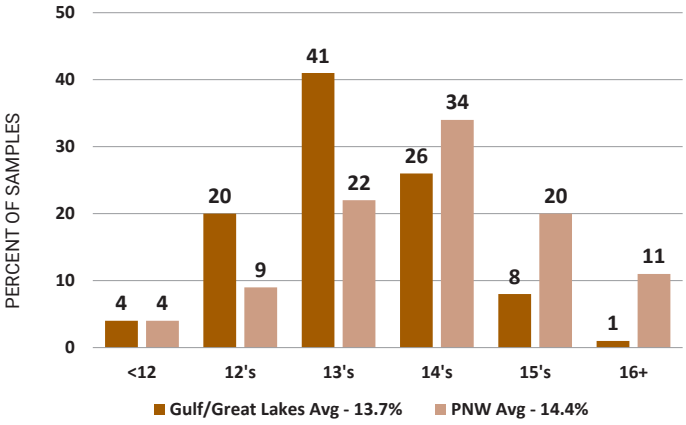
TEST WEIGHT | Kilograms/Hectoliter



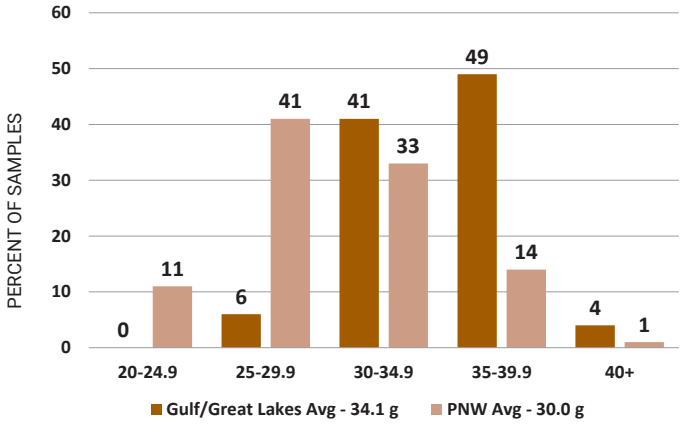
WHEAT MOISTURE | Percent



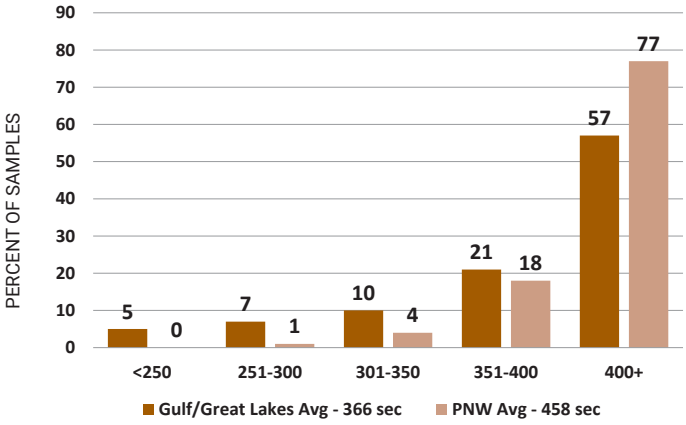
PROTEIN (12% MB) | Percent



THOUSAND KERNEL WEIGHT | Grams



FALLING NUMBER | Seconds



GULF/GREAT LAKES-EXPORTABLE HARVEST SURVEY

The 2024 U.S. hard red spring (HRS) wheat crop grown in the eastern (Gulf/Great Lakes-exportable) region offers a high grade profile and many positive attributes. With some record yields, protein is lower than average. DON and lower falling numbers affected some areas but are not significant in the overall crop averages. Dough properties and absorption are lower overall with better performance in higher protein segments. Overall, this crop offers good performance attributes. Buyers can buy with confidence, but diligent contract specifications are still the best way to get the quality demanded.

GULF/GREAT LAKES-EXPORTABLE CROP HIGHLIGHTS

The average **GRADE** of the 2024 Gulf/Great Lakes-exportable crop is U.S. No. 1 Northern Spring (NS), with 97% of samples grading U.S. No. 1.

TEST WEIGHT averages are similar to last year and the 5-year average.

DAMAGED KERNELS are higher than last year and the 5-year average due to elevated disease pressure in central and eastern areas.

VITREOUS KERNEL (DHV) levels are improved over 2023, although still lower than typical due to harvest time rains and lower crop protein.

WHEAT PROTEIN averages trended lower in eastern areas due to higher yields and seasonal moisture.

DON levels are higher this year, reflecting higher Fusarium head blight pressure.

1000 KERNEL WEIGHT (TKW) is lower than last year but higher than the 5-year average.

WHEAT FALLING NUMBER values are lower than last year but similar to the 5-year average with nearly 80% of the crop over 350 seconds. There is variability due to untimely rains in eastern areas.

Buhler **LABORATORY MILL** extraction is higher than last year and the 5-year average. Lab mill settings are not adjusted to account for kernel parameter shifts between crop years. The extraction is calculated on a tempered wheat basis.

FLOUR ASH is similar to last year and lower than the 5-year average.

AMYLOGRAPH average is notably lower than last year and the 5-year average, reflecting untimely rains during harvest in some parts of the eastern region.

DOUGH PROPERTIES suggest a crop with weaker dough characteristics compared to last year and the 5-year average.

FARINOGRAPH absorption is lower than in recent years, likely because of lower average protein levels. Eastern areas show weaker dough characteristics.

ALVEOGRAPH values indicate weaker dough with lower P/L ratio and lower W-value.

EXTENSOGRAPH data indicate weaker dough properties with greater extensibility, relative to last year and the 5-year average.

Baking evaluations show similar **LOAF VOLUMES** compared to last year and the 5-year average. Dough handling properties scored slightly higher than in recent years, with good bread scores.

"After an excellent growing season in northwest Minnesota, harvest began in mid-August with high yields, sound test weight and good protein. However, two thirds of the way through harvest we received a significant amount of rain that adversely impacted certain quality factors. Portions of the crop have quality issues; however, our grain marketing system can segregate accordingly so that customers receive the quality standards they desire."

— Mark Jossund, Minnesota wheat farmer

GULF/GREAT LAKES-EXPORTABLE HARVEST DATA

	2024 BY PROTEIN[1]			2024	2023	5-Year
	Low	Med	High	Avg	Avg	Avg
WHEAT GRADE DATA:						
Test Weight (lb/bu)	61.8	61.6	61.5	61.7	61.7	61.6
(kg/hl)	81.3	81.0	80.9	81.1	81.2	81.1
Damaged Kernels (%)	0.5	1.9	1.0	1.2	0.1	0.4
Foreign Material (%)	0.0	0.0	0.0	0.0	0.0	0.0
Shrunken & Broken (%)	0.4	0.3	0.5	0.4	0.5	0.6
Total Defects (%)	0.9	2.2	1.5	1.6	0.6	1.0
Vitreous kernels (%)	52	56	57	55	44	57
Grade	1 NS	1 NS	1 NS	1 NS	1 NS	1 NS
WHEAT NON-GRADE DATA:						
Dockage (%)	0.4	0.5	0.4	0.5	0.5	0.5
Moisture (%)	13.1	12.9	12.8	13.0	12.8	12.7
Protein (%) 12%/0% mb	12.7/14.4	14.0/15.9	15.2/17.3	13.7/15.5	14.3/16.3	14.4/16.4
Ash (%) 14%/0% mb	1.49/1.73	1.56/1.81	1.65/1.92	1.55/1.80	1.51/1.76	1.56/1.81
1000 Kernel Weight (g)	34.2	34.4	33.3	34.1	36.6	32.7
Kernel Size (%) lg/md/sm	61/38/1	63/36/1	60/38/2	62/37/1	63/36/1	54/44/2
Sedimentation (cc)	61.0	66.0	67.0	64.1	68.0	65.6
Falling Number (sec)	355	382	351	366	386	365
DON (ppm)	1.4	1.0	1.3	1.2	0.0	0.3
FLOUR DATA:						
Lab Mill Extraction (%)	67.9	68.5	67.3	68.0	66.8	67.5
Color: L*	90.2	90.0	90.4	90.2	90.1	90.2
a*	-2.1	-2.0	-1.9	-2.0	-1.1	-1.3
b*	9.6	9.6	9.2	9.5	9.2	9.2
Protein (%) 14%/0% mb	11.3/13.1	12.7/14.8	13.7/15.9	12.3/14.3	12.8/14.9	13.2/15.4
Ash (%) 14%/0% mb	0.46/0.53	0.47/0.55	0.49/0.57	0.47/0.55	0.47/0.55	0.50/0.58
Wet Gluten (%) 14% mb	29.8	33.4	37.1	32.6	33.2	34.0
Falling Number (sec)	375	382	350	374	378	374
Amylograph Viscosity: 65g (BU)	459	523	429	481	566	566
RVA: Pasting Temp. (°C)/Peak Visc. (cP)	88.1/2069	87.2/2109	87.2/1889	87.6/2054	90.9/1942	77.9/2166
Hot Paste Visc. (cP)/Final Visc. (cP)	1309/2132	1333/2226	1191/1992	1299/2147	1486/2320	1641/2493
Damaged Starch (%)	7.2	6.6	6.4	6.8	6.4	6.4
SRC: Water/50% Sucrose (%)	67/109	67/110	68/112	67/110	70/115	71/117
5% Lactic Acid/5% Na_2CO_3 (%)	148/92	153/91	156/89	151/91	151/96	147/99
Gluten Performance Index (GPI)	0.74	0.76	0.78	0.75	0.72	0.68
DOUGH PROPERTIES:						
Farinograph: Peak Time (min)	4.9	7.2	7.4	6.3	8.2	7.7
Stability (min)	10.5	11.4	12.1	11.2	16.1	13.8
Absorption (%)	60.8	61.4	62.2	61.3	62.1	62.0
Alveograph: P (mm)	94	88	85	90	94	86
L (mm)	94	135	137	119	121	133
P/L Ratio	1.00	0.65	0.62	0.76	0.78	0.65
W (10^{-4} J)	325	408	401	373	411	388
Extensograph (45/135 min): Resistance (BU)	409/721	504/779	521/839	468/766	665/1171	566/927
Extensibility (cm)	17.7/15.8	18.0/15.3	17.9/14.0	17.9/15.3	17.0/14.0	16.8/14.2
Area (cm^2)	87/132	111/143	113/139	102/138	145/194	122/164
BAKING EVALUATION:						
Pan Bread: Bake Absorption (%)	64.3	64.8	67.6	65.1	63.8	66.8
Loaf Volume (cc)	950	985	1025	978	971	979
Specific Volume (cc/g)	7.66	7.92	8.19	7.86	—	—
SPAGHETTI EVALUATION:						
Color: L*	59.5	58.6	57.6	58.8	56.0	58.0
a*	3.7	4.0	4.1	3.9	5.4	5.0
b*	27.6	27.3	27.0	27.4	26.0	26.9
Cooked Weight (g)	29.9	30.1	27.3	29.5	31.6	31.3
Cooking Loss (%)	5.3	5.1	4.7	5.1	7.0	6.8
Cooked Firmness (g cm)	5.5	5.8	6.6	5.8	3.7	3.7
% OF SAMPLES:	**19**	**21**	**8**	**48**		

[1]Protein Range: Low, <13.5%; Med, 13.5 - 14.5%; High, >14.5%.

PACIFIC NORTHWEST-EXPORTABLE HARVEST SURVEY

The 2024 U.S. hard red spring (HRS) wheat crop grown in the western (PNW-exportable) region offers high grades, sound kernels and a high protein content average. Functional performance shows strong dough properties with slightly lower absorption. Baking properties are good with near average bake absorption, but slightly lower loaf volumes. Due to late-season hot, dry conditions, this crop includes a wider range of yields, protein levels and kernel size. Overall, this is a highly functional crop. Buyers can buy with confidence, but diligent contract specifications are still the best way to get the quality demanded.

PNW-EXPORTABLE CROP HIGHLIGHTS

The average **GRADE** of the 2024 PNW-exportable crop is U.S. No. 1 Dark Northern Spring (DNS), with 86% of samples grading U.S. No. 1.

TEST WEIGHT averages are similar to last year but slightly lower than the 5-year average.

DAMAGED KERNELS are near zero, although **SHRUNKEN AND BROKEN** levels are slightly higher than 2023.

VITREOUS KERNEL (DHV) levels are improved over last year and the 5-year average.

WHEAT PROTEIN averages are higher than last year and reflect expanding dryness during the growing season.

DON levels are slightly higher this year, with isolated pockets of Fusarium head blight pressure raising the average.

1000 KERNEL WEIGHT (TKW) is lower than last year due to late-season heat stress, but matches the 5-year average.

WHEAT FALLING NUMBER values are notably higher than a year ago, with 95% of the crop higher than 350 seconds.

Buhler **LABORATORY MILL** extraction is higher than last year and the 5-year average. Lab mill settings are not adjusted to account for kernel parameter shifts between crop years. The extraction is calculated on a tempered wheat basis.

FLOUR ASH is similar to last year and slightly below the 5-year average.

AMYLOGRAPH average is notably higher than last year and the 5-year average, reflecting drier growing conditions and sound kernels.

DOUGH PROPERTIES suggest a crop with stronger dough characteristics compared to last year and the 5-year average.

FARINOGRAPH absorption is slightly lower than in recent years. Western area production shows strong dough characteristics.

ALVEOGRAPH values indicate stronger dough with a higher P/L ratio and higher W-value.

EXTENSOGRAPH data indicate similar strength but greater extensibility, relative of last year and the 5-year average.

Baking evaluations show slightly lower **LOAF VOLUMES** compared to last year and the 5-year average. Dough handling properties scored slightly higher than in recent years, with good bread scores.

"We had adequate spring moisture to get the crop off to a good start. That, combined with cooler early summer temperatures supported growth and yield potential. Hot, dry weather mid growing season did impact yields and test weights in some far western areas. Overall, the crop quality is excellent with few issues in our area, though protein levels are more variable this year. Our quality should meet customer needs and production will be higher than average."

— Mark Birdsall, North Dakota wheat farmer

PACIFIC NORTHWEST-EXPORTABLE HARVEST DATA

	2024 BY PROTEIN[1]			2024	2023	5-Year
	Low	Med	High	Avg	Avg	Avg
WHEAT GRADE DATA:						
Test Weight (lb/bu)	61.8	61.4	59.6	60.7	60.7	61.2
(kg/hl)	81.3	80.7	78.4	79.8	79.8	80.5
Damaged Kernels (%)	1.0	0.3	0.0	0.3	0.5	0.3
Foreign Material (%)	0.0	0.0	0.0	0.0	0.0	0.0
Shrunken & Broken (%)	0.9	0.8	1.6	1.2	1.1	1.2
Total Defects (%)	1.9	1.1	1.6	1.5	1.6	1.5
Vitreous kernels (%)	64	66	92	78	61	75
Grade	1 NS	1 NS	1 DNS	1 DNS	1 NS	1 DNS
WHEAT NON-GRADE DATA:						
Dockage (%)	0.8	0.8	0.7	0.7	0.8	0.7
Moisture (%)	12.0	11.6	11.3	11.6	11.7	11.3
Protein (%) 12%/0% mb	12.7/14.4	14.1/16.0	15.5/17.6	14.4/16.4	14.1/16.0	14.6/16.6
Ash (%) 14%/0% mb	1.56/1.81	1.50/1.74	1.56/1.81	1.54/1.79	1.46/1.69	1.52/1.77
1000 Kernel Weight (g)	33.7	31.0	27.5	30.0	32.1	30.0
Kernel Size (%) lg/md/sm	48/49/3	39/58/3	23/69/8	34/61/5	39/57/4	36/60/4
Sedimentation (cc)	67.0	66.0	69.0	67.6	68.1	66.1
Falling Number (sec)	418	448	484	458	373	377
DON (ppm)	0.1	0.6	0.4	0.4	0.0	0.1
FLOUR DATA:						
Lab Mill Extraction (%)	67.5	68.6	66.9	67.6	66.7	66.5
Color: L*	90.5	90.1	89.8	90.1	90.0	90.3
a*	-2.2	-2.1	-2.0	-2.1	-1.2	-1.4
b*	9.9	9.8	9.9	9.8	9.8	9.7
Protein (%) 14%/0% mb	11.5/13.4	12.6/14.7	13.8/16.0	12.9/15.0	12.8/14.9	13.5/15.6
Ash (%) 14%/0% mb	0.46/0.53	0.48/0.56	0.47/0.55	0.47/0.55	0.48/0.56	0.50/0.58
Wet Gluten (%) 14% mb	29.3	33.5	37.2	34.2	32.4	34.8
Falling Number (sec)	394	411	421	412	394	398
Amylograph Viscosity: 65g (BU)	685	655	790	725	639	678
RVA: Pasting Temp. (°C)/Peak Visc. (cP)	88.1/2433	88.9/2427	87.4/2469	88.0/2448	91.5/2050	78.8/2161
Hot Paste Visc. (cP)/Final Visc. (cP)	1639/2549	1809/2683	1705/2705	1721/2662	1578/2415	1712/2543
Damaged Starch (%)	6.9	6.6	6.1	6.4	6.4	6.5
SRC: Water/50% Sucrose (%)	68/113	69/115	69/118	69/116	71/121	73/122
5% Lactic Acid/5% Na_2CO_3 (%)	155/97	151/95	161/95	157/95	154/101	150/104
Gluten Performance Index (GPI)	0.74	0.72	0.76	0.74	0.69	0.66
DOUGH PROPERTIES:						
Farinograph: Peak Time (min)	4.7	7.8	9.8	8.0	7.6	8.6
Stability (min)	13.1	14.2	15.9	14.7	12.2	13.1
Absorption (%)	61.1	62.6	62.7	62.3	62.8	63.1
Alveograph: P (mm)	100	95	89	93	88	89
L (mm)	101	126	145	129	131	132
P/L Ratio	0.99	0.75	0.61	0.72	0.67	0.67
W (10^{-4} J)	369	415	454	422	384	387
Extensograph (45/135 min): Resistance (BU)	530/908	504/852	551/1036	532/950	550/1001	537/977
Extensibility (cm)	17.7/16.1	16.9/16.7	17.7/13.6	17.5/15.1	16.2/13.4	15.9/13.1
Area (cm^2)	119/167	103/173	119/166	114/168	118/159	111/160
BAKING EVALUATION:						
Pan Bread: Bake Absorption (%)	65.5	67.6	68.2	67.4	65.4	68.2
Loaf Volume (cc)	900	960	1000	965	993	970
Specific Volume (cc/g)	7.39	7.89	8.24	7.93	—	—
SPAGHETTI EVALUATION:						
Color: L*	60.0	59.1	58.6	59.1	56.6	58.5
a*	3.4	3.5	4.0	3.7	5.2	4.8
b*	29.7	29.4	29.6	29.6	27.6	28.4
Cooked Weight (g)	30.0	29.3	28.7	29.2	32.4	31.4
Cooking Loss (%)	5.7	4.9	5.1	5.2	6.9	6.7
Cooked Firmness (g cm)	5.5	5.6	6.3	5.9	3.3	3.6
% OF SAMPLES:	**12**	**16**	**24**	**52**		

[1]Protein Range: Low, <13.5%; Med, 13.5 - 14.5%; High, >14.5%.

SOFT WHITE

Grown primarily in the Pacific Northwest (PNW) and shipped via Pacific ports, approximately 80% of soft white (SW) wheat is exported from the United States. It typically has a low protein of 8.5 to 10.5% (12% mb), low moisture and weak gluten. SW includes winter and spring varieties that provide a wide range of protein and functionality within the class.

For the miller, SW delivers excellent results. Arriving at the mill with an average moisture of less than 10%, an average test weight of more than 79 hectoliter mass and a low quantity of screenings, SW wheat provides the millers every opportunity for high flour extraction. The lower wheat moisture provides numerous financial and processing opportunities to the miller.

For the baker, the finer particle size may increase the rate of water absorption, decrease mix time and improve production efficiencies. With the fine particle size and starch characteristics, SW flour creates a unique and tender texture for many end-products.

APPLICATIONS

From specialty products such as sponge cakes to blending with HRS for improving bread color, U.S. SW wheat flour has the versatility to improve the quality of a wide variety of products.

Applications include:

- Biscuits
- Sugar snap cookies
- Cakes
- Muffins
- Pastries
- Wafers/Ice cream cones
- Other confectionary products
- Cereals and cereal bars
- Crackers
- Snack foods
- Fried Spring Rolls
- Steamed bread, Chinese southern-type
- Tempura batter
- Quick breads
- Flat Breads
- Flours (cake, pastry, self-rising)

SCAN THIS QR CODE for more information.

SURVEY METHODOLOGY

SAMPLE COLLECTION AND ANALYSIS

The Wheat Marketing Center (WMC) in Portland, Oregon conducted wheat and flour quality testing and analyses. Federal Grain Inspection Service (FGIS) graded and tested wheat protein content.

SAMPLE TESTING

Official grade, protein, moisture, 1000 kernel weight and falling number tests were determined on each sample. The remaining tests were conducted on 3 composite samples categorized by protein ranges of <9.0%, 9.0 to 10.5%, >10.5% and one composite of all White Club (Club) samples. The methods are described in the Analysis Methods section of this booklet.

429
SAMPLES OF SOFT WHITE

27
SAMPLES OF WHITE CLUB

collected from state, private grain inspection agencies and commercial wheat handling operations.

3
STATES SURVEYED

95%
OF TOTAL SW PRODUCTION REPRESENTED

SOFT WHITE PRODUCTION

FOR THE MAJOR PRODUCING STATES (MMT)

	2024		2023		2022		2021		2020	
	SW	CLUB	SW	CLUB	SW	CLUB	SW	CLUB	SW	CLUB
Washington	3.4	0.1	2.6	0.1	3.3	0.3	1.9	0.1	3.8	0.2
Oregon	1.3	0.0	1.0	0.0	1.3	0.0	0.8	0.0	1.2	0.0
Idaho	1.7	0.0	1.5	0.0	1.7	0.0	1.4	0.0	2.0	0.0
Three-State Total	**6.4**	**0.1**	**5.1**	**0.2**	**6.3**	**0.3**	**4.1**	**0.2**	**6.9**	**0.3**
Three-State SW Total	**6.5**		**5.3**		**6.6**		**4.3**		**7.2**	
Total SW Production	**6.7**		**5.8**		**6.9**		**4.8**		**7.6**	

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

HARVEST SURVEY

The 2024 soft white (SW) Pacific Northwest (PNW) crop experienced adequate moisture and moderate temperatures, resulting in typical protein distribution. This year's SW crop has appropriately weak to medium gluten strength and finished product characteristics are acceptable to good. SW is an essential ingredient for cakes, pastries, cookies and snack foods. This year's high protein segment provides opportunities in blends for crackers, Asian noodles, steamed breads, flat breads and pan breads. Club, with very weak gluten strength, is typically used in a Western White blend with SW for cakes and delicate pastries.

WEATHER AND HARVEST

WINTER PLANTING conditions significantly improved from the prior year, with ample moisture helping crops establish well. Winter moisture and mild temperatures further supported crop growth after dormancy.

SPRING PLANTING started with good soil moisture and was aided by rain and cool weather.

As the crop **DEVELOPED**, prolonged hot, dry weather stressed spring-planted fields impacting yields, while mature winter-planted fields were less affected. Overall, the harvest was generally ahead of average with average to above average yields.

PRODUCTION of the 2024 PNW SW crop is estimated at 6.7 MMT, a 17% increase from last year.

CROP HIGHLIGHTS

The average **GRADE** of the 2024 crop is U.S. No. 1, with Club also grading U.S. No. 1.

TEST WEIGHT averages for SW trended higher this year with all protein composites above 60 lb/bu (78.9 kg/hl). Club test weight was comparable to last year.

WHEAT PROTEIN (12% mb) is in a normal range this year for SW and Club; lower averages than last year are due to more moisture and cooler temperatures during kernel development.

WHEAT FALLING NUMBER average is greater than 300 sec and comparable to 2023 and the 5-year average for SW and Club.

Buhler **LABORATORY MILL** straight grade extractions, **L*** values (whiteness), and **FLOUR ASH** are similar to last year for SW. Club straight grade flour extraction and flour ash are down slightly this year with an L* value similar to last year. Damaged starch trended higher than last year for both SW and Club, likely due to slightly harder kernels. Flour extractions should not be compared to the 5-year average as the calculation has shifted from a total product weight basis to a tempered wheat weight basis. Commercial mills should see better extractions.

WET GLUTEN contents for SW flour are lower this year compared to 2023 and the 5-year average. This likely reflects higher yields and mild temperatures as the crop developed.

SOLVENT RETENTION CAPACITY (SRC) lactic acid values for SW are in a normal range for weak to medium gluten strength. Water SRC values are up slightly compared to last year but are comparable to the 5-year average for SW. Overall, SW composites have SRC profiles suitable for good cookie and cracker performance. Lactic acid and water SRC values for Club are consistent with very weak gluten with low water holding capacity.

STARCH PASTING PROPERTIES as shown by Amylograph and RVA viscosities for SW and Club indicate the crop is suitable for batter-based products. The overall SW and Club averages are similar to last year's and the 5-year average.

SW and Club show typical **DOUGH PROPERTIES** ranging from very weak to medium gluten strength and low water absorption values similar to their respective 2023 and 5-year averages.

SPONGE CAKE volumes for SW are similar to 2023 and the 5-year average with softer textures than last year (lower hardness). Club sponge cake volume is slightly smaller than last year and the 5-year average with softer texture. All cakes were baked from an experimentally milled straight grade flour. For comparison, control cakes baked at the same time from a commercially milled short patent cake flour have an average volume of 1132 cc and an average firmness of 273 g.

Average SW and Club **COOKIE** diameters and spread ratios are significantly larger than last year. These values should not be compared to the 5-year averages as the cookie method has changed as of 2023.

Average SW **PAN BREAD** bake absorptions are in a normal range with specific loaf volumes and scores that trend with protein content and bake absorption. Blends of hard wheat with up to 20% SW should produce acceptable pan breads, especially at the higher end of the SW protein spectrum.

CHINESE SOUTHERN-TYPE STEAMED BREAD specific volumes for SW and Club are similar to last year and larger than the 5-year average. Product appearance, especially external, was better than last year for both SW and Club.

HARVEST DATA

	2024					2023		5-Year	
	SW BY PROTEIN[1]			SW	Club	SW	Club	SW	Club
	Low	Med	High	Avg	Avg	Avg	Avg	Avg	Avg
WHEAT GRADE DATA:									
Test Weight (lb/bu)	60.8	61.1	60.3	60.9	60.5	60.3	60.7	60.8	60.6
(kg/hl)	80.0	80.4	79.3	80.0	79.6	79.3	79.8	80.0	79.8
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	0.1	0.1	0.1	0.1	0.0	0.1	0.1
Shrunken & Broken (%)	0.4	0.5	0.7	0.5	1.0	0.6	1.2	0.6	1.0
Total Defects (%)	0.5	0.5	0.8	0.6	1.1	0.7	1.3	0.7	1.1
Grade	1 SW	1 SW	1 SW	1 SW	1 WC	1 SW	1 WC	1 SW	1 WC
WHEAT NON-GRADE DATA:									
Dockage (%)	0.3	0.4	0.4	0.4	1.1	0.4	0.6	0.5	0.6
Moisture (%)	9.1	8.9	9.0	9.0	8.4	9.1	8.6	9.2	8.5
Protein (%) 12%/0% mb	8.1/9.2	9.7/11	11.3/12.8	9.2/10.5	9.5/10.8	11.1/12.6	10.6/12	10.3/11.6	10.4/11.6
Ash (%) 14%/0% mb	1.35/1.57	1.44/1.68	1.43/1.66	1.40/1.63	1.31/1.52	1.38/1.6	1.26/1.47	1.41/1.62	1.31/1.5
1000 Kernel Weight (g)	37.2	35.2	32.1	35.7	31.2	32.5	29.9	33.8	30.2
Kernel Size (%) lg/md/sm	92/8/0	88/12/0	77/22/1	88/12/0	79/20/1	83/16/1	75/24/1	83/16/1	71/28/1
Single Kernel: Hardness	20.5	24.2	24.1	22.6	26.4	20.7	22.1	27.1	28.6
Weight (mg)	38.6	38.2	35.7	38.0	34.7	35.2	32.6	37.0	33.6
Diameter (mm)	2.74	2.71	2.63	2.71	2.60	2.70	2.49	2.71	2.52
Sedimentation (cc)	9.3	11.8	14.7	11.1	7.8	14.1	8.4	17.3	11.3
Falling Number (sec)	335	337	355	339	332	336	327	332	341
FLOUR DATA:									
Lab Mill Extraction (%)[2]	70.8	70.7	68.9	70.5	71.7	70.3	72.1	71.4	72.9
Color: L*	93.3	93.2	93.2	93.2	93.4	93.1	93.2	92.9	92.9
a*	-2.4	-2.3	-2.1	-2.3	-2.2	-2.2	-2.0	-2.1	-2.0
b*	8.5	8.4	8.1	8.4	8.1	8.1	7.8	8.0	7.8
Protein (%) 14%/0% mb	6.6/7.7	8.4/9.8	9.7/11.3	7.8/9.1	7.8/9.1	9.7/11.2	9.5/11	9.2/10.7	9.4/10.9
Ash (%) 14%/0% mb	0.46/0.53	0.45/0.52	0.44/0.51	0.45/0.53	0.45/0.52	0.46/0.54	0.48/0.56	0.44/0.51	0.46/0.53
Wet Gluten (%) 14% mb	12.6	22.7	27.1	18.9	–	28.9	–	23.9	–
Falling Number (sec)	357	377	377	368	379	369	346	361	365
Amylograph Viscosity: 65g (BU)	502	512	614	522	500	569	512	527	517
RVA: Pasting Temp. (°C)/Peak Visc. (cP)	69.5/2267	82.4/2273	82.3/2419	76.7/2291	69.4/2235	81.3/2393	71.0/2281	–	–
Hot Paste Visc. (cP)/Final Visc. (cP)	1582/3027	1614/3033	1759/3166	1620/3049	1608/2970	1675/3146	1611/3041	–	–
Damaged Starch (%)	4.4	4.2	3.5	4.2	4.0	3.6	3.4	3.9	3.5
SRC: Water/50% Sucrose (%)	54/98	55/100	57/103	55/99	53/92	51/97	51/93	53/96	52/92
5% Lactic Acid/5% Na_2CO_3 (%)	91/69	96/72	108/71	96/71	73/68	105/68	71/66	102/75	75/71
Gluten Performance Index (GPI)	0.55	0.56	0.62	0.56	0.46	0.64	0.44	0.58	0.46
DOUGH PROPERTIES:									
Farinograph: Peak Time (min)	–	1.2	1.4	1.3	–	2.5	–	1.9	–
Stability (min)	–	2.0	2.4	2.1	–	3.0	–	2.5	–
Absorption (%)	–	50.9	52.1	51.2	–	51.2	–	51.8	–
Alveograph: P (mm)	40	41	43	41	26	35	23	36	23
L (mm)	76	57	102	72	42	110	79	98	75
P/L Ratio	0.53	0.72	0.42	0.59	0.62	0.34	0.29	0.39	0.36
W (10^{-4} J)	80	70	104	79	29	92	34	85	34
Extensograph (45 min): Resistance (BU)	–	246	286	256	–	284	–	247	–
Extensibility (cm)	–	15.2	16.2	15.5	–	17.7	–	18.0	–
Area (cm^2)	–	57	69	60	–	74	–	67	–
BAKING EVALUATION:									
Sponge Cake: Volume (cc)	1115	1094	1063	1099	1081	1089	1110	1106	1120
Hardness (g)	289	324	277	302	287	353	337	–	–
Cookie: Diameter (cm)	8.5	8.6	8.2	8.5	8.4	7.7	7.9	8.4	8.8
Spread Factor (diameter/height)	9.0	9.5	9.1	9.2	10.0	8.2	8.8	9.4	10.9
Pan Bread: Bake Absorption (%)	54.7	55.8	57.4	55.5	–	56.1	–	–	–
Loaf Volume (cc)	590	668	677	635	–	696	–	–	–
Specific Volume (cc/g)	4.40	4.90	5.10	4.71	–	–	–	–	–
CHINESE SOUTHERN-TYPE STEAMED BREAD EVALUATION:									
Specific Volume (cc/g)	2.5	2.6	2.8	2.6	2.7	2.7	2.7	2.1	2.4
Hardness (g)	1688	1831	1688	1748	1621	–	–	–	–
% OF SAMPLES:	**44**	**42**	**14**	**100**	**100**				

[1] Protein Range: Low, <9.0%; Medium, 9.0 - 10.5%; High, >10.5%.
[2] The lab mill extraction calculation changed in 2023; values are not comparable to the 5-year average. See analysis methods.
[3] The cookie methodology changed in 2023; values are not comparable to the 5-year average. See analysis methods.

SUBCLASSES

Under the Official United States Standards for Grain, soft white wheat is divided into the following three subclasses:

SOFT WHITE (SW)

- Contains not more than 10% of white club wheat.
- SW, *Triticum aestivum* (common wheat), also known as "Common Soft White," has a white bran and soft endosperm. Soft white is often used for typical soft wheat applications and has low to medium-low gluten strength.

WHITE CLUB (WC, CLUB)

- Contains not more than 10% of other soft white wheats.
- *Triticum compactum* (white club wheat) has a white bran and very soft endosperm and is known as the softest class of U.S. wheat. Club wheat has very weak gluten and its use results in excellent cake quality (high ratio sponge cake). It is normally exported as a component of Western White but can also be purchased separately.

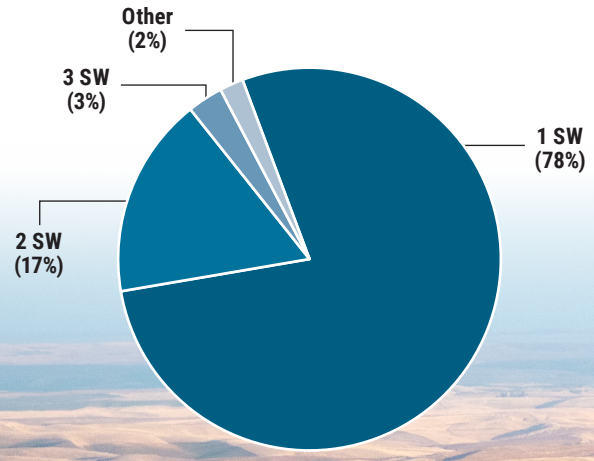
WESTERN WHITE (WW)

- Contains more than 10% of white club wheat and more than 10% of other soft white wheats.
- Some customers specify varying levels of the soft white wheat and white club wheat blend to take advantage of club wheat's weaker gluten characteristics for sponge cake and other confections. Western White is prized for its cake baking quality.

"It's hard to top the consistent quality of PNW soft white wheat. Despite challenging weather conditions in the spring and early summer, this year's soft white wheat crop meets the specifications our customers have come to expect, with average protein levels and test weights. Solid yields and consistent quality are a testament to the investments growers have made into variety development, research, and sustainable production practices."

— Clark Hamilton and Cory Kress, Idaho wheat farmers

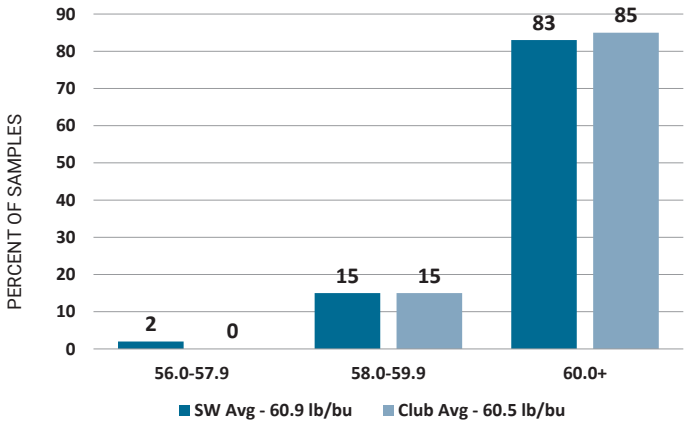
DISTRIBUTION BY GRADE



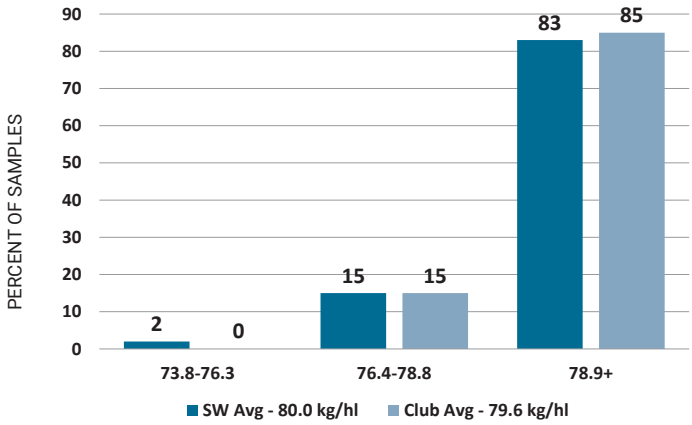
Lori J. Maricle, Washington Grain Commission

DISTRIBUTIONS

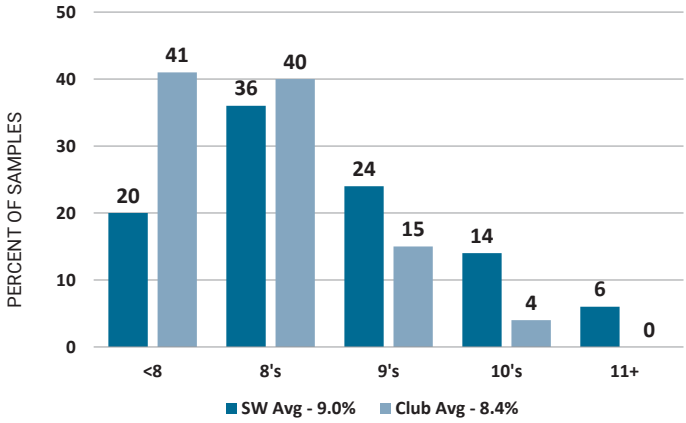
TEST WEIGHT | Pounds/Bushel



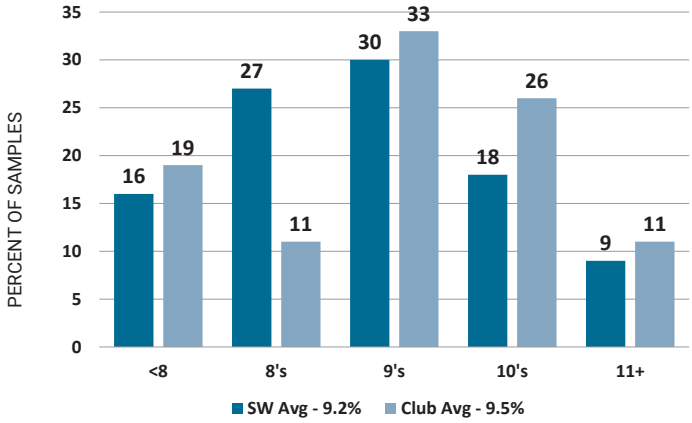
TEST WEIGHT | Kilograms/Hectoliter



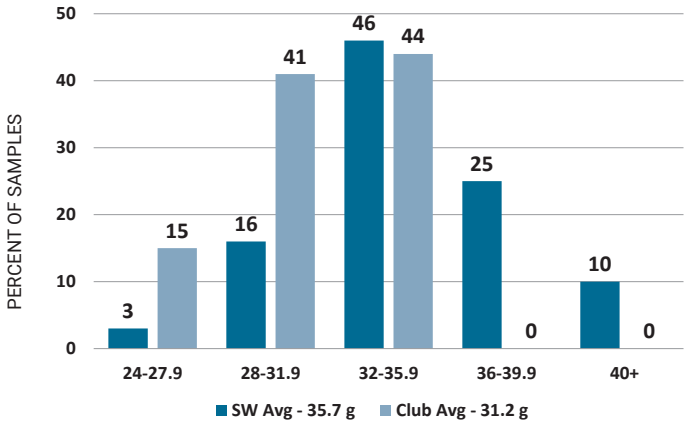
WHEAT MOISTURE | Percent



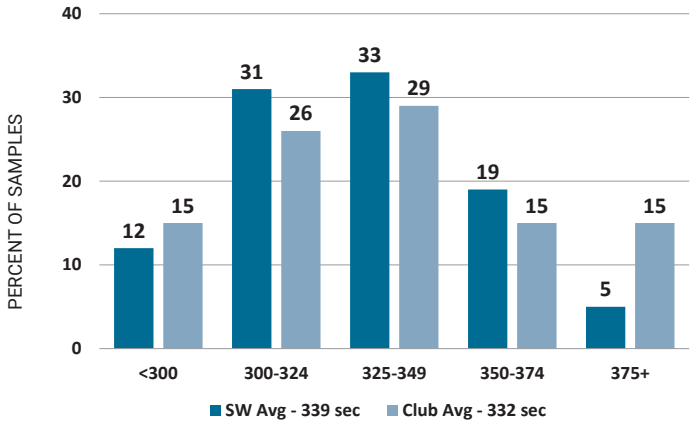
PROTEIN (12% MB) | Percent



THOUSAND KERNEL WEIGHT | Grams



FALLING NUMBER | Seconds



SOFT RED WINTER

Grown in the eastern third of the United States and shipped via Gulf, Atlantic, and Great Lakes ports, soft red winter (SRW) wheat is the third largest class of wheat grown in the United States. SRW is a high-yielding wheat with low protein of 8.5 to 10.5% (12% mb), soft endosperm, red bran, and weak gluten. It is used in pastries, cakes, cookies, crackers, pretzels, flat breads and for blending flours.

For the miller, SRW helps diversify the types of flour produced to improve the quality of many products. SRW blended with hard red spring (HRS) and hard red winter (HRW) wheat can lower grist cost and improve bread crumb texture or improve the quality and appearance of a wide variety of products.

For the baker, the lower moisture content of the flour produced with SRW creates an advantage by increasing the added water volume while optimizing water absorption and product quality to the consumer.

APPLICATIONS

U.S. SRW wheat, commonly used for specialty products such as sponge cakes, cookies, crackers and other confectionary products, also adds value to the miller and baker as a blending wheat.

Applications include:

- Cookies
- Pastries
- Cakes
- Cereals or cereal bars
- Crackers
- Pretzels
- Snack foods
- Fried Spring Rolls
- Mooncake
- Baguettes
- Empanadas
- Flat breads
- Flours (cake, pastry, self-rising, wafer)
- Blending wheat to improve extensibility

SCAN THIS QR CODE for more information.

SAMPLE COLLECTION AND ANALYSIS

Great Plains Analytical Laboratory (GPAL) in Kansas City, Missouri, collected the samples and conducted the quality analyses.

SAMPLE TESTING

Test weight, moisture, protein, 1000 kernel weight, wheat ash and falling number were determined on each sample, and DON on a portion of the samples. The remaining tests were determined on 18 composite samples. Results were weighted by estimated production for each reporting area and combined into Overall, East Coast-exportable and Gulf-exportable averages. The methods are described in the Analysis Methods section of this booklet.

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SAMPLES OF SOFT RED WINTER

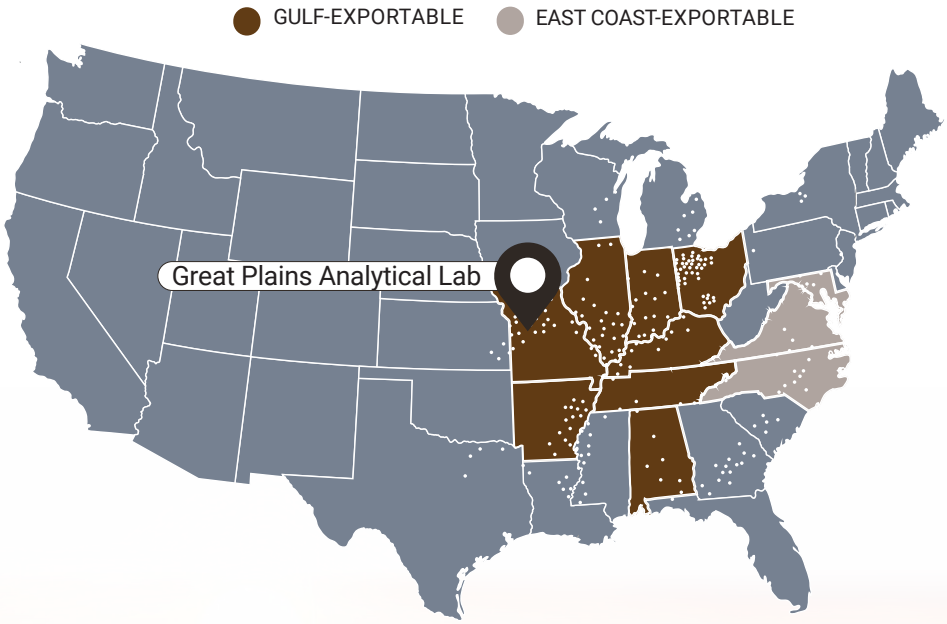
collected from elevators in 18 reporting areas.

11

STATES SURVEYED

75%

OF TOTAL SW PRODUCTION REPRESENTED



HARVEST SURVEY

The SRW crop is grown over a wide area of the eastern United States. The production region experienced excellent winter moisture followed by mid-season drought and heat, which reduced test weight and yield potential. Despite the environmental challenges, the crop exhibits good milling characteristics, low sprout damage and DON levels are generally below the USDA 2.0 ppm threshold. Processors will find a versatile crop with good qualities for cookies and crackers. With higher protein and good extensibility, the crop should also be valuable in blending for baking applications. Buyers should be happy with the quality of the entire 2024 SRW crop and are encouraged to review their quality specifications to ensure that purchases meet their expectations.

WEATHER AND HARVEST

PLANTING started at a normal pace mid-September 2023 and kept a normal pace throughout. The area seeded to SRW in fall 2023 for the 2024 harvest is estimated by USDA at 6.14 million acres (2.48 million hectares), down 17% seeded for the 2023 harvest and down 4% over the 5-year average.

As the crop **DEVELOPED**, much of the SRW growing region experienced its warmest winter on record and received plentiful moisture through the winter. Moderate temperatures continued throughout the spring. Crop conditions generally stayed high throughout the growing season, with pockets of adverse weather and limited disease concerns.

HARVEST started in mid-May. Heavy showers and storms hit the central and eastern U.S. from late May to early June. Hot, dry conditions late June through July sped up the harvest, making it faster than last year and the 5-year average.

PRODUCTION of the 2024 SRW crop is estimated to be 9.3 MMT, down from last year's bumper crop but above the 5-year average of 9.0 MMT.

CROP HIGHLIGHTS

The overall **GRADE** sample average for the 2024 SRW harvest survey is U.S. No. 2 SRW.

TEST WEIGHT averages trended lower this year and likely reflect mid-season heat and dryness.

WHEAT PROTEIN (12% mb) averages are higher compared to last year's crop and the 5-year average. The higher protein content reflects expanding drought during the growing season.

WHEAT MOISTURE in this year's crop is lower than 2023 and the 5-year average, due to hotter and drier conditions.

The **WHEAT FALLING NUMBER** average for the East Coast is notably higher than last year and 5-year average due to better harvest conditions. The Gulf average is lower than last year but in line with the 5-year average, reflecting isolated adverse weather during harvest. Overall, this year's falling number values indicate the crop is sound.

VOMITOXIN (DON) averages are higher than last year, but still below the USDA threshold of 2.0 ppm and indicate that the sampled crop is relatively free of DON.

SINGLE KERNEL values reflect that this year's crop is lighter and has slightly smaller diameters than last year, but similar to the 5-year average. Compared to last year, the East Coast kernels are softer, and Gulf kernels are similar.

AMYLOGRAPH VISCOSITY indicates starch characteristics that are suitable for batter-based products. The Overall and Gulf values are lower than average. The East Coast value is significantly higher than average and reinforces the higher falling numbers and lower amylase activity compared to last year.

SOLVENT RETENTION CAPACITY values for this crop indicate excellent quality for all typical applications. Sucrose values indicate cookies and crackers will benefit from reduced bake time and should not experience any excess water-holding issues.

DOUGH PROPERTIES suggest this crop is in a similar range of values compared to last year and the 5-year average and typical for SRW.

COOKIE SPREAD FACTOR values indicate the crop has good spreadability. The Gulf values are lower compared to last year and 5-year average and indicate room for improvement with formulation adjustments. The East Coast values are the same as last year and similar to the 5-year average.

LOAF VOLUME averages are higher than last year and similar to 5-year averages, reflecting the higher protein and greater extensibility of this year's crop, and also indicates suitability for blending.

HARVEST DATA

	TOTAL			EAST COAST[1]			GULF[1]		
	2024 Avg	2023 Avg	5-Year Avg	2024 Avg	2023 Avg	5-Year Avg	2024 Avg	2023 Avg	5-Year Avg
WHEAT GRADE DATA:									
Test Weight (lb/bu)	59.2	60.3	59.6	59.5	59.6	58.8	59.2	60.4	59.8
(kg/hl)	78.0	79.3	78.4	78.3	78.4	77.4	77.9	79.5	78.7
Damaged Kernels (%)	0.5	0.3	0.3	0.5	0.3	0.7	0.5	0.3	0.2
Foreign Material (%)	0.2	0.2	0.1	0.2	0.1	0.1	0.2	0.2	0.1
Shrunken & Broken (%)	0.6	0.6	0.6	0.6	0.4	0.7	0.6	0.6	0.6
Total Defects (%)	1.3	1.0	1.0	1.3	0.8	1.4	1.3	1.1	0.9
Grade	2 SRW	1 SRW	2 SRW	2 SRW	2 SRW	2 SRW	2 SRW	1 SRW	2 SRW
WHEAT NON-GRADE DATA:									
Dockage (%)	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.5	0.4
Moisture (%)	12.9	13.3	13.3	13.2	13.8	13.6	12.9	13.2	13.2
Protein (%) 12%/0% mb	9.8/11.1	9.3/10.6	9.4/10.7	9.8/11.1	9.4/10.7	9.6/10.9	9.8/11.1	9.3/10.6	9.3/10.6
Ash (%) 14%/0% mb	1.41/1.64	1.40/1.63	1.38/1.60	1.39/1.62	1.36/1.58	1.34/1.56	1.41/1.64	1.41/1.64	1.39/1.62
1000 Kernel Weight (g)	32.7	35.9	33.8	32.7	36.4	35.0	32.7	35.8	33.5
Kernel Size (%) lg/md/sm	86/13/1	89/10/1	87/12/1	85/14/1	90/09/1	88/12/1	86/13/1	89/10/1	87/12/1
Single Kernel: Hardness	25.1	24.5	23.1	22.3	24.6	23.7	25.6	24.5	23.0
Weight (mg)	33.4	36.4	34.3	33.3	37.0	35.3	33.4	36.3	34.1
Diameter (mm)	2.63	2.68	2.65	2.59	2.69	2.66	2.64	2.68	2.65
Sedimentation (cc)	13.5	12.6	11.1	12.9	12.7	11.8	13.6	12.6	10.9
Falling Number (sec)	316	320	310	317	293	290	316	326	315
DON (ppm)	0.7	0.3	0.7	0.4	0.2	0.3	0.8	0.3	0.8
FLOUR DATA:									
Lab Mill Extraction (%)	70.1	68.4	67.0	68.8	66.5	66.6	70.4	68.8	67.1
Color: L*	90.8	91.0	91.1	90.9	91.1	91.0	90.8	91.0	91.2
a*	-2.1	-2.2	-2.3	-2.1	-2.1	-2.3	-2.1	-2.2	-2.3
b*	9.2	8.7	9.0	9.0	8.1	8.8	9.2	8.8	9.1
Protein (%) 14%/0% mb	8.0/9.3	7.3/8.5	7.5/8.7	8.1/9.4	7.3/8.5	7.6/8.9	8.0/9.3	7.3/8.5	7.4/8.6
Ash (%) 14%/0% mb	0.43/0.50	0.42/0.49	0.42/0.49	0.42/0.49	0.38/0.44	0.42/0.49	0.43/0.50	0.43/0.50	0.42/0.48
Wet Gluten (%) 14% mb	22.4	20.5	20.4	23.2	20.5	21.3	22.3	20.5	20.2
Falling Number (sec)	313	320	339	320	287	291	312	328	350
Amylograph Viscosity: 65g (BU)	560	655	566	605	401	410	552	709	605
Damaged Starch (%)	3.8	3.3	3.0	3.5	3.4	3.1	3.8	3.3	3.0
SRC: Water/50% Sucrose (%)	51/86	51/85	53/89	51/92	50/84	53/90	51/85	51/86	53/88
5% Lactic Acid/5% Na_2CO_3 (%)	100/69	99/68	104/71	111/69	96/67	105/72	99/69	99/68	103/71
Gluten Performance Index (GPI)	0.65	0.64	0.65	0.68	0.64	0.65	0.64	0.64	0.65
DOUGH PROPERTIES:									
Farinograph: Peak Time (min)	1.2	1.2	1.2	1.0	1.2	1.3	1.2	1.2	1.1
Stability (min)	1.9	1.7	1.6	1.4	1.6	1.8	2.0	1.7	1.6
Absorption (%)	52.7	52.5	52.1	52.0	52.4	52.5	52.8	52.5	52.0
Alveograph: P (mm)	41	51	41	40	50	43	41	52	41
L (mm)	90	57	71	97	56	72	89	57	70
P/L Ratio	0.45	0.90	0.59	0.41	0.89	0.60	0.46	0.90	0.58
W (10^{-4} J)	98	94	84	109	89	88	96	95	83
Extensograph (45 min): Resistance (BU)	206	219	187	245	204	181	199	222	189
Extensibility (cm)	14.5	14.8	15.7	15.2	15.3	16.4	14.4	14.7	15.5
Area (cm^2)	51	55	51	64	53	52	49	56	50
BAKING EVALUATION:									
Cookie: Diameter (cm)	8.9	9.0	9.0	9.1	9.0	8.9	8.9	9.0	9.0
Spread Factor (diameter/height)	9.4	9.7	10.2	10.0	9.9	10.1	9.2	9.6	10.2
Pan Bread: Bake Absorption (%)	54.8	54.4	54.1	54.5	51.1	53.7	54.9	55.1	54.1
Loaf Volume (cc)	634	602	629	672	587	622	627	606	630
Specific Volume (cc/g)	4.6	–	–	4.9	–	–	4.5	–	–
% OF SAMPLES:	**100**			**22**			**78**		

[1]East Coast - Maryland, Virginia and North Carolina; Gulf - Alabama, Arkansas, Illinois, Indiana, Kentucky, Missouri, Ohio and Tennessee.

SOFT RED WINTER PRODUCTION

FOR THE MAJOR PRODUCING STATES (MMT)

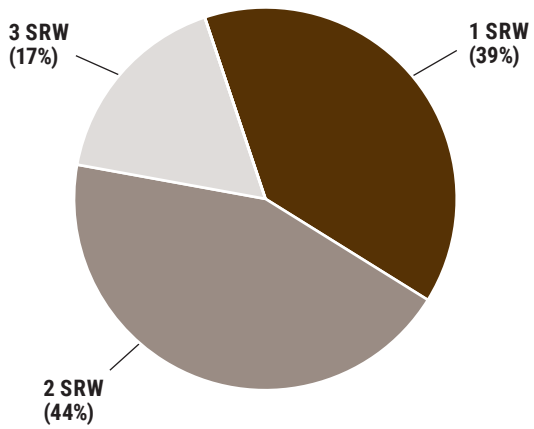
	2024	2023	2022	2021	2020
Alabama	0.1	0.3	0.2	0.2	0.1
Arkansas	0.1	0.3	0.2	0.2	0.1
Georgia	0.1	0.1	0.2	0.2	0.1
Illinois	1.6	1.8	1.2	1.3	1.0
Indiana	0.6	0.8	0.5	0.6	0.5
Kentucky	0.8	1.1	0.8	0.8	0.6
Maryland	0.4	0.5	0.4	0.3	0.3
Michigan	0.6	0.9	0.6	0.8	0.6
Missouri	1.0	1.1	0.7	0.9	0.6
North Carolina	0.5	0.8	0.7	0.5	0.6
New York	0.2	0.2	0.2	0.2	0.2
Ohio	1.1	1.4	1.0	1.2	0.9
Pennsylvania	0.4	0.5	0.4	0.4	0.4
Tennessee	0.7	0.8	0.7	0.6	0.4
Virginia	0.2	0.3	0.3	0.2	0.2
Wisconsin	0.5	0.5	0.5	0.5	0.2
Surveyed-States Total*	**7.0**	**9.3**	**6.6**	**7.0**	**5.3**
East Coast-Exportable	1.0	1.5	1.3	1.1	1.1
Gulf-Exportable	5.9	7.8	5.3	5.9	4.2
Sixteen-State Total	**8.7**	**11.4**	**8.5**	**9.1**	**6.8**
Total SRW Production	**9.3**	**12.2**	**9.1**	**9.8**	**7.2**

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

**Eleven states denoted by italics were surveyed accounting for 75% of 2024 SRW production.*

DISTRIBUTION BY GRADE

(BASED ON 18 COMPOSITE SAMPLES)

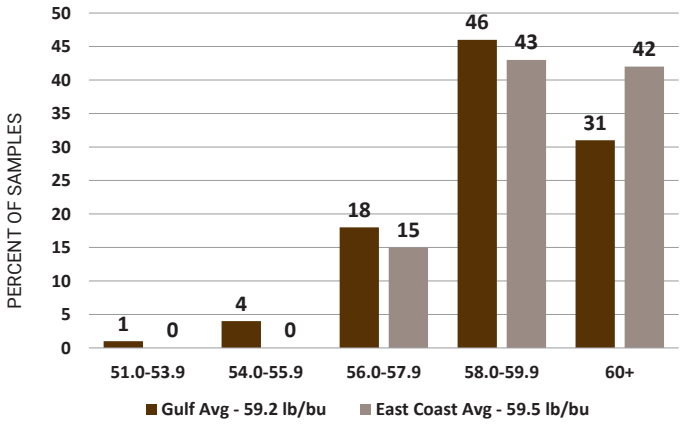


"Ohio has produced another incredible SRW wheat crop this year. Thanks to favorable growing conditions we are finding higher protein levels than last year and not seeing any issues with vomitoxin. We hope that our overseas customers will be pleased with the high quality SRW on the market this year."

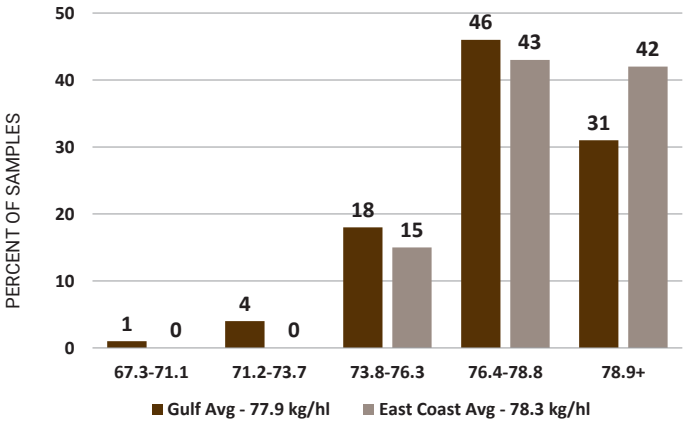
— Ray Van Horn, Ohio wheat farmer

DISTRIBUTIONS

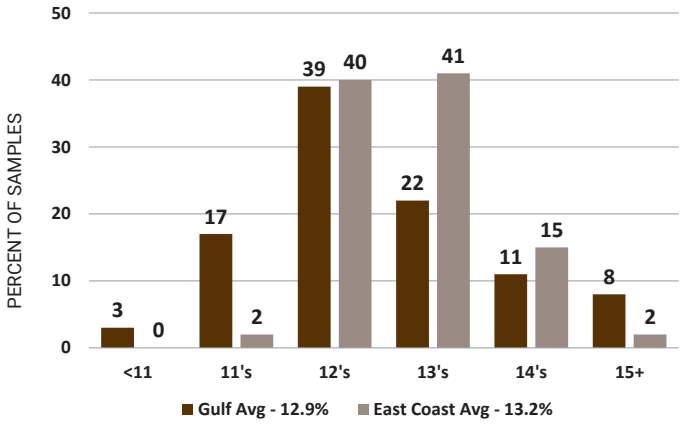
TEST WEIGHT | Pounds/Bushel



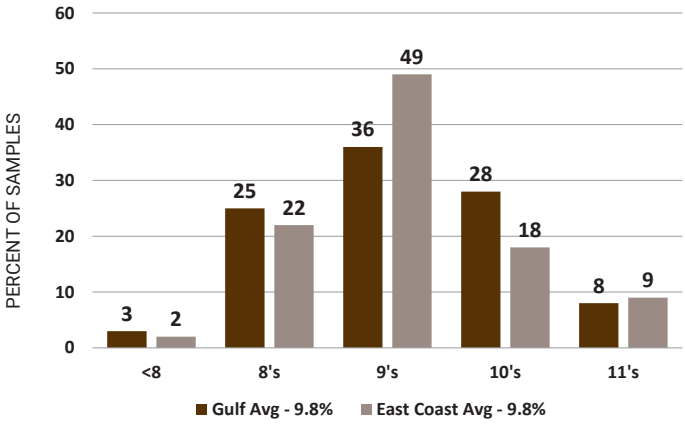
TEST WEIGHT | Kilograms/Hectoliter



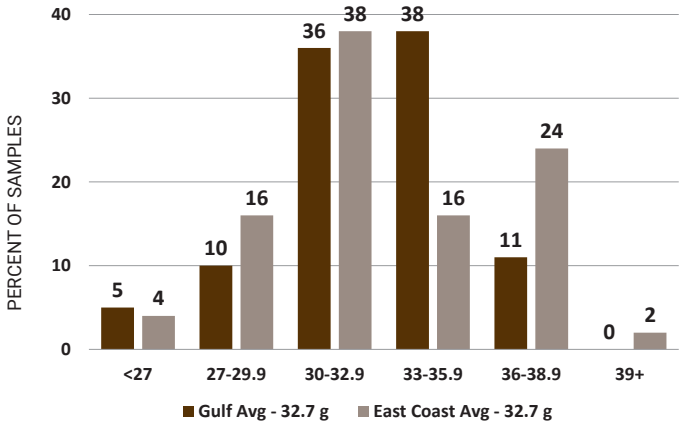
WHEAT MOISTURE | Percent



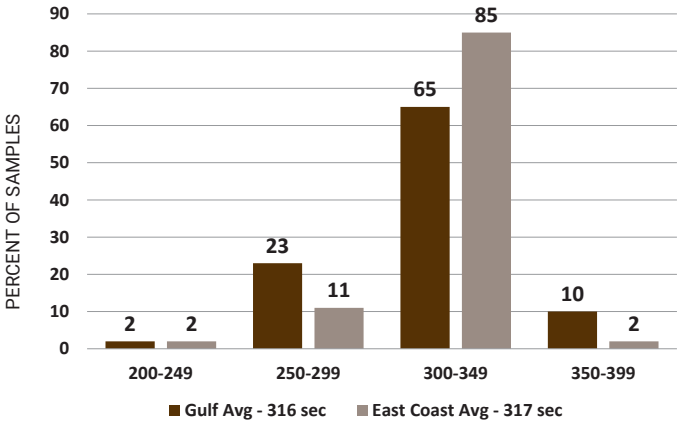
PROTEIN (12% MB) | Percent



THOUSAND KERNEL WEIGHT | Grams



FALLING NUMBER | Seconds



DURUM

Northern Durum is grown primarily in the North Central region and shipped via Gulf, Great Lakes and Pacific ports, while Desert Durum®, is grown primarily under contract in the desert Southwest (Arizona and California) and shipped via the Gulf or West Coast. Durum is the fifth largest class of wheat grown in the United States and has a high protein content of 12.0 to 15.0% (12% mb), rich amber color, yellow endosperm, high gluten and white bran.

For the miller, durum is a large, very hard kernel with the potential for very high extraction of high quality, low ash semolina that is ideal for fine pasta. Desert Durum® is harvested and shipped at a very low moisture content, an advantage to millers that contributes to efficient transportation costs and high extraction rates.

For consumers of pasta, couscous and Mediterranean breads, durum helps deliver excellent color and texture.

APPLICATIONS

Hard Amber Durum (HAD) sets the "gold standard" for premium pasta products, couscous and some Mediterranean breads and cakes.

Applications include:

- Premium quality long and short goods pasta
- Blends (with HRS) for pizza doughs
- Durum semolina
- Couscous
- Mediterranean breads and cakes

SCAN THIS QR CODE for more information.

SURVEY METHODOLOGY

NORTHERN DURUM SAMPLE COLLECTION AND ANALYSIS

The Durum Quality Lab, North Dakota State University, Fargo, North Dakota, conducted the quality analyses.

NORTHERN DURUM SAMPLE TESTING

Official grade, test weight, vitreous kernel, 1000 kernel weight, protein and falling number were determined on each sample. The remaining tests were conducted on 6 composite samples categorized by growing region for Northern Durum. The methods are described in the Analysis Methods section of this booklet.

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SAMPLES OF NORTHERN DURUM

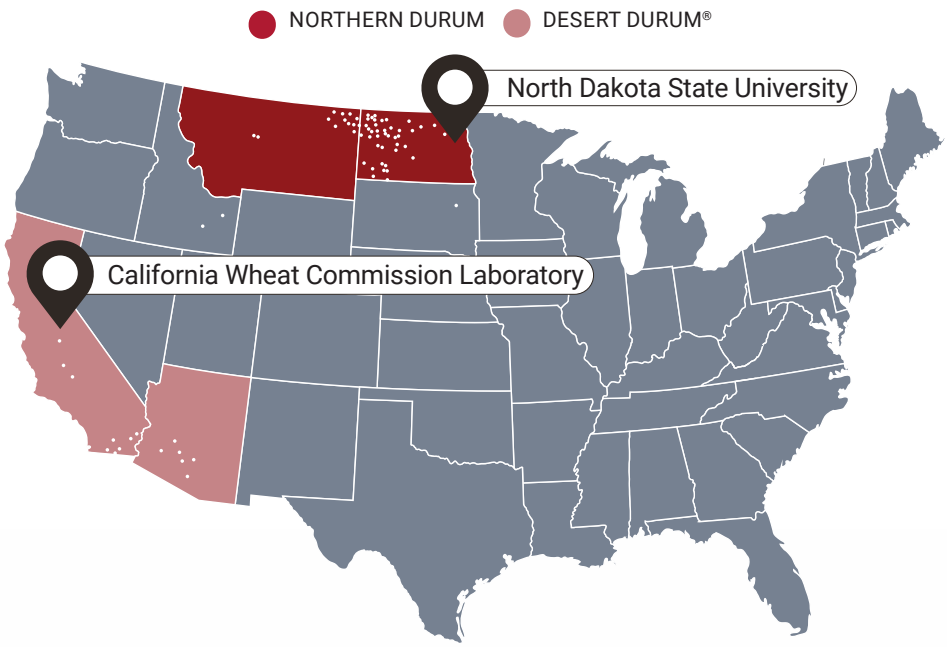
collected from fields, farm bins and local elevators by the National Agricultural Statistics Service.

4

STATES SURVEYED

100%

OF TOTAL DURUM PRODUCTION REPRESENTED



7

SAMPLES OF DESERT DURUM®

collected by a Federal Grain Inspection Service (FGIS) licensed inspection agency or submitted by handlers to a licensed agency.

DESERT DURUM® SAMPLE COLLECTION AND ANALYSIS

California Wheat Commission Laboratory conducted the quality analyses.

DESERT DURUM® SAMPLE TESTING

All tests were conducted on each sample. Production-weighted results are reported. The Desert Durum® production area is highlighted on the map above. The methods are described in the Analysis Methods section of this booklet.

DURUM PRODUCTION

FOR THE MAJOR PRODUCING STATES (MMT)

	2024	2023	2022	2021	2020
Arizona	0.2	0.1	0.3	0.1	0.1
California	0.1	0.1	0.1	0.1	0.0
Montana	0.5	0.6	0.5	0.3	0.7
North Dakota	1.4	0.9	0.8	0.5	1.0
Four-State Total	2.2	1.6	1.7	1.0	1.9
Northern Durum	1.9	1.4	1.4	0.8	1.7
Desert Durum®	0.3	0.2	0.4	0.2	0.2
Total Durum Production	**2.2**	**1.6**	**1.7**	**1.0**	**1.9**

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

SUBCLASSES

Under the Official United States Standards for Grain, durum wheat is divided into the following three subclasses based on vitreous kernel content:

HARD AMBER DURUM (HAD)

- Contains at least 75% hard, vitreous kernels of amber color.

AMBER DURUM (AD)

- Contains between 60-74% hard, vitreous kernels of amber color.

DURUM (D)

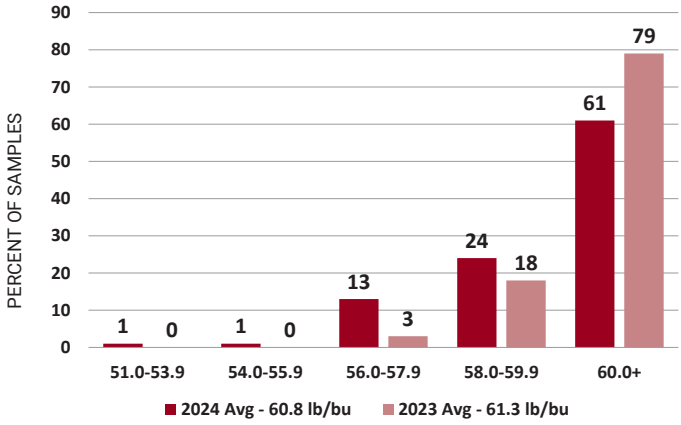
- Contains less than 60% hard, vitreous kernels of amber color.

"Early season crop conditions across much of the region were good with adequate moisture and no excessive heat. Where it continued to rain later, yields were above average but in some drier, hotter areas yields fell short of average. We produced a good quality durum crop overall but some late heat here in southwest North Dakota lowered our typical test weights. With more planted area, customers can draw from larger supplies this year."

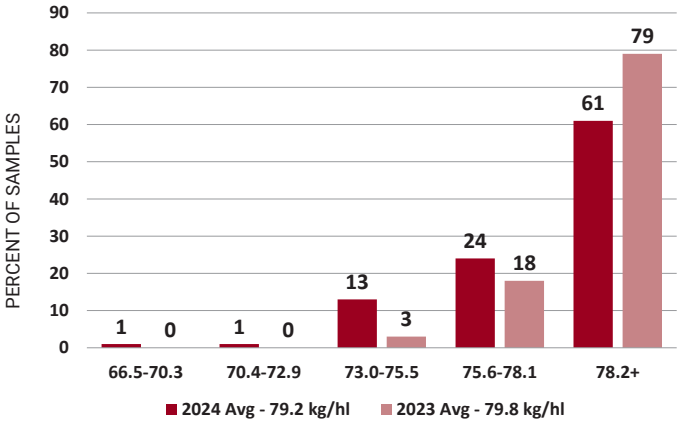
— Don Hardy, North Dakota wheat farmer

NORTHERN DURUM DISTRIBUTIONS

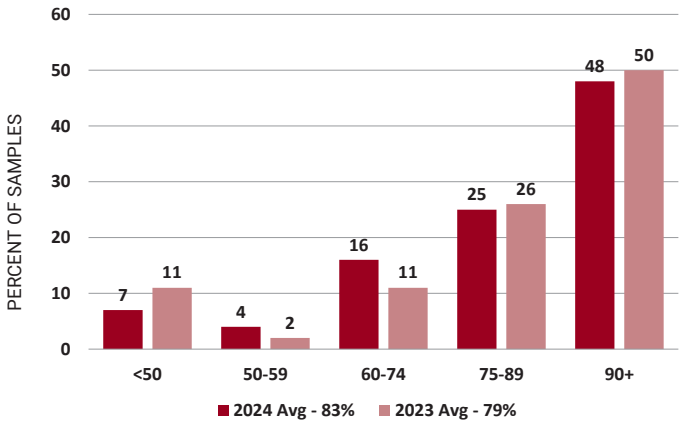
TEST WEIGHT | Pounds/Bushel



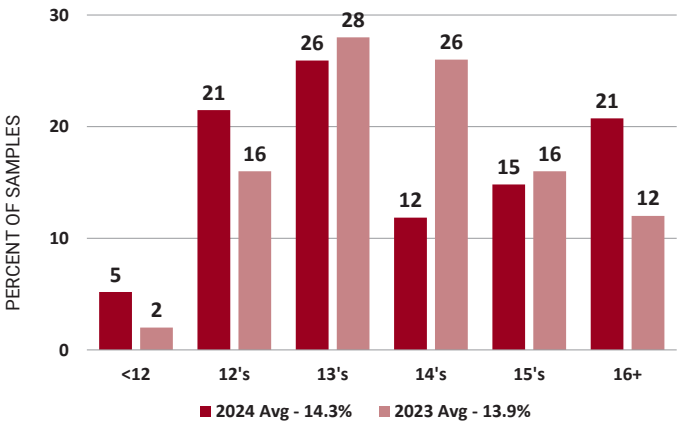
TEST WEIGHT | Kilograms/Hectoliter



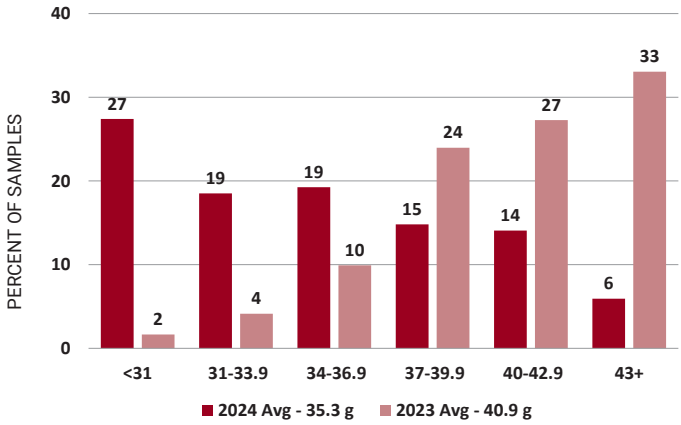
VITREOUS KERNELS | Percent



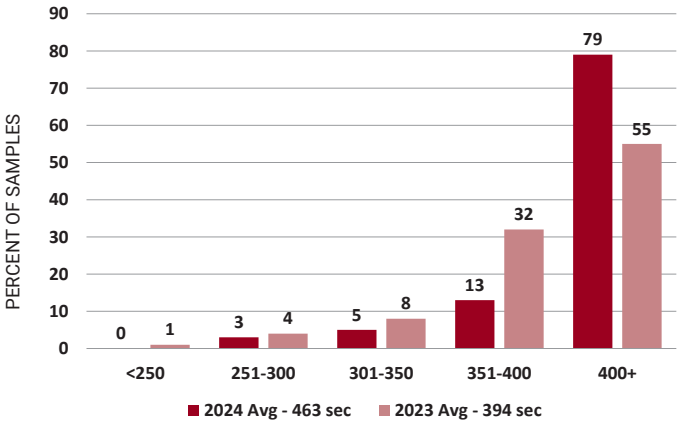
PROTEIN (12% MB) | Percent



THOUSAND KERNEL WEIGHT | Grams



FALLING NUMBER | Seconds



NORTHERN DURUM HARVEST SURVEY

The 2024 crop boasts greater production, high grades, high protein, low damage levels and sound kernels with functional performance that is characteristic for Northern Durum. The vast difference in growing season conditions across the region created wider than typical variance for some kernel parameters. Buyers will find a good to excellent crop that will meet their quality demands for producing pasta, couscous and bread products.

WEATHER AND HARVEST

PLANTING started well ahead of average due to milder weather. Moisture conditions at planting were good in most areas, but far western areas remained dry. The majority of the crop was planted by early June.

The crop **EMERGED** under mostly favorable conditions. Early development benefited from precipitation and cooler temperatures. Later in the growing season, less moisture and higher temperatures in the west affected yield potential, while sufficient rainfall in the east helped maintain yields. Disease pressure was low.

HARVEST began in early August, ahead of average. Conditions were mostly dry, with minimal delays. North Dakota saw good yields, while Montana had lower yields due to hotter, drier growing conditions. Harvest progress was slightly ahead of average and mostly finished by the end of September

Durum **PRODUCTION** in the U.S. Northern Plains is at 1.9 MMT, 35% higher than last year.

CROP HIGHLIGHTS

The average **GRADE** of the 2024 crop is U.S. No. 1 Hard Amber Durum (HAD); 38% of the crop grades U.S. No. 1 HAD. This crop shows a wider grade distribution due to some samples with lower test weight or higher damage.

TEST WEIGHTS trended lower this year due to late season heat and drought stress; nearly two-thirds of the crop has a test weight of 60.0 lb/bu (78.2 kg/hl) or higher.

DAMAGED KERNEL count is slightly higher than 2023 but lower than the 5-year average.

VITREOUS KERNEL (HVAC) content is higher than last year and equal to the 5-year average.

WHEAT PROTEIN is notably higher this year, especially in areas with more stressful growing conditions. While average protein is higher, there is variable protein content, with a larger portion of the harvest falling into both the extremely high and very low categories. Nearly three-fourths of this year's crop has a protein content of 13.0% (12% mb) or higher.

1000 KERNEL WEIGHT (TKW) averages trended lower this year, due to hot, dry conditions in western regions, resulting in smaller kernels.

KERNEL MOISTURE averages trended higher this year due to wetter growing and harvest conditions in some areas of the production region.

WHEAT FALLING NUMBER values were very high and indicate the crop is sound.

DON levels are generally low.

LABORATORY MILLING was performed on a Quadromat® Junior mill and is not indicative of commercial milling performance. Semolina extraction is significantly higher than last year and nearly 5% above the average.

SEMOLINA PROTEIN content is similar to last year; however, there was a slight increase in protein loss during milling, which is due to more protein being stored in the bran and the presence of small, thin kernels in some regions.

SEMOLINA COLOR values are similar to last year and the five-year average. Ash is higher than last year and speck counts are lower.

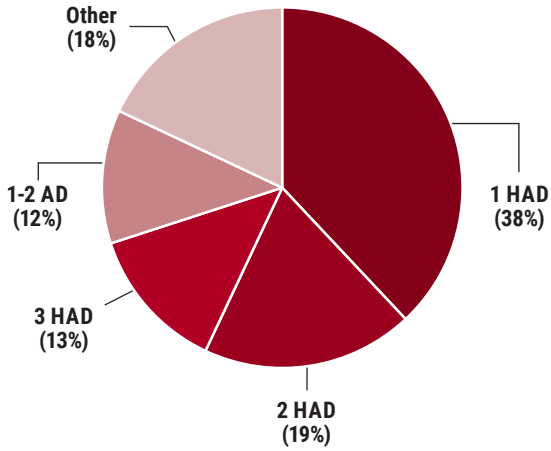
DOUGH STRENGTH parameters indicated strength very similar to last year and within an average range of a typical durum crop.

SPAGHETTI EVALUATIONS show lower color and cooked weight, similar cooked loss, and higher cooked firmness compared to last year.

NORTHERN DURUM HARVEST DATA

	2024 Avg	2023 Avg	5-Year Avg
WHEAT GRADE DATA:			
Test Weight (lb/bu)	60.8	61.3	61.3
(kg/hl)	79.2	79.8	79.8
Damaged Kernels (%)	0.6	0.4	0.8
Foreign Material (%)	0.1	0.0	0.0
Shrunken & Broken (%)	0.7	0.6	0.8
Total Defects (%)	1.4	1.0	1.6
Vitreous kernels (%)	83	79	83
Grade	1 HAD	1 HAD	1 HAD
WHEAT NON-GRADE DATA:			
Dockage (%)	0.8	1.1	1.0
Moisture (%)	12.2	11.5	11.2
Protein (%) 12%/0% mb	14.3/16.3	13.9/15.8	14.1/16.0
Ash (%) 14%/0% mb	1.58/1.84	1.43/1.66	1.57/1.83
1000 Kernel Weight (g)	35.3	40.9	42.7
Kernel Size (%) lg/md/sm	42/53/5	56/42/2	50/46/4
Falling Number (sec)	463	394	404
Sedimentation (cc)	79	81	69
DON (ppm)	0.3	0.0	0.2
SEMOLINA DATA:			
Lab Mill Extraction (%)	—	—	—
Semolina Extraction (%)	60.7	52.0	55.3
Color: L*	81.1	83.4	83.3
a*	-3.1	-2.5	-2.4
b*	30.0	30.1	30.2
Protein (%) 14%/0% mb	12.3/14.3	12.4/14.4	12.6/14.7
Ash (%) 14%/0% mb	0.68/0.79	0.63/0.73	0.63/0.73
Specks (no/10 in^2)	25	27	27
Wet Gluten (%) 14% mb	31.7	32.1	33.8
Gluten Index (%)	89	91	77
SPAGHETTI EVALUATION:			
Color: L*	58.9	60.3	60.4
a*	3.7	3.5	3.8
b*	41.0	44.6	45.0
Cooked Weight (g)	30.1	31.6	31.4
Cooking Loss (%)	7.2	7.3	7.3
Cooked Firmness (g cm)	6.7	3.9	4.1
SAMPLE COUNT:	**251**	**225**	

NORTHERN DURUM GRADE DISTRIBUTION



DESERT DURUM® HARVEST SURVEY

Desert Durum® is a registered certification mark of the Arizona Grain Research and Promotion Council and the California Wheat Commission, which authorize its use only to designate durum grown under irrigation in the desert valleys and lowlands of Arizona and California.

Desert Durum® can be produced and delivered "identity preserved" to domestic and export markets, which allows customers to purchase grain with quality traits specific to their processing needs. Annual requirements can be pre-contracted with grain merchandisers ahead of the fall-winter planting season for harvest in late May through early July. Varietal identity is maintained by experienced growers planting certified seed and merchandisers who store and ship according to customers' preferred delivery schedules.

Desert Durum® production acreage in 2024 was higher than 2023. According to USDA, yields were 3.18 tons/acre, and quality was uniformly good. Based on our 2024 variety survey, Miwok was the most widely grown variety in California.

CROP HIGHLIGHTS

Desert Durum® exhibits consistently large kernels and low moisture, traits that contribute to efficient transportation costs and high extraction rates. The 2024 crop will deliver the valuable milling, semolina and pasta quality traits that customers have learned to expect and appreciate.

The overall **GRADE** sample average for the 2024 Desert Durum® harvest survey is U.S. No. 1 Hard Amber Durum (HAD).

Average **TEST WEIGHT** was comparable to both last year and the 5-year average, reflecting a high average typical of Desert Durum®.

The average **VITREOUS KERNEL (HVAC)** content was both comparable to last year and the 5-year average, reflecting a high average typical of Desert Durum®.

Average **DAMAGE KERNELS** and **TOTAL DEFECTS** were both low and comparable to both last year and the 5-year average.

Kernel **MOISTURE** was slightly lower than last year, and comparable to the 5-year average, a characteristic of Desert Durum®. More water can be added to the grain prior to milling adding additional value to millers.

WHEAT PROTEIN average was comparable to last year and the 5-year average, reflecting a high average typical of Desert Durum®.

The average **1000 KERNEL WEIGHT (TKW)** was slightly higher than last year, and the 5-year average, reflecting a high average typical of Desert Durum®.

WHEAT FALLING NUMBER values were slightly higher than last year, but slightly lower than the 5-year average, reflecting a high average typical of Desert Durum®.

SEMOLINA ASH was slightly higher than last year, and the 5-year average.

The **WET GLUTEN** average was slightly lower than last year and the 5-year average.

The **GLUTEN INDEX** average was slightly lower than last year, but comparable to the 5-year average.

SEMOLINA COLOR b* value (yellow color) was slightly lower than last year but higher than the 5-year average. The value indicates the semolina color is bright yellow in color.

Spaghetti **COOKED FIRMNESS** average was comparable to last year, and slightly higher than the 5-year average, indicating the pasta has good cooking tolerance and eating quality.

"Desert Durum® growers favored by good weather conditions plus their stewardship of crop, land and water were able to get good yields with protein averaging 13.4% (12% mb) this 2024 season. Although markets have been slow, having the assurance of a good quality crop gives confidence to the buyers that they are getting U.S. No. 1 HAD wheat, excellent for their pasta milling purposes."

— Victor Lopez, California wheat farmer

DESERT DURUM® HARVEST DATA

	2024 Avg	2023 Avg	5-Year Avg
WHEAT GRADE DATA:			
Test Weight (lb/bu)	63.1	63.0	63.3
(kg/hl)	82.2	82.0	82.4
Damaged Kernels (%)	0.2	0.1	0.1
Foreign Material (%)	0.0	0.1	0.0
Shrunken & Broken (%)	0.5	0.3	0.4
Total Defects (%)	0.7	0.5	0.6
Vitreous kernels (%)	98	98	98
Grade	1 HAD	1 HAD	1 HAD
WHEAT NON-GRADE DATA:			
Dockage (%)	0.4	0.3	0.3
Moisture (%)	7.1	7.6	7.2
Protein (%) 12%/0% mb	13.7/16.4	13.6/15.8	13.8/15.7
Ash (%) 14%/0% mb	1.66/1.94	1.65/1.91	1.66/1.92
1000 Kernel Weight (g)	50.0	48.8	48.2
Kernel Size (%) lg/md/sm	94/6/0	92/8/0	92/8/0
Falling Number (sec)	646	607	662
Sedimentation (cc)	61	62	64
DON (ppm)	—	—	—
SEMOLINA DATA:			
Lab Mill Extraction (%)	82.1	78.8	78.4
Semolina Extraction (%)	70.7	73.0	72.5
Color: L*	85.8	86.0	85.9
a*	-3.8	-4.2	-3.9
b*	32.2	32.9	31.6
Protein (%) 14%/0% mb	13.7/16.4	13.1/15.2	12.8/14.9
Ash (%) 14%/0% mb	0.85/0.98	0.76/0.88	0.82/0.95
Specks (no/10 in^2)	23	30	22
Wet Gluten (%) 14% mb	32.8	34.3	34.6
Gluten Index (%)	72	79	73
SPAGHETTI EVALUATION:			
Color: L*	56.3	55.0	56.2
a*	-0.2	0.2	0.0
b*	43.6	44.1	43.6
Cooked Weight (g)	29.5	29.0	29.7
Cooking Loss (%)	5.8	6.2	5.9
Cooked Firmness (g cm)	7.3	7.4	7.1
SAMPLE COUNT:	**7**	**13**	

ANALYSIS METHODS

WHEAT GRADE FACTORS

U.S. Wheat Grade is a numeric value from 1 to 5 or the designation "Sample Grade," which reflects the physical condition of a sample and thus may indicate its general suitability for milling. All numeric factors other than test weight are reported as a percentage by weight of the sample. (See table on page 4.) Unless otherwise noted, all Wheat Grade Factor methodology can be found in the Official U.S. Standards for Grain. Grade determining factors include:

TEST WEIGHT is a measure of density in pounds per bushel (lb/bu) or kilograms per hectoliter (kg/hl). Test weight may indicate potential milling yield and the general condition of the sample. Problems during the growing season or at harvest often reduce test weight.

- **Method:** AACCI 55-10.01. The official USDA measurement is in lb/bu. • For converting to kg/hl, see Unit Conversion Factors on page 5.

DAMAGED KERNELS show signs of disease, insect activity, frost or sprouting and may adversely affect milling and flour quality.

FOREIGN MATERIAL is any material other than wheat that remains after dockage is removed. Because foreign material can be a similar size and weight as wheat and is not easily removed, it may adversely affect milling and flour quality.

SHRUNKEN AND BROKEN kernels have a shrunken or shriveled appearance or were broken in handling that may reduce milling yield.

TOTAL DEFECTS is the sum of damaged kernels, foreign material and shrunken and broken kernels.

VITREOUS KERNELS in HRS wheat 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. Vitreous kernel is the percentage handpicked from a 15 gram (g) clean wheat sub-sample. Vitreous kernel will not determine numeric grade value but will affect subclass designation.

Cereals & Grains Association (formerly American Association of Cereal Chemists International, AACCI) publishes approved methods for determining kernel, flour and end-product testing.

Scan this QR code for more information.

WHEAT NON-GRADE FACTORS

Non-grade factors do not affect numerical grades but can be used to determine the quality of the wheat. All non-grade factors, except moisture, are measured after dockage is removed. Non-grade testing services are available from FGIS or private unofficial inspection companies if requested in the sales contract. Flour based specifications cannot be tested by FGIS at the time of loading and must be contracted out to a private laboratory, normally on composite samples provided by FGIS at the time of loading.

DOCKAGE is the percentage by weight of material removed from a sample by the Carter Dockage Tester and does not influence the numerical grade. Being easy to remove, dockage should not affect milling quality but may have other economic effects for buyers. U.S. Wheat Grade Factors are determined after dockage is removed.

- **Method:** Official USDA procedures.

MOISTURE content is the percentage of water by weight in 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 removed from a sample, other analysis results should be mathematically converted to a standard moisture basis (mb), such as 14%, 12% or dry matter (0%), so test results can be consistently evaluated (see page 5). Moisture is measured before removing dockage from the sample.

- **Methods:** HRW, HRS, SW: AACC 39-01.01, 39-10.01 and 39-11.01, Near-Infrared Reflectance (NIR) method. • Northern Durum: AACCI 44-11.01, Dielectric meter method, Motomco Moisture Meter. • SRW, Desert Durum®: AACCI 44-15.02, Air-oven method.

PROTEIN content is the percentage of protein by weight in a sample. Because there is no rapid way to measure wheat protein quality, protein quantity is used in trade and by millers as an indicator of the suitability of wheat or flour for various products and is an important factor in determining wheat value. High protein is usually desired for products such as pan breads, pasta, buns and frozen yeast-raised products. Low protein and low gluten are usually desired for products such as cookies, wafers, snacks or cakes.

- **Wheat Protein (12% mb) Methods:** HRW, HRS, Northern Durum, SW: AACCI 39-25.01, NIR method, whole kernels. Desert Durum®: AACCI 46-30.01, Dumas CAN method, ground whole meal.
- **Flour and Semolina Protein (14% mb) Methods:** HRW, HRS, Northern Durum: AACCI 39-10.01, NIR method. • SW, SRW, Desert Durum®: AACCI 46-30.01, Dumas CAN method.

ASH content is the percentage of minerals by weight in wheat or flour. In wheat, minerals are primarily concentrated in the bran. Ash content indicates milling performance by indirectly revealing the amount of mineral content (bran) contamination in flour. Ash in flour can impart a darker color to finished products. Products requiring white (bright) color call for low ash content, while whole wheat flour has higher ash content. Wheat grown under irrigation and high levels of flour fortification can have higher ash levels due to higher mineral content in the flour. Readers are encouraged to look at flour color in conjunction with ash content.

- **Method:** AACCI 08-01.01 expressed on a 14% mb for all classes. Methodology is same for wheat and flour/semolina.

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

WHEAT NON-GRADE FACTORS CONTINUED

- **Methods:** Shuey, W. 1960. Cereal Sci. Today. 5(3):71-75 for all classes. • Wheat is sifted with a RoTap sifter. Kernels remaining over a U.S. Standard Sieve No. 7 (2.80 mm opening) are "large"; passing through the No. 7 screen but not the Tyler No. 9 or US No. 10, are "medium," and passing through the Tyler No. 9 or US No. 10 screen are "small." • HRW, HRS, SW, Northern Durum: Tyler No. 7 (2.80 mm) and No. 9 (2.00 mm) screens. • Desert Durum®: U.S. No. 7 (2.82 mm) and No. 10 (2.00 mm). Note: Desert Durum® sieve openings are narrower for large and medium kernels than the openings for Northern Durum.

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 indicate the uniformity of the sample and help millers experienced with the system to optimize flour milling yields. Kernel characteristics may help millers optimize tempering and adjust roll gap settings.

- **Methods:** HRW, SRW, SW, Durum (Northern, Desert Durum®): AACCI 54-31.01 using Perten SKCS 4100. • Note: as of 2022, the SKCS test is no longer performed on HRS.

1000 KERNEL WEIGHT (or thousand kernel weight, TKW) is the weight in grams of 1,000 kernels of wheat and may indicate specific kernel weight and expected milling yield.

- **Methods:** HRS, Durum (Northern, Desert Durum®), SRW: based on a 10 g clean wheat sample counted by an electronic counter, results converted to express weight by 1,000 kernels, expressed on an as-is mb. • SW: based on the average weight of three 100-kernel samples multiplied by 10, expressed on a 14% mb. • HRW: average of SKCS kernel weight in milligrams (mg) x 1,000 equals in g, expressed on an as-is mb.

SEDIMENTATION value is a measure of the volume of sediment that results when lactic acid is added to a sifted, ground wheat sample. High sedimentation volume indicates high molecular weight glutenin sub-units (strong gluten) while low sedimentation volume indicates weaker gluten.

- **Methods:** HRW, HRS, SW, SRW: AACCI 56-61.02, Sedimentation. • Northern Durum: Micro sedimentation, Dick, J.W. and Quick, J.S. 1983. Cereal Chem. 60(4):315-318. • Desert Durum®: AACCI 56-70.01, Sodium Dodecyl Sulfate (SDS) sedimentation.

FALLING NUMBER is the time required for a plunger to fall through a boiling (100°C) heated mixture of flour

and water and is an indirect measure of enzyme activity. Sprouted wheat releases alpha-amylase (α-amylase), which breaks down starch into sugars. High falling number values indicate low α-amylase activity. Some α-amylase is required for certain products such as yeast-raised bread. However, excessive α-amylase in wheat cannot be removed and is difficult to reduce by blending. Flour with excessive amylase activity produces a sticky dough that can cause processing problems and products with poor color, poor crumb grain and weak texture. Falling number usually correlates closely with amylograph peak viscosity results.

- **Methods:** AACCI 56-81.04 for all classes. Methodology is same for flour and wheat falling number. • SW, SRW, HRW and HRS use the 2019 USDA/FGIS barometric pressure correction modification procedure; average value is a simple means of sample results. • All values expressed on a 14% mb.

DON (DEOXYNIVALENOL), or vomitoxin, produced by Fusarium fungi, is the most common mycotoxin in wheat.

- **Methods:** All analysis is on ground wheat. • HRS, Northern Durum: gas chromatograph with electron capture detector as described by Tacke, B.K., Casper, H.H. 1996. J. AOAC Int. 79(2):472-5. • SRW: Neogen ELISA. • HRW: Charm ROSA DonQ2 Quantitative Test.

FLOUR AND SEMOLINA FACTORS

Flour and semolina tests are used to measure specific properties of flour or semolina to determine how flour or semolina will perform during processing, and thus ensuring the flour or semolina has desirable characteristics for an end-product. It is important to remember that all testing reported in this book is conducted on lab-milled wheat.

SEE "WHEAT NON-GRADE FACTORS" FOR PROTEIN, ASH AND FALLING NUMBER.

LABORATORY MILLING EXTRACTION is the percentage by weight of flour/semolina obtained from a wheat sample. The extraction rate is always significantly lower from a laboratory mill than the rate that can be obtained on a commercial mill. Lab milling is done mainly to obtain flour/semolina for other tests. Settings are not optimized and remain the same year-to-year.

- **Methods:** Laboratory samples are cleaned and tempered according to AACCI 26-10.02. As of 2023, all extraction rates are calculated as tempered wheat basis [flour extraction = (weight of flour recovered/ weight of tempered wheat milled)*100]. Prior to 2023, HRW, HW and SW were reported as total product yield; extraction will report slightly lower than previously. • HRS flour is aged 10 days before analysis. Due to timing, no other classes are aged before analysis. • SW, SRW: AACCI 26-31.01, Buhler Laboratory Mill (MLU 202). • HRS, HW: AACCI 26-21.02, Buhler Laboratory Mill (MLU 202). • HRW: Tandem Buhler Mill. • Northern Durum: Brabender® Quadrumat Junior Semolina Mill; grain is tempered to 15.5% moisture one day before milling. • Desert Durum®: Modified Roller Mill.

COLOR measures a sample's lightness (L*) on a scale of 0 to 100 and "chromaticity" or hue on two scales from -60 to +60 for green to red (a*) and blue to yellow (b*). High L* values indicate a bright color and higher b* values indicate more yellow. Durum semolina and flour color are influenced by endosperm color, particle size and ash content and often affects finished product color.

- **Methods:** CIE 1976 L*a*b* color system. • Minolta method using Minolta Chroma Meter with Granular-Materials attachment CR-A50 • Desert Durum®: CR-200 colorimeter. • Northern Durum, HRS, SW, SRW: CR-410 colorimeter.

WET GLUTEN is a measure of the quantity of gluten in ground wheat (whole meal) or flour as determined using the Glutomatic System. Wet gluten forms when 2% salt water is added to the protein in ground wheat or flour and is responsible for the elasticity and extensibility characteristics of dough.

- **Methods:** All classes: AACCI 38-12.02 (Glutomatic procedure) performed on flour. Less initial salt water is used for soft wheat, more initial salt water is used for hard wheat. • All values expressed on 14% mb. • As of 2023, wet gluten values are no longer reported for Club wheat.

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. As of 2023 gluten index values are no longer reported for HRW, HRS, SW and SRW.

AMYLOGRAPH VISCOSITY measures flour starch pasting properties that are important to products such as sheeted Asian noodles. Amylograph also measures enzyme (α-amylase) activity indirectly, which is usually from sprout damage.

- **Methods:** HRW, SRW: AACCI 22-10.01. • HRS, SW: AACCI 22-10.01 modified to use 65 g flour (14% mb) and 450 ml distilled water. • HRS uses paddle; SW uses pins.

RAPID VISCO ANALYZER (RVA) generates a curve indicating the viscosity during controlled heating, holding, cooling temperature cycles as a paddle rotates at a constant speed, measuring the functional and pasting properties of starch and cereal flours. Values reported include:

PASTING TEMPERATURE is the temperature at which starch begins to gelatinize.

PEAK VISCOSITY is a measurement of the greatest

FLOUR AND SEMOLINA FACTORS CONTINUED

viscosity achieved during heating. More viscous slurries may indicate lower enzyme activity in flour. Less viscous slurries may indicate less swelling capacity and lower water-holding capacity. Higher values usually result in softer, more cohesive product texture while lower values result in firmer, "clean break" type textures.

HOT PASTE VISCOSITY or Trough Viscosity is the minimum viscosity achieved after the peak viscosity and can indicate shear thinning (starch granule breakdown during shearing). Lower values usually imply greater potential for starch granule deformation, while stable values imply less potential for starch granule deformation.

FINAL VISCOSITY or Cold Paste Viscosity is the viscosity at the end of the cooling stage and may indicate the tendency for the gelatinized starch to gel or retrograde after cooling.

- **Methods:** HRS and SW: AACCI 76-21.01, STD1 pasting profile. RVA data are not yet available for HRW or SRW.

DAMAGED STARCH, the percentage by weight of damaged starch in a flour sample, is a measure of the physical damage done to starch granules during milling. Hard wheat flour typically has higher starch damage than soft wheat flour. Damaged starch granules readily absorb more water, which affects dough mixing and other processing properties. Because starch damage depends on how the sample was milled, this factor is important for interpreting other reported results.

- **Methods:** SRW, HRW: AACCI 76-30.02, Enzymatic hydrolysis. • HRS: AACCI method 76-31.01, Megazyme. • SW: AACCI 76-33.01, SDmatic.

SOLVENT RETENTION CAPACITY (SRC) is the amount of a solvent retained by flour after a period of solvation, and then centrifugation. The weight of the gel created

by the solvation process is expressed as percentage of the weight of flour used in each test, corrected to 14% moisture basis. Four solvents are commonly used – deionized water (measuring overall water absorption/ control solvent), sucrose (measuring arabinoxylan content), lactic acid (high molecular weight glutenins) and sodium carbonate (starch damage) – present a profile of water absorption and retention of the flour measured. Specific ranges of lower SRC values are desirable for specific soft wheat products, while higher SRC values are desirable for bread products. Gluten performance index (GPI), a calculation of three SRC values – [lactic acid/(sodium carbonate + sucrose)] – is a good predictor of overall performance of flour in baking applications.

- **Methods:** HRW, HRS, SRW: AACCI 56-11.02. • HRS, SW: modified rocker shaker (SRC Multi-Tube Automatic Shaker) by Poolphol. • SRW, HRW: manual method.

SUGGESTED SOLVENT RETENTION CAPACITY (SRC) VALUES ARE AS FOLLOWS:

Type of SRC Solvent:	100% Water	50% Sucrose	5% Sodium Carbonate (pH 11)	5% Lactic Acid (pH 2)	Gluten performance index (GPI)
Cracker Flour	50 - 70	80 - 110	60 - 85	100 - 120	
Cookie Flour	50 - 70	80 - 110	60 - 85	85 - 100	
Wafer Flour	50 - 70	80 - 110	60 - 85	80 - 100	
Generic Pan Bread Flour	65 - 70	105 - 115	80 - 90	>130	Min. 0.60
Very Strong Bakers Flour	65 - 70	105 - 115	80 - 90	>140	Min. 0.75

Products made with soft wheat flour (cookies, crackers and wafers) are very sensitive to Lactic Acid SRC values but share similar profiles for the other solvents. A precise Lactic Acid profile with the other solvents in the recommended ranges will go a long way towards eliminating in-plant process problems.

For bread flour, sodium carbonate (Na_2CO_3) maximum value at 88 is recommended. If excessive damaged starch is present (Na_2CO_3> 90), bread staling will be accelerated with reduced shelf life. Higher Sucrose SRC values indicate higher water retention capacity in the finished bread. GPI is highly correlated to bread volume. For generic pan bread flour, GPI values of =>0.65 are recommended for optimum pan bread loaf volume; for very strong bakers flour, GPI values of =>0.75 are recommended. Higher Lactic Acid SRC values and lower Na_2CO_3 values will increase GPI. Na_2CO_3 values can be modified in the milling process.

SPECKS in a semolina sample are small particles of bran or other material that escaped the wheat cleaning and semolina purifying process. Millers can control speck count by thoroughly cleaning and properly tempering and conditioning the wheat before milling. Specks can detract from pasta appearance and desirability.

- **Methods:** A random sample is pressed under a clear plate and the specks (brown and black particles) are counted. This is a subjective measurement unless using an objective imaging machine. • Desert Durum®: Count 1 in^2 and multiply a factor [(no. of specks x 3) + 2] to get total specks for 10 in^2. • Northern Durum: Average of three separate 1in^2 determinations is expressed as specks per 10 in^2.

DOUGH PROPERTY FACTORS

Physical dough tests are used to provide information about the rheological properties of flour and dough, which aid in determining how dough will perform during mixing and further processing. This information is essential for knowing the suitability of dough for different end-products and how the dough will perform during the manufacturing process.

FARINOGRAPH generates a curve that indicates the resistance of dough to mixing (the power used over time) as flour and water are mixed into dough. The results describe the mixing properties of the dough and include:

PEAK TIME is the time interval from the first addition of water to the maximum curve-center consistency of 500 Brabender Units (BU) 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 time 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 products such as yeast-raised breads, while short stability times indicate weaker gluten useful in many other products.

ABSORPTION is the amount of water (as a percent by weight on a 14% mb) required to center the curve peak on the 500-BU line. High water absorption in bread products provides economic advantages by producing more dough pieces with the same amount of flour compared to lower water absorption. Low water absorption is ideal for cookie and cracker products because water has to be baked off for stable finished products.

- **Methods:** HRW, HRS, SW, SRW: AACCI 54-21.02, Constant Flour Weight Procedure. • SW modifies with 50 g bowl; starting in 2023, only medium and high protein SW are tested.

DOUGH PROPERTY FACTORS CONTINUED

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. This method determines deformation resistance of the gluten macropolymer through poly-dimensional deformation, unlike the Extensograph which measures uni-directional gluten deformation. Values reported include:

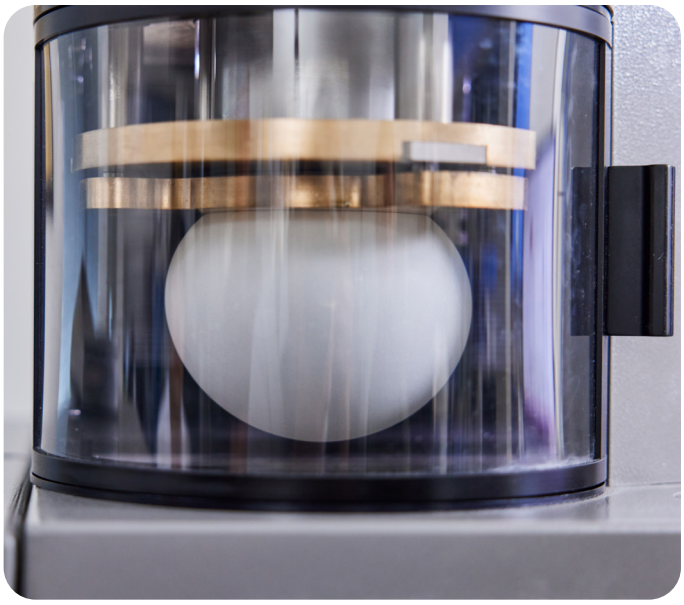
P ("overpressure" or resistance), measured in millimeters of water to the maximum height of the curve, reflects the maximum pressure while blowing the bubble of dough and indicates dough resistance to extension.

L (length), the length of the curve measured in millimeters, reflects the size of the bubble and indicates dough extensibility.

W (the area under the curve), measured in 10^{-4} J, 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 adapted hydration using a Consistograph, for stronger wheats including durum. Requirements differ depending on intended flour use. Low P values (indicating weak gluten) and short L values (low 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 P/L values close to 0.75 are favored for durum for pasta.

- **Methods:** HRW, HRS, SW, SRW and Durum (Northern, Desert Durum®): AACCI 54-30.02, constant hydration method, Chopin-Alveolab.



EXTENSOGRAPH measures the elasticity and stretch resistance of dough, generating a force-time curve for a piece of dough that is unilaterally stretched until it breaks. Results include:

RESISTANCE, measured as the height of the curve 5 cm after the curve has started to rise, reflects the force counteracting the stretching.

MAXIMUM, measured at the maximum curve height in Brabender Units (BU), reflects the maximum force applied and indicates the resistance of the dough to extension.

EXTENSIBILITY, measured as the total length of the curve at the baseline in centimeters, reflects how far the dough was stretched.

AREA is the area under the curve reported in cm^2.

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.

- **Methods:** HRS, HRW: AACCI 54-10.01, modified 45 and 135-min rest. • SW, SRW: AACCI 54-10.01, 45-min rest.

EVALUATION OF END-PRODUCTS

End-product tests are the final laboratory testing in the evaluation of wheat quality. Standardized methods are used to evaluate the suitability of the sample for that product or similar products.

BREAD

BAKING ABSORPTION is the water required for optimum dough mixing performance, expressed as a percent of flour weight on a 14% mb.

LOAF VOLUME is the volume of a test loaf after baking. Higher loaf volumes indicate better baking performance for pan breads.

SPECIFIC VOLUME is defined as the ratio of volume in milliliters to the weight in grams. Larger specific volume is usually preferred.

METHODS:

- **HRW:** AACCI 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 to 125 rpm. The dough is fermented for 60 min, punched two times, then molded, panned and proofed for 60 min before baking at 218°C (425°F) for 18 min. Loaf volume is measured by rapeseed displacement immediately after baking. Crumb grain and texture are evaluated on a 0 to 6 scale, which for this booklet is converted to a 1 to 10 scale.
- **SRW:** AACCI 10-10.03 ("pup loaf" method); 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 by rapeseed displacement immediately after baking.

- **HRS:** AACCI 10-09.01 (long fermentation method) modified: 15 SKB units (fungal amylase/100 g flour, 1.5% instant dry yeast, 10 ppm ammonium phosphate, 2% added shortening). Dough is mechanically punched, molded and baked in "Shogren-type" pans. Scoring is based on a 1 to 10 scale with higher numbers indicating preferred quality attributes.
- **SW:** AACCI 10-10.03 ("pup loaf" method) with 180 min fermentation measured by laser light using a Tex Vol Instrument (BVM-L370).

EVALUATION OF END-PRODUCTS CONTINUED

SPAGHETTI

Spaghetti (or pasta) was made using the laboratory procedure described by Walsh, Ebeling, and Dick, Cereal Sci. Today: 16(11) 385, 1971. A 1-Kg semolina was mixed with the appropriate amount of water that gave a dough consistency of 30-32% total water absorption.

The other processing conditions used were:

- **Northern Durum, HRS:** Water temperature, 40 C, extruder shaft speed 25 rpm and vacuum, 18 in. Hg; the dough was pressed through an 84-strand teflon-coated spaghetti die with 1.57 mm openings. Semolina-water mixture is extruded using a DeMaco laboratory pasta extruder. The extruded spaghetti samples were dried at high temperature (70-90 C) for 12 hrs, using maximum temperature and relative humidity of 73 C and 83%, respectively.
- **Desert Durum®:** Water temperature, 40 C, extruder shaft speed 29 rpm and vacuum, 18 in. Hg; the dough was pressed through an 96-strand teflon-coated spaghetti die with 1.78 mm openings. Semolina-water mixture is extruded using a Standard Industry laboratory pasta extruder. The extruded spaghetti samples were dried at low temperature (40 C) for 18 hrs, using maximum temperature and relative humidity of 40 C and 95%, respectively.

COOKED WEIGHT is the increase in weight of pasta by cooking and is best used in conjunction with firmness values to determine the cooking qualities of a spaghetti sample. The increase in cooked weight should be approximately three times or 300%.

- **Method**: 10 g of dry spaghetti are placed in 300-350 ml boiling distilled water and cooked for 12 min. The cooked and drained spaghetti sample is weighed, and the results are reported in grams.

COOKING LOSS is a measure of the amount of soluble components that leach from pasta during cooking.

- **Method:** AACC Method 66-50.01. After drying the residue is weighed and reported as percentage of the original dry sample.

FIRMNESS is a measure of the amount of work required to bite through a strand of spaghetti.

- **Method:** AACCI Method 66-50.01 with a Plexiglas tooth attached to a Texture Analyzer (Model TA-XT2, Texture Technology Corp., Scarsdale, New York). Firmness values will differ due to variance in dry spaghetti diameter ranges: Desert Durum® is 1.60-1.65 mm and Northern Durum is 1.35 to 1.45 mm.

COLOR is the measure of finished spaghetti color after the drying process.

- **Method**: CIE 1976 L*a*b* color system. See "color" under Flour and Semolina Factors. • High L* values indicate a bright color and higher b* values indicate more yellow. • Desert Durum® is measured with a CR-200 colorimeter and Northern Durum is measured with a CR-410 colorimeter.

SPONGE CAKE

VOLUME is measured by Tex-Vol Volumeter. Larger volume indicates better flour.

HARDNESS measured by TA-XT Plus texture analyzer for hardness in grams of resistance during compression. Lower number means softer texture.

- **Method:** SW, SRW: volume (measured by laser scanning topography using a Tex Vol Instrument (BVM-L370)) and hardness is measured by TA-XT Plus texture analyzer. Flour with low protein content, weak gluten characteristics and low ash content make good quality sponge cake. • Japanese standard method described by Nagao in Cereal Chemistry 53:977-988, 1976. Sponge cake control flour is "western white." • Mechanical folding method as described by Mense et al. in Cereal Chemistry https://doi.org/10.1002/cche.10791, 2024.

Note: Total Score is a subjective measurement and as of 2023 is no longer reported.

SUGAR-SNAP COOKIES (BISCUITS)

DIAMETER (d), or width, is a static measurement of spread (in cm) and set time during baking and is an indicator of good pastry-making and specifically cookie-baking potential. Larger diameter is preferred.

HEIGHT (h), or thickness, is closely related to diameter with larger diameters (measured in cm) typically leading to reduced height.

SPREAD FACTOR is determined by d/h ratio with adjustments to constant atmospheric pressure and conditions depending on elevation and barometric pressure reading corrected to sea level.

- **Method:** SW, SRW: AACCI 10-50.05, macro-method.

Note: Prior to 2023, SW cookie testing was conducted according to micro-method AACCI 10-52.02. Diameter and height of cookies made with both AACCI 10-52.02 and 10-50.05 are different due to changes in formulation and procedure; however, the overall trend is similar.

STEAMED BREAD (CHINESE SOUTHERN-TYPE)

SPECIFIC VOLUME is defined as the ratio of volume in milliliters to the weight in grams. Larger specific volume is usually preferred.

HARDNESS measured by TA-XT Plus texture analyzer for hardness in grams of resistance during compression. Lower number means softer texture.

- **Method:** Steam bread was prepared using no-time dough methods (WMC procedures) • SW, white club (WC, Club): flour 100% (400 g), sugar 15%, shortening 4%, baking powder 1.2%, instant yeast 0.8%, nonfat dry milk powder 3% and water 39 to 43%. Yeast is dissolved in water before use.

LABORATORY TESTING

The data in this report are derived from sample testing and analysis conducted at partner laboratories across the United States. Their locations and the wheat class that each laboratory tests is noted below.

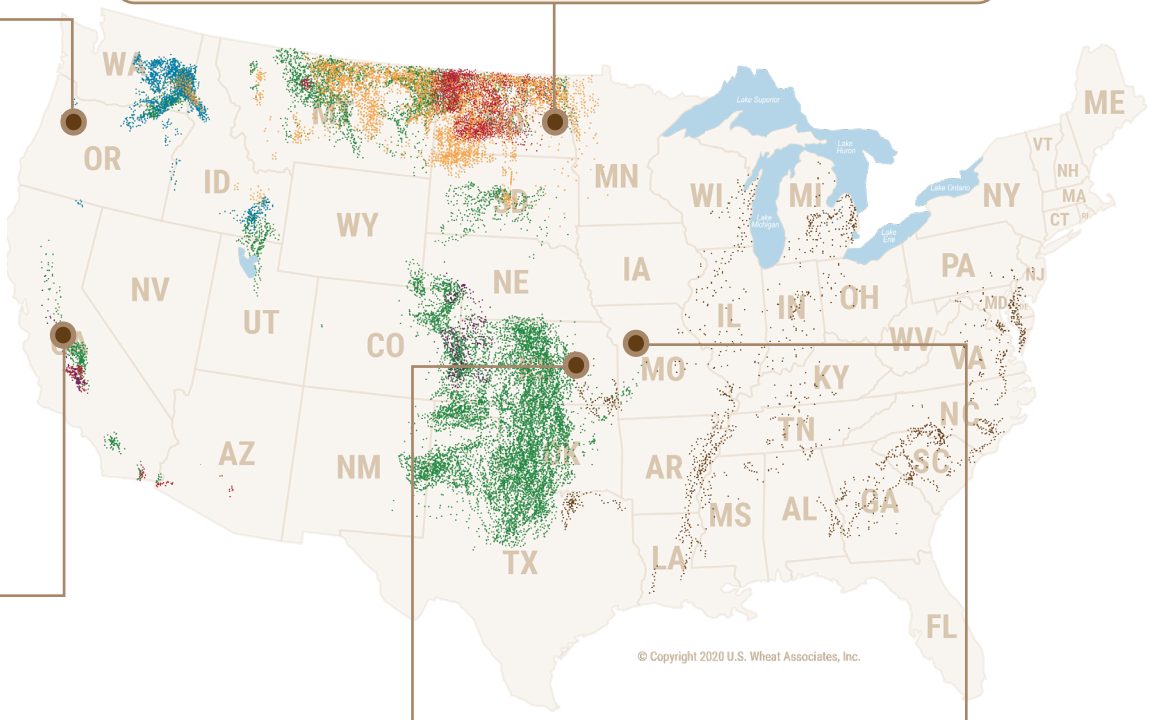
NDSU NORTH DAKOTA STATE UNIVERSITY

The HRS Wheat Quality Lab at NDSU in Fargo, North Dakota, conducted quality testing and analyses on **hard red spring (HRS)**.

The Durum Quality Lab at NDSU conducted quality testing and analyses on **Northern Durum**.

WHEAT MARKETING CENTER

The WMC in Portland, Oregon conducted quality testing and analyses on **soft white (SW)**.



California WHEAT COMMISSION

The CWC Laboratory in Woodland, California conducted quality testing and analyses on **Desert Durum®**.

USDA Agricultural Research Service

PGI Plains Grains Inc.

The USDA/ARS Hard Winter Wheat Quality Lab (HWWQL) in Manhattan, Kansas conducted the quality testing for **hard red winter (HRW)**. Plains Grains Inc. in Lincoln, Nebraska provided analyses.

GPAL

Great Plains Analytical Laboratory in Kansas City, Missouri, conducted quality testing on **soft red winter (SRW)**.

STORIES OF SUSTAINABILITY

Farmers are called to wisely use the gifts of soil, water, and seed to produce a crop and living. They nourish and improve the land for the next generation, working every day to provide a sustainable source of high-quality wheat for the world.

SCAN THIS QR CODE OR VISIT USWHEAT.ORG FOR STORIES OF SUSTAINABILITY.

DEPENDABLE PEOPLE. RELIABLE WHEAT.

The U.S. farm families who produce the wheat and the industry that supplies it remain committed to operating a transparent and open market. Here are some of the reasons why our overseas customers know they can depend on the integrity of our supply chain, the quality of U.S. wheat and our unmatched reliability as a supplier.

THE U.S. WHEAT "STORE" IS ALWAYS OPEN.

U.S. farmers overcome significant risk every year to meet domestic wheat demand and still provide half their crop for export markets. Farmers and commercial warehouses can store and efficiently transport wheat in top condition to meet overseas demand when needed and throughout the marketing year.

PRICES ARE TRANSPARENT AND HONORED.

U.S. wheat export prices are discovered openly through futures exchanges and basis costs and are always available to customers. Private exporters use risk management tools to honor sales contract prices often made months in advance of vessel loading.

QUALITY IS ASSURED.

USW publishes weekly reports during harvest that summarize initial wheat quality findings. USW works with several organizations and laboratories to analyze hundreds of wheat samples for all six U.S. wheat classes and publishes all results in the annual Crop Quality Report. Our staff, farmers and industry experts then travel the world to present the results to our customers and end users. U.S. country elevators and export elevators inspects and tests wheat as it arrives and segregates each class by quality to meet customer requirements. The Federal Grain Inspection Service (FGIS) independently inspects wheat at vessel loading to certify that the quality loaded matches the customer's specifications.

EXPORT LOGISTICS DEEMED ESSENTIAL.

In the COVID-19 outbreak, all farmers and food distribution industries were deemed essential. Export grain systems and FGIS inspections have continued operating with little or no interruption.

DIRECT GOVERNMENT EXPORT INTERVENTION IS BANNED.

Several U.S. federal laws protect the sanctity of all export contracts. The only exception is a declared national emergency.

BUYERS RECEIVE UNMATCHED TRADE SERVICING AND TECHNICAL SUPPORT.

With funding from U.S. wheat farm families and USDA's Foreign Agricultural Service, experienced USW staff and consultants add exceptional value to all U.S. wheat class imports.

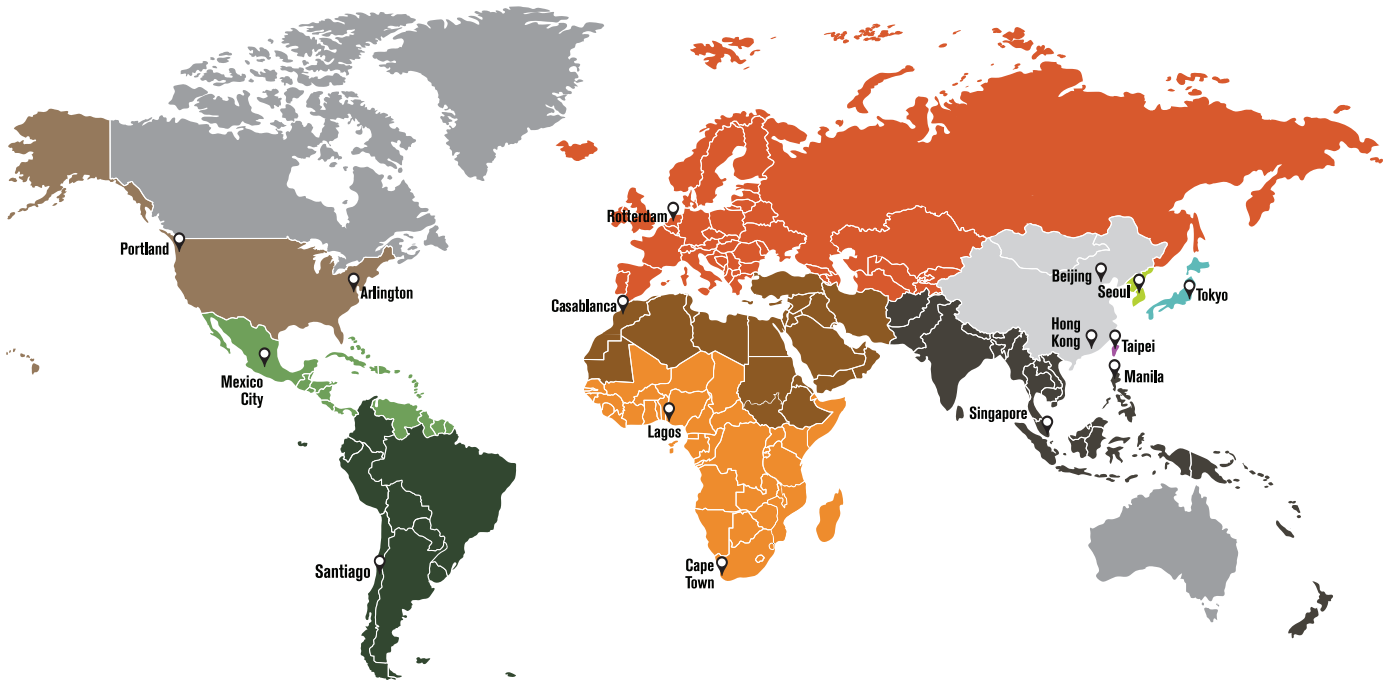
FOSTERING TRADE.

USW invests substantial funding from farmers and federal programs to help overcome trade or technical barriers that would otherwise keep end-users from realizing the highest value and most revenue from using U.S. wheat.

U.S. WHEAT ASSOCIATES

Dependable People. Reliable Wheat.

www.uswheat.org



WORLD HEADQUARTERS

3103 10th Street, North, Suite 300
Arlington, VA 22201

TELEPHONE (202) 463-0999
FAX (703) 524-4399
EMAIL infoARL@uswheat.org

WEST COAST U.S. OFFICE

1200 NW Naito Parkway, Suite 600
Portland, OR 97209

TELEPHONE (503) 223-8123
FAX (503) 223-5026
EMAIL infoPDX@uswheat.org

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 wheat's profitability for U.S. wheat producers and its value for their customers." USW activities are funded by producer checkoff dollars managed by 17 state wheat commissions and USDA Foreign Agricultural Service cost-share programs. For more information, visit www.uswheat.org or contact your state wheat commission.

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