

2022 **CROP QUALITY REPORT**

High quality wheat for every need.



**U.S. WHEAT
ASSOCIATES**

Dependable People. Reliable Wheat.





FROM THE PRESIDENT

Dear Friends:

On behalf of my colleagues at U.S. Wheat Associates (USW), we are very pleased to present the 2022 U.S. Wheat Crop Quality Report.

This annual report represents our goal to provide the most complete information about the milling and end-use qualities of U.S. wheat. With market factors keeping global wheat prices and volatility high, using this data will help you increase the value of your purchases, improve your products, and grow your business.

Just as your costs increased, so did the cost of producing and transporting wheat. Yet once again, U.S. wheat farmers overcame much risk to produce excellent quality hard red winter (HRW), hard red spring (HRS), soft red winter (SRW), white and durum wheat classes for their overseas customers.

The supply and functional quality of the 2022 U.S. HRS and soft white (SW) wheat crops are much improved from last year. Dry growing conditions limited the U.S. HRW supply this year, but the crop meets or exceeds typical specifications. The 2022 U.S. SRW wheat crop is very sound with good milling characteristics and baking performance. Just like the consistently excellent Desert Durum® crop, the Northern durum crop maintained a U.S. No. 1 HAD grade throughout the year.

With the dedicated support from your local USW representatives, we recommend using this and past performance data as a baseline for comparing your own results.

This report reflects the support of our state wheat commission members and many public and private service providers who collect and analyze the samples and tabulate results. We also appreciate the sustained support of our respected partners at the USDA Foreign Agricultural Service.

Thank you again for choosing U.S. wheat!

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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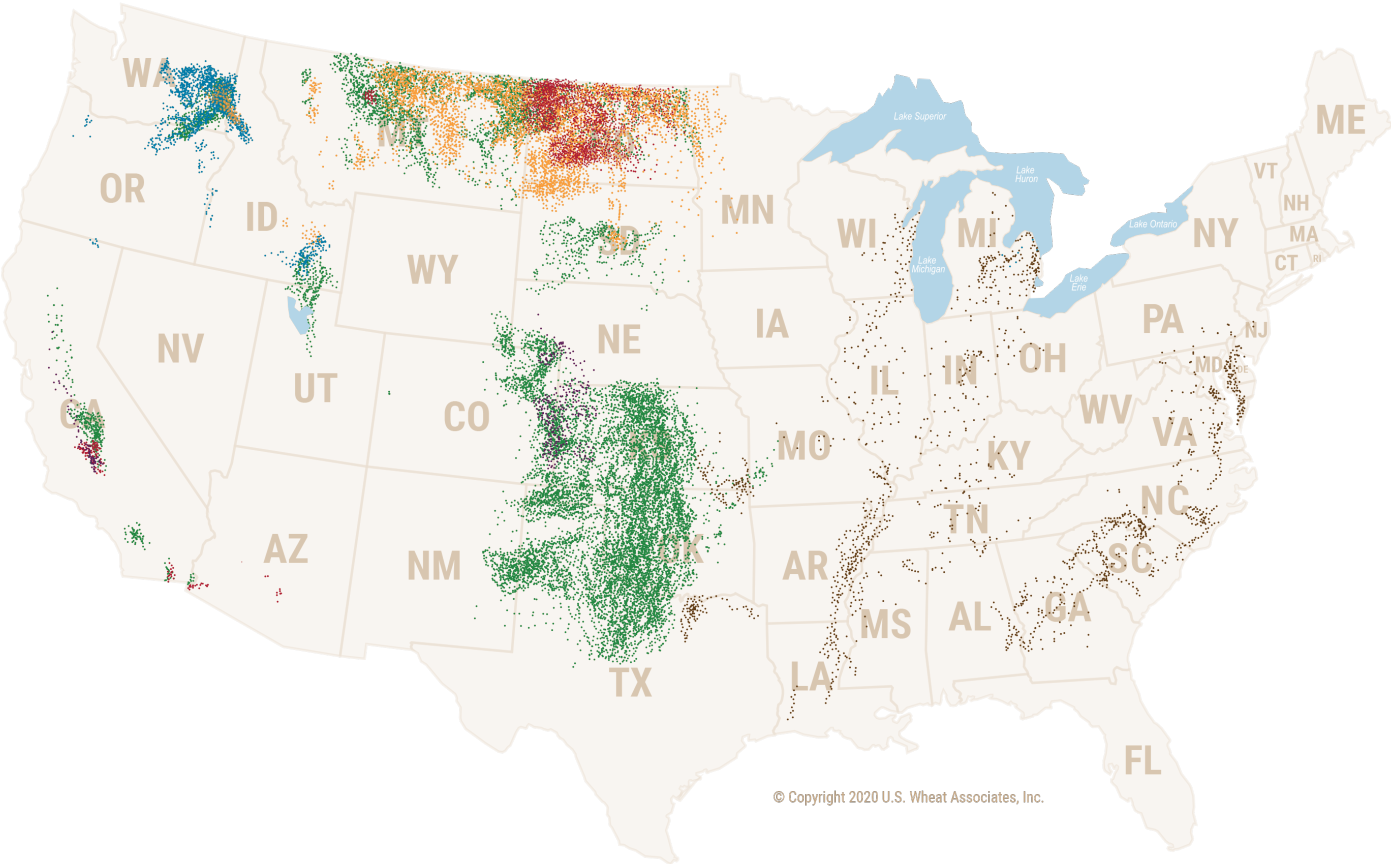
A note on Hard White

The 2022 Hard White crop quality data can now be found in a stand-alone report. Scan the QR code below with the camera application on your smartphone to access the report and further information at the USW website (www.uswheat.org/cropquality).





2022 CROP QUALITY OVERVIEW



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PLANTING AND HARVEST DATES

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



U.S. PRODUCTION BY CLASS

CROP YEAR (BEGINNING JUNE 1) (MMT)

	2022	2021	2020	2019	2018
Hard Red Winter	14.5	20.4	17.9	22.7	18.0
Hard Red Spring	12.1	8.1	14.4	15.2	16.0
Hard White	0.5	0.7	0.6	0.9	0.9
Durum	1.7	1.0	1.9	1.6	2.1
Soft White	6.9	4.8	7.6	6.6	6.5
Soft Red Winter	9.2	9.8	7.2	6.5	7.8
Total	44.9	44.8	49.7	53.4	51.3

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

U.S. SUPPLY AND DEMAND

ESTIMATED FOR 2022/23 (BEGINNING JUNE 1) (MMT)

	HRW	HRS	SRW	White ¹	Durum	Total
Beginning stocks	9.8	3.8	2.6	1.4	0.6	18.2
Production	14.5	12.1	9.2	7.4	1.7	44.9
Imports	0.1	1.6	0.1	0.1	1.2	3.3
Total Supply	24.4	17.6	11.9	9.0	3.6	66.4
Domestic Use	11.5	7.9	5.7	2.3	2.1	29.6
Exports	6.0	6.1	3.7	4.6	0.7	21.1
Total demand	17.5	14.0	9.4	7.0	2.8	50.7
Ending stocks	6.9	3.5	2.5	2.0	0.8	15.7
Stocks 5-year average	9.9	6.7	2.3	4.3	1.1	27.1

Based on USDA Supply/Demand estimates as of October 12, 2022.

¹Includes 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	
	2022	5-Year Avg	2022	5-Year Avg	2022	5-Year Avg	2022	5-Year Avg	2022	5-Year Avg	2022	5-Year Avg
Test Weight (lb/bu)	61.0	60.9	62.1	61.5	61.0	61.1	60.1	58.9	61.8	61.1	64.1	62.8
(kg/hl)	80.2	80.0	81.6	80.9	80.2	80.3	79.1	77.5	80.4	79.5	83.4	81.8
Grade	1 HRW	1 HRW	1 NS	1 NS	1 SW	1 SW	1 SRW	2 SRW	1 HAD	1 HAD	1 HAD	1 HAD
Dockage (%)	0.5	0.5	0.6	0.5	0.5	0.5	0.4	0.3	1.1	0.9	0.2	0.3
Moisture (%)	10.2	11.1	11.6	12.0	8.9	9.1	12.4	13.3	11.0	11.3	7.3	6.9
Wheat Protein (%), 12% mb	13.0	11.6	14.3	14.6	9.5	10.0	9.6	9.5	13.7	14.4	13.2	13.8
Wheat Ash (%), 14% mb	1.57	1.52	1.57	1.55	1.47	1.37	1.46	1.62	1.64	1.55	1.58	1.68
1000 Kernel Weight (g)	31.4	31.3	30.4	30.7	34.8	34.6	32.9	32.7	40.4	42.3	51.9	47.1
Falling Number (sec)	361	370	386	375	340	327	327	309	433	399	713	665
Flour/Semolina Extraction (%) ²	78.1	75.2	66.2	68.2	71.7	72.2	66.4	67.4	n/a	n/a	79.7	77.1
Flour/Semolina Ash (%) ²	0.52	0.51	0.49	0.53	0.40	0.43	0.41	0.43	0.64	0.66	0.79	0.83
Wet Gluten (%)	32.3	25.5	34.5	35.2	19.9	22.9	20.7	21.2	33.4	34.5	33.4	34.2
Farinograph:												
Peak Time (min)	5.8	4.5	8.0	8.1	2.1	2.1	1.2	1.2	n/a	n/a	n/a	n/a
Stability (min)	8.9	8.9	12.2	12.5	2.0	2.6	1.6	1.8	n/a	n/a	n/a	n/a
Absorption (%)	59.8	58.5	63.1	62.8	50.8	52.1	51.2	52.4	n/a	n/a	n/a	n/a
W (10 ⁻⁴ J)	216	229	400	383	79	84	85	83	222	204	180	239
Loaf Volume (cc)	939	851	938	978	641	n/a	624	675	n/a	n/a	n/a	n/a
Production (MMT)	14.4	18.7	12.1	13.2	6.9	6.5	9.2	8.1	1.4	1.4	0.4	0.2

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¹HRW data does not include California.

²Durum 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 Classes²					
Contrasting classes	1.0	2.0	3.0	10.0	10.0
Total ³	3.0	5.0	10.0	10.0	10.0
Stones	0.1	0.1	0.1	0.1	0.1
MAXIMUM COUNT LIMITS (ALL GRADES):					
Other material (1000 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, castor beans, crotalaria seeds, glass, stones, or unknown foreign substance.

ABBREVIATIONS

°C	Celsius	in	inch
°F	Fahrenheit	J	joules
α-amylase	alpha-amylase	kg	kilogram
AACCI	American Association of Cereal Chemists	kg/hl	kilograms/hectoliter
AD	Amber Durum	lb	pound
BU	Brabender Unit	lb/bu	pounds/bushel
bu	Winchester bushel	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
hr	hour	USDA	United States Department of Agriculture
HRS	Hard Red Spring	WMC	Wheat Marketing Center
HRW	Hard Red Winter	WW	Western White

UNIT CONVERSION FACTORS

The weight units conversion matrix should be read from the top, left. For example: **1 MT** is equal to **1000 kg**.

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)

	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	2,204.60	2,240	2,000	100	2.205
MT	0.0272	0.0005	1	1.016	0.9072	22.046	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	1.11993	1	0.05	0.0011
cwt	0.600	0.01	22.046	22.3986	20.3748	1	0.022
kg	27.2	0.4536	1000	1,016	907.2	45.36	1

FLOUR PROTEIN:

14% mb to dry basis = Protein (14% mb) x 0.86

Dry basis to 14% mb = Protein (14% mb) / 0.86

WHEAT PROTEIN:

12% mb to dry basis = Protein (12% mb) x 0.88

Dry basis to 12% mb = Protein (12% mb) / 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
- Blending improver
- Cereals
- Croissants
- Dumplings, Chinese
- Flatbreads
- Flours (general-purpose, bread)
- Hard rolls
- Hearth breads
- Noodles, Asian-style
- Pan breads (white, whole wheat, whole grain, etc.)
- Pasta
- Steamed bread (mushipan)
- Wide variety of other baked goods
- Yeast breads and rolls

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



SURVEY METHODOLOGY

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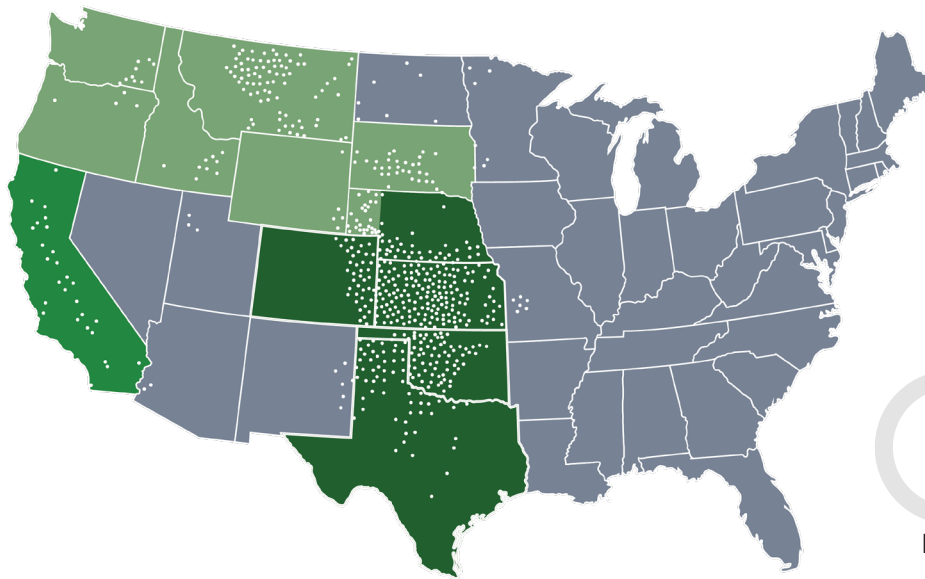
Samples collected from grain elevators in 40 reporting areas after at least 30% of the local harvest was complete.

SAMPLE COLLECTION AND ANALYSIS

Plains Grains Inc. in Stillwater, Oklahoma and USDA/ARS Hard Winter Wheat Quality Lab in Manhattan, Kansas collected samples and conducted quality analyses.

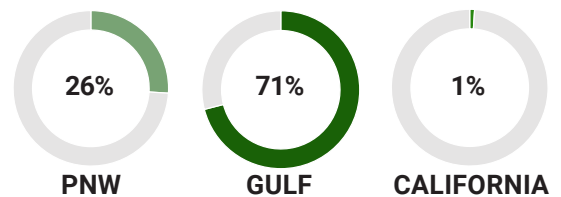
SAMPLE TESTING

Official grade and non-grade factors were determined on each sample. Functionality tests were conducted on 75 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 Composite, Gulf-Tributary and PNW-Tributary averages. The methods are described in the Analysis Methods section of this booklet.



12
STATES SURVEYED FOR QUALITY
DATA

98%
OF TOTAL HRW PRODUCTION
REPRESENTED



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



HARD RED WINTER PRODUCTION

FOR THE MAJOR PRODUCING STATES (MMT)

	2022	2021	2020	2019	2018
California	0.1	0.2	0.1	0.1	0.2
Colorado	0.9	1.8	1.1	2.5	1.7
Idaho	0.3	0.2	0.3	0.3	0.3
Kansas	6.2	9.3	7.3	8.8	7.2
Montana	1.6	1.5	2.1	2.6	2.1
Nebraska	0.7	1.1	0.9	1.4	1.3
Oklahoma	1.8	3.1	2.8	3.0	1.9
Oregon	0.1	0.1	0.1	0.1	0.1
South Dakota	1.0	0.7	0.9	1.1	0.9
Texas	1.0	1.9	1.6	1.8	1.4
Washington	0.3	0.2	0.3	0.5	0.5
Wyoming	0.0	0.1	0.1	0.1	0.1
Twelve-State Total	14.1	20.1	17.7	22.3	17.7
Gulf-Tributary	10.3	16.5	13.2	16.6	12.7
PNW-Tributary	3.8	3.5	4.4	5.6	4.8
Total HRW Production	14.5	20.4	17.9	22.7	18.0

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

PLANTED area for the 2022 HRW crop was estimated to be 23.5 million acres (9.5 million hectares) seeded in fall 2021, similar to planted acres the previous year.

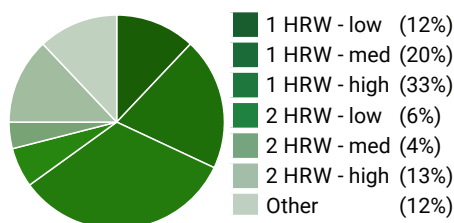
GROWING conditions varied among the HRW production regions. Southern and Central Plains experienced historic drought resulting in lower yields and smaller kernels, but higher protein. While the Northern Great Plains and PNW experienced favorable growing conditions resulting in high yields, very good kernel characteristics, but lower protein.

PRODUCTION of the 2022 HRW crop is estimated to be 14.4 MMT, down 29% from 20.4 MMT in 2021 due to widespread drought across much of the HRW production region. The 2022 HRW production is the lowest on record since 1963.

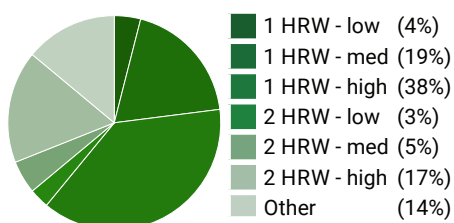
DISTRIBUTIONS BY GRADE

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

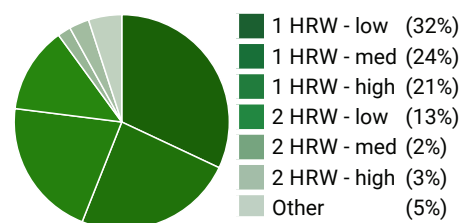
OVERALL



GULF-TRIBUTARY



PNW-TRIBUTARY



COMPOSITE HARVEST DATA

	2022 BY PROTEIN ¹			2022	2021	5-Year
	Low	Med	High	Avg	Avg	Avg
WHEAT GRADE DATA:						
Test Weight (lb/bu)	62.0	61.3	60.9	61.0	60.4	60.9
(kg/hl)	81.5	80.7	80.0	80.2	79.5	80.0
Damaged Kernels (%)	0.3	0.5	0.5	0.5	2.1	0.6
Foreign Material (%)	0.2	0.1	0.1	0.1	0.3	0.2
Shrunken & Broken (%)	1.1	1.1	1.1	1.1	0.8	0.9
Total Defects (%)	1.6	1.8	1.8	1.8	1.7	1.4
Grade	1 HRW	1 HRW	1 HRW	1 HRW	1 HRW	1 HRW
WHEAT NON-GRADE DATA:						
Dockage (%)	0.3	0.4	0.5	0.5	0.5	0.5
Moisture (%)	10.8	9.6	10.4	10.2	11.2	11.1
Protein (%) 12%/0% mb	11.2/12.7	12.1/13.8	13.5/15.3	13.0/14.8	11.9/13.5	11.6/13.2
Ash (%) 14%/0% mb	1.50/1.71	1.52/1.73	1.60/1.86	1.57/1.83	1.59/1.82	1.52/1.76
1000 Kernel Weight (g)	30.0	32.1	31.3	31.4	30.5	31.3
Kernel Size (%) lg/md/sm	61/37/2	64/35/1	56/42/2	58/40/2	68/31/1	66/32/2
Single Kernel: Hardness	68.8	63.5	67.5	66.4	62.0	62.7
Weight (mg)	30.0	32.1	31.2	31.4	30.4	31.4
Diameter (mm)	2.59	2.62	2.58	2.59	2.60	2.62
Sedimentation (cc)	44.9	52.9	59.0	57.2	46.6	47.1
Falling Number (sec)	357	367	359	361	372	370
DON (ppm)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
FLOUR DATA:						
Lab Mill Extraction (%)	77.7	78.3	77.9	78.1	74.9	75.2
Color: L*	90.9	90.7	90.3	90.4	90.6	90.9
a*	-1.6	-1.6	-1.5	-1.6	-1.5	-1.5
b*	9.7	10.1	9.9	10.0	9.9	10.1
Protein (%) 14%/0% mb	9.9/11.5	11.3/13.4	12.6/14.7	12.2/14.2	10.8/12.5	10.5/12.2
Ash (%) 14%/0% mb	0.51/0.59	0.52/0.60	0.53/0.62	0.52/0.60	0.50/0.59	0.51/0.59
Wet Gluten (%)	24.2	29.5	33.5	32.3	27.0	25.5
Gluten Index	99	96	92	94	96	97
Falling Number (sec)	402	406	403	404	415	377
Amylograph Viscosity: 65g (BU)	802	790	762	769	776	669
Damaged Starch (%)	6.8	6.8	6.6	6.7	5.6	6.4
SRC: Water/50% Sucrose (%)	63/104	66/113	66/114	65/112	67/109	64/108
5% Lactic Acid/5% Na ₂ CO ₃ (%)	118/82	136/86	139/86	135/86	125/90	131/90
Gluten Performance Index (GPI) (%)	0.66	0.68	0.72	0.69	0.63	0.67
DOUGH PROPERTIES:						
Farinograph: Peak Time (min)	4.2	5.4	5.9	5.8	5.1	4.5
Stability (min)	8.8	8.5	9.1	8.9	9.3	8.9
Absorption (%)	56.7	58.7	60.2	59.8	58.2	58.5
Alveograph: P (mm)	84	92	92	92	89	87
L (mm)	56	63	66	65	64	75
P/L Ratio	1.58	1.47	1.43	1.44	1.36	1.17
W (10 ⁻⁴ J)	175	213	219	216	203	229
Extensograph (45/135 min): Resistance (BU)	472/849	479/839	453/830	459/828	478/781	467/774
Extensibility (cm)	13.4/11.3	14.3/12.6	15.1/13.8	14.8/13.4	14.4/12.7	14.1/12.1
Area (cm ²)	82/117	90/129	89/137	89/133	90/121	79/112
BAKING EVALUATION:						
Pan Bread: Bake Absorption (%)	61.9	63.8	65.9	65.3	62.1	62.5
Crumb Grain and Texture (1-10)	5.6	6.4	6.3	6.3	6.6	6.3
Loaf Volume (cc)	828	910	952	939	877	851
% OF PRODUCTION:						
	7	23	70	100		

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



GULF-TRIBUTARY HARVEST SURVEY

Historic drought conditions greatly impacted HRW grown in the Southern and Central Great Plains, leading to fewer kernels per head and lower yields. Because of the dryness, disease and insect pressure did not affect quality. Despite the environmental challenges, grain quality is excellent with high protein content, high extraction, soundness and notable absorption levels. The loaf volumes achieved surpass U.S. quality targets. Overall, this crop meets or exceeds typical HRW contract specifications and should provide high value to customers.

2022 GULF-TRIBUTARY CROP HIGHLIGHTS

The average **GRADE** for the 2022 Gulf-tributary HRW harvest survey is U.S. No. 1 HRW. Despite challenging growing conditions, 86% of Gulf-tributary crop graded U.S. No. 2 or better.

TEST WEIGHT average is 60.4 lb/bu (79.4 kg/hl), indicative of sound wheat.

SHRUNKEN AND BROKEN average at 1.2%, reflects the environmental challenges for this year's crop.

PROTEIN content average is 13.0% (12% mb) with 58% of the samples 12.5% or higher.

KERNELS are smaller and harder than average, but they are also uniform in shape resulting in higher lab mill extractions.

WHEAT FALLING NUMBER average is 337 sec, indicative of sound wheat.

FLOUR ASH average of 0.53% (14% mb) is comparable to the 5-year average.

WET GLUTEN average of 31.1% is well above last year and the 5-year average, reflective of excellent gluten strength.

SOLVENT RETENTION CAPACITY GPI value of 0.68 is higher than last year and the 5-year average and indicates good performance of flour

in baking applications.

DOUGH PROPERTIES suggest that this crop has improved absorption over last year and improved stability reflecting the higher average protein content.

FARINOGRAPH PEAK and **STABILITY** times of 5.7 and 9.1 min, respectively, are shorter than last year but higher than the 5-year average.

Average **BAKE ABSORPTION** is 65.1%, significantly higher than last year.

Average **LOAF VOLUME** of 940 cc is well above last year and 5-year averages, indicative of excellent baking quality.

"2022 was a challenging year for Hard Red Winter (HRW) wheat farmers. The year started out very dry, but rain in April and May finally made a crop. Yields varied and total production was down. However, it was a really good quality crop overall. We are excited about the protein levels, the test weights were good, and the kernels are uniform. I think you're going to be happy with the quality of the HRW wheat crop this year."

— Mike McClellan, Kansas wheat farmer



Kansas, June 2022, Mike McClellan



Texas, May 2022, Kimbrell Farms

GULF-TRIBUTARY HARVEST DATA

	2022 BY PROTEIN ¹			2022	2021	5-Year
	Low	Med	High	Avg	Avg	Avg
WHEAT GRADE DATA:						
Test Weight (lb/bu)	60.5	60.6	60.2	60.4	60.6	60.5
(kg/hl)	79.6	79.7	79.3	79.4	79.7	79.6
Damaged Kernels (%)	0.7	1.0	0.9	0.9	0.5	0.3
Foreign Material (%)	0.3	0.2	0.2	0.2	0.3	0.2
Shrunken & Broken (%)	0.9	1.1	1.2	1.2	0.9	1.0
Total Defects (%)	1.8	2.2	2.3	2.3	1.8	1.5
Grade	1 HRW	1 HRW	1 HRW	1 HRW	1 HRW	1 HRW
WHEAT NON-GRADE DATA:						
Dockage (%)	0.4	0.4	0.5	0.5	0.5	0.5
Moisture (%)	11.1	11.0	10.5	10.7	11.4	11.3
Protein (%) 12%/0% mb	11.1/12.7	12.2/13.8	13.6/15.4	13.0/14.8	11.6/13.2	11.7/13.3
Ash (%) 14%/0% mb	1.48/1.72	1.53/1.78	1.59/1.85	1.57/1.83	1.59/1.81	1.53/1.78
1000 Kernel Weight (g)	30.7	31.2	30.0	30.4	30.9	30.7
Kernel Size (%) lg/md/sm	63/35/2	62/37/1	55/43/2	57/41/2	71/28/1	65/34/1
Single Kernel: Hardness	59.4	63.6	66.2	65.0	61.0	62.2
Weight (mg)	30.7	31.2	30.0	30.4	30.8	30.7
Diameter (mm)	2.57	2.59	2.55	2.56	2.62	2.58
Sedimentation (cc)	39.4	48.7	56.4	53.5	44.2	46.4
Falling Number (sec)	338	332	339	337	373	374
DON (ppm)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
FLOUR DATA:						
Lab Mill Extraction (%)	78.1	78.4	77.8	78.0	75.1	75.3
Color: L*	90.7	90.6	90.4	90.6	90.6	90.9
a*	-1.6	-1.5	-1.4	-1.5	-1.5	-1.5
b*	9.9	9.8	9.8	9.8	9.9	10.2
Protein (%) 14%/0% mb	9.9/11.5	11.1/12.9	12.5/14.6	12.0/13.9	10.8/12.6	10.6/12.3
Ash (%) 14%/0% mb	0.52/0.60	0.53/0.61	0.54/0.63	0.53/0.62	0.50/0.59	0.52/0.60
Wet Gluten (%)	23.3	28.1	33.1	31.1	26.2	25.9
Gluten Index	98	97	91	93	96	97
Falling Number (sec)	389	382	395	392	415	383
Amylograph Viscosity: 65g (BU)	652	634	629	633	782	685
Damaged Starch (%)	6.6	6.6	6.5	6.5	5.5	6.3
SRC: Water/50% Sucrose (%)	62/103	66/114	66/115	66/114	68/110	65/107
5% Lactic Acid/5% Na ₂ CO ₃ (%)	115/81	137/87	137/86	135/86	126/91	130/88
Gluten Performance Index (GPI) (%)	0.62	0.69	0.68	0.68	0.65	0.67
DOUGH PROPERTIES:						
Farinograph: Peak Time (min)	4.2	5.4	6.0	5.7	4.8	4.6
Stability (min)	8.7	8.7	9.2	9.1	8.9	8.9
Absorption (%)	56.7	58.4	60.2	59.5	57.9	58.3
Alveograph: P (mm)	82	89	89	89	87	84
L (mm)	55	65	73	70	64	77
P/L Ratio	1.51	1.38	1.22	1.28	1.36	1.11
W (10 ⁻⁴ J)	168	208	226	217	195	225
Extensograph (45/135 min): Resistance (BU)	452/810	479/839	454/826	460/828	462/761	458/780
Extensibility (cm)	13.3/11.3	14.3/12.7	15.1/13.9	14.8/13.4	14.3/12.6	14.2/12.3
Area (cm ²)	90/129	90/138	89/134	87/117	88/120	92/130
BAKING EVALUATION:						
Pan Bread: Bake Absorption (%)	61.2	63.6	66.0	65.1	61.6	62.6
Crumb Grain and Texture (1-10)	5.8	6.5	6.4	6.4	6.5	6.4
Loaf Volume (cc)	842	918	959	940	867	862
% OF PRODUCTION:	6	17	50	73		

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



PNW-TRIBUTARY HARVEST SURVEY

While it was a moderately dry year for HRW grown in the Northern Great Plains and Pacific Northwest (PNW), the northern region recovered from last year's historic drought. The 2022 PNW-tributary crop has sound kernel and milling characteristics, quality protein, and notable absorption levels. The loaf volumes achieved surpass U.S. quality targets. Overall, this crop meets or exceeds typical HRW contract specifications and should provide high value to customers.

2022 PNW-TRIBUTARY CROP HIGHLIGHTS

The average **GRADE** for the 2022 PNW-tributary HRW harvest survey is U.S. No. 1 HRW.

TEST WEIGHT average is 61.3 lb/bu (80.5 kg/hl), indicative of sound wheat.

PROTEIN content average is 12.8% (12% mb), comparable to the 5-year average.

KERNELS are larger and slightly softer than last year, but they are also uniform in shape resulting in higher lab mill extractions.

WHEAT FALLING NUMBER average is 370 sec, indicative of sound wheat.

FLOUR ASH average of 0.52% (14% mb) is comparable to last year and 5-year averages.

WET GLUTEN average of 32.7% is well above last year and the 5-year average, reflective of excellent gluten strength.

SOLVENT RETENTION CAPACITY GPI value of 0.70 is higher than last year and the 5-year average and indicates good performance of flour in baking applications.

DOUGH PROPERTIES suggest that

this crop has consistent water absorption with good stability and slightly shorter peak time than last year but comparable to the 5-year average.

FARINOGRAPH ABSORPTION of 59.9 is similar to last year and the 5-year average.

Average **BAKE ABSORPTION** is 65.4%, higher than last year and similar to the 5-year average.

Average **LOAF VOLUME** of 939 cc is well above last year and 5-year averages, indicative of excellent baking quality.

"The 2022 Hard Red Winter wheat crop in South Dakota was well above average for yield and quality this year. State average yield exceeded 50 bushels per acre (3.4 tons per hectare). Field average yields between 70 and 90 bushels per acre (4.7 and 6.1 tons per hectare) were quite common. Protein and test weights were also above average."

— Bryan Jorgensen, South Dakota wheat farmer



South Dakota, July 2022, Bryan Jorgensen



Washington, May 2022, Diamond S. Farms

PNW-TRIBUTARY HARVEST DATA

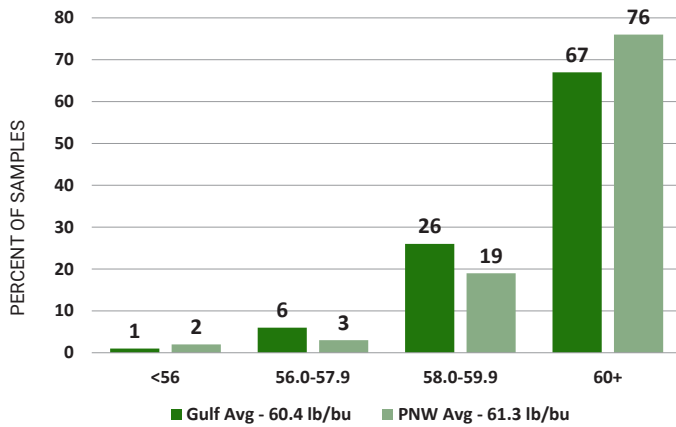
	2022 BY PROTEIN ¹			2022	2021	5-Year
	Low	Med	High	Avg	Avg	Avg
WHEAT GRADE DATA:						
Test Weight (lb/bu)	62.5	61.6	61.1	61.3	59.6	61.6
(kg/hl)	82.2	81.0	80.3	80.5	78.4	80.9
Damaged Kernels (%)	0.1	0.4	0.4	0.4	0.2	0.1
Foreign Material (%)	0.2	0.1	0.1	0.1	0.2	0.1
Shrunken & Broken (%)	1.2	1.1	1.0	1.1	0.1	0.6
Total Defects (%)	1.5	1.6	1.6	1.6	1.1	1.0
Grade	1 HRW	1 HRW	1 HRW	1 HRW	2 HRW	1 HRW
WHEAT NON-GRADE DATA:						
Dockage (%)	0.3	0.5	0.5	0.5	0.4	0.4
Moisture (%)	10.7	9.1	10.4	10.1	10.2	10.3
Protein (%) 12%/0% mb	11.3/12.9	11.9/13.5	13.1/14.9	12.8/14.6	13.2/15.0	12.2/13.9
Ash (%) 14%/0% mb	1.54/1.79	1.48/1.72	1.61/1.88	1.58/1.84	1.56/1.85	1.48/1.72
1000 Kernel Weight (g)	29.7	32.5	31.7	31.8	28.2	32.7
Kernel Size (%) lg/md/sm	56/43/1	68/31/1	60/39/1	60/39/1	50/48/2	68/31/1
Single Kernel: Hardness	72.2	63.5	67.9	67.0	67.6	67.1
Weight (mg)	29.7	32.5	31.7	31.8	28.2	32.7
Diameter (mm)	2.59	2.64	2.59	2.60	2.51	2.67
Sedimentation (cc)	47.0	54.5	59.9	58.5	59.6	54.8
Falling Number (sec)	364	380	367	370	366	363
DON (ppm)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
FLOUR DATA:						
Lab Mill Extraction (%)	77.6	78.3	78.0	78.1	73.9	74.7
Color: L*	91.0	90.7	90.3	90.4	90.6	91.0
a*	-1.6	-1.6	-1.5	-1.6	-1.4	-1.5
b*	9.6	10.2	10.0	10.1	9.9	10.0
Protein (%) 14%/0% mb	9.9/11.5	11.3/13.1	12.6/14.6	12.3/14.2	12.4/14.4	11.4/13.2
Ash (%) 14%/0% mb	0.51/0.59	0.51/0.59	0.53/0.61	0.52/0.61	0.52/0.61	0.49/0.58
Wet Gluten (%)	24.5	30.1	33.6	32.7	31.4	28.4
Gluten Index	99	96	93	94	96	96
Falling Number (sec)	407	415	406	408	413	372
Amylograph Viscosity: 65g (BU)	858	848	811	820	746	638
Damaged Starch (%)	6.9	6.9	6.7	6.7	5.8	6.7
SRC: Water/50% Sucrose (%)	64/105	64/110	66/113	65/109	68/110	67/108
5% Lactic Acid/5% Na ₂ CO ₃ (%)	127/84	134/86	145/85	135/85	126/91	135/92
Gluten Performance Index (GPI) (%)	0.67	0.68	0.73	0.70	0.65	0.68
DOUGH PROPERTIES:						
Farinograph: Peak Time (min)	4.2	5.4	5.9	5.8	6.6	5.2
Stability (min)	8.8	8.4	9.0	8.9	11.2	9.6
Absorption (%)	56.7	58.8	60.2	59.9	59.9	60.4
Alveograph: P (mm)	85	93	93	93	98	97
L (mm)	57	62	63	63	65	75
P/L Ratio	1.60	1.50	1.50	1.50	1.51	1.31
W (10 ⁻⁴ J)	177	215	217	216	243	263
Extensograph (45/135 min): Resistance (BU)	525/953	478/839	450/839	457/828	563/883	486/753
Extensibility (cm)	13.6/11.3	14.4/12.4	15.1/13.5	14.9/13.2	14.8/13.3	14.3/12.7
Area (cm ²)	89/127	88/134	89/132	106/142	90/121	94/127
BAKING EVALUATION:						
Pan Bread: Bake Absorption (%)	62.2	63.9	65.9	65.4	64.6	65.9
Crumb Grain and Texture (1-10)	5.5	6.4	6.3	6.3	6.9	6.3
Loaf Volume (cc)	823	907	950	939	925	866
% OF PRODUCTION:	1	6	20	27		

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

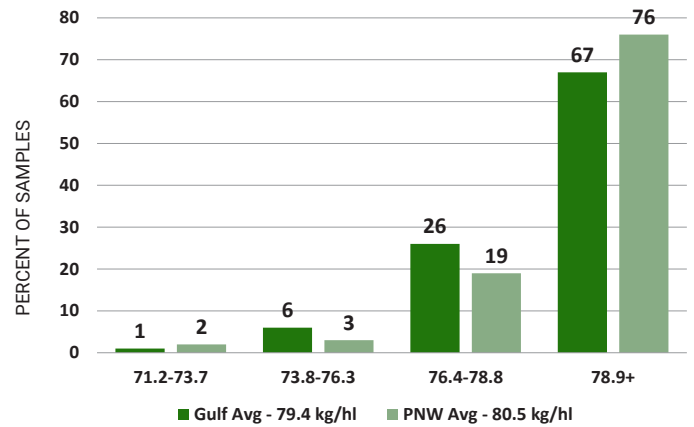


DISTRIBUTIONS

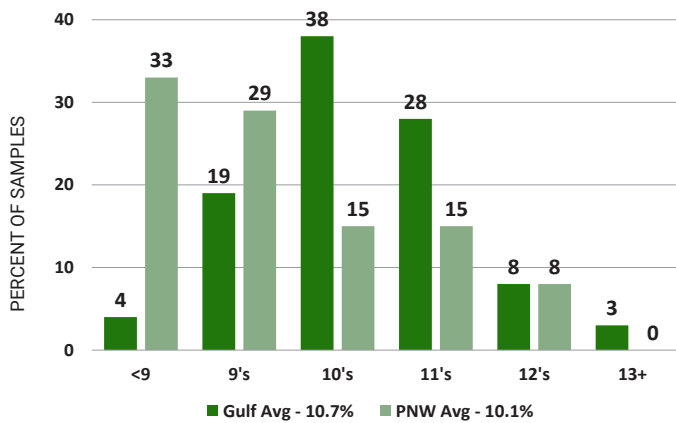
TEST WEIGHT | Pounds/Bushel



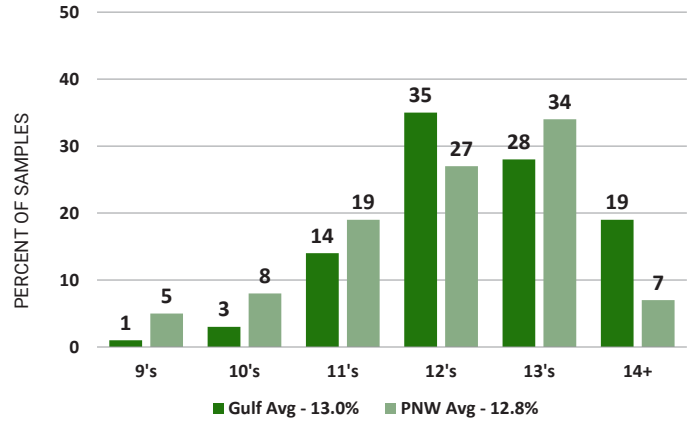
TEST WEIGHT | Kilograms/Hectoliter



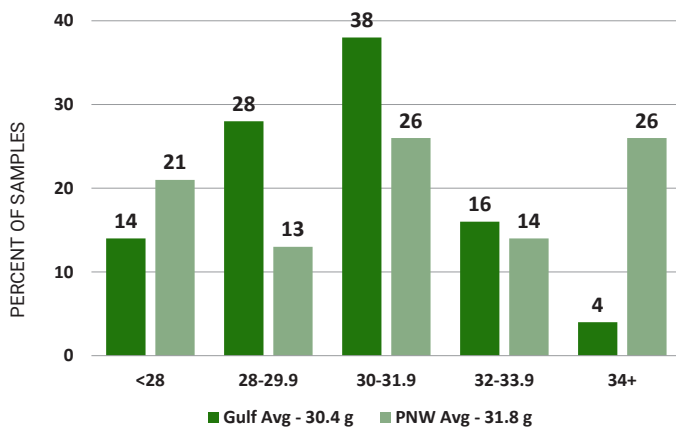
WHEAT MOISTURE | Percent



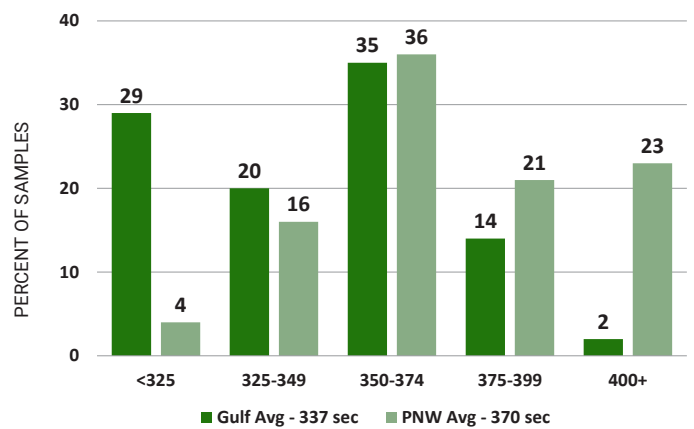
PROTEIN (12% MB) | Percent



1000 KERNEL WEIGHT | Grams



FALLING NUMBER | Seconds



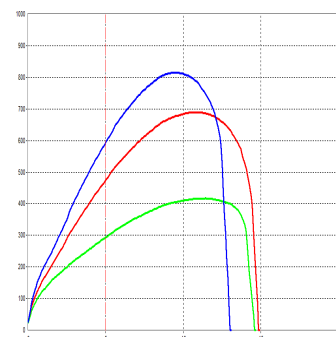
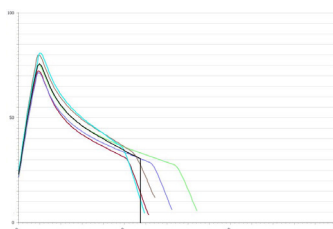
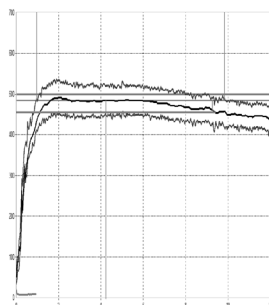
COMPOSITE DOUGH PROPERTIES

FARINOGRAMS

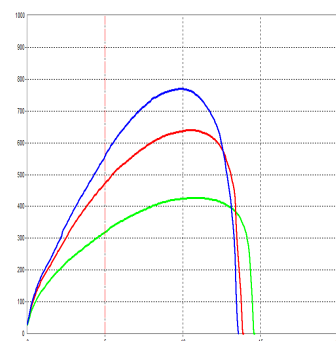
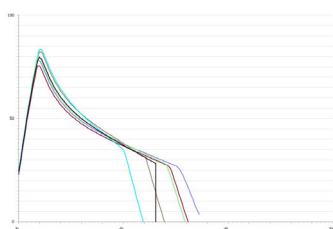
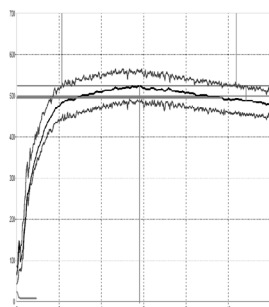
ALVEOGRAMS

EXTENSOGRAMS

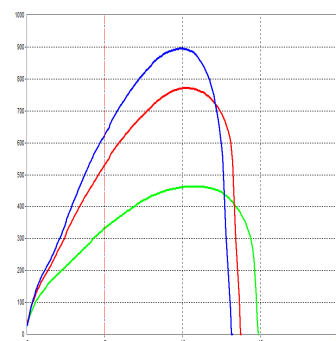
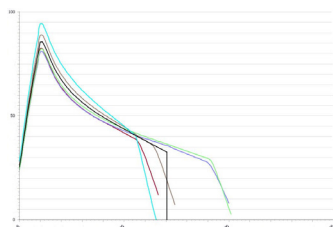
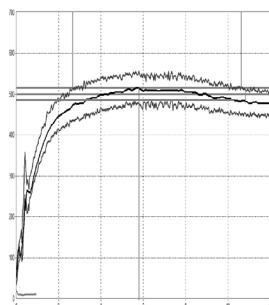
LOW
PROTEIN



MEDIUM
PROTEIN



HIGH
PROTEIN



"I grow Hard Red Winter to diversify my production with Soft White wheat. The goal is to achieve a high protein, high quality wheat, with dry land moisture. Through soil and tissue tests, I strive to meet the 11.5% protein goal. Last year I received half the annual moisture and my yield was a third of the usual production but we met the protein goal. This year, with 14 inches of moisture we were blessed with twice our average year. Rain and input costs prevented me from applying extra fertilizer, so protein was lower than last year. But I'm pretty happy where I ended up."

– Clint Carlson, Oregon wheat farmer

CALIFORNIA HARVEST AND DATA SURVEY

OVERVIEW: California's wheat growing regions are defined by climate, value of alternative crops and distinct differences in variety selection. Most California hard wheat is planted from October to January and harvested in June and July. With the strong demand for new crop wheat in the domestic marketplace, importers are encouraged to express their interest in purchasing California wheat in early spring.

WEATHER AND HARVEST: California had a very wet winter in 2021/22 with rainfall totals well above average. As the crop developed there were abnormally dry conditions from mid-March until June, impacting grain yield and quality on non-irrigated fields. In the Sacramento Valley, early June rainfall fell on a mature crop, resulting in lower falling numbers for that region's crops.

SUMMARY: California hard wheat varieties are known for their low moisture and large and uniform kernel size. Because wheat is predominantly grown under irrigation, growers achieve high yields and consistent quality. Overall, the majority of the 2022 crop has medium protein. Consistent with other years, the 2022 crop has low moisture, high flour extraction and strong baking performance — all of which make California wheat suitable for blending.

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Samples collected from grain elevators during local harvest.

California Wheat Commission Laboratory and Federal Grain Inspection Service (FGIS) conducted tests and analyses. Official grade and non-grade factors and functionality tests were determined on each sample. Results are weighted averages. The methods are described in the Analysis Methods section of this booklet.

	MEDIUM PROTEIN ¹		HIGH PROTEIN ¹	
	2022	2021	2022	2021
WHEAT GRADE DATA:				
Test Weight (lb/bu)	63.1	63.3	62.3	62.1
(kg/hl)	82.9	83.2	81.9	81.7
Damaged Kernels (%)	0.0	0.0	0.1	0.0
Foreign Material (%)	0.0	0.1	0.1	0.3
Shrunken & Broken (%)	0.6	0.6	0.6	0.8
Total Defects (%)	0.6	0.7	0.8	1.0
Grade	1 HRW	1 HRW	1 HRW	1 HRW
WHEAT NON-GRADE DATA:				
Dockage (%)	1.1	0.7	1.1	1.2
Moisture (%)	9.6	9.6	9.7	9.7
Protein (%) 12%/0% mb	11.0/12.50	11.9/13.5	12.3/14.0	12.6/14.3
Ash (%) 14%/0% mb	1.39/1.62	1.45/1.68	1.42/1.65	1.51/1.76
1000 Kernel Weight (g)	40.9	43.5	44.3	42.9
Kernel Size (%) lg/md/sm	91/9/0	93/7/0	92/8/0	84/16/0
Single Kernel: Hardness	66.0	69.5	54.9	69.5
Weight (mg)	40.1	41.9	43.4	40.0
Diameter (mm)	3.05	3.09	3.11	2.93
Sedimentation (cc)	41.3	43.0	42.3	56.0
Falling Number (sec)	343	344	413	369
DON (ppm)	<0.5	<0.5	<0.5	<0.5
FLOUR DATA:				
Lab Mill Extraction (%)	68.6	68.2	69.7	66.6
Color: L*	93.1	92.4	92.7	92.0
a*	-1.3	-1.1	-1.3	-1.1
b*	7.5	8.9	8.7	8.8
Protein (%) 14%/0% mb	9.7/11.2	10.8/12.6	11.0/12.80	11.3/13.1
Ash (%) 14%/0% mb	0.44/0.52	0.44/0.51	0.42/0.48	0.47/0.54
Wet Gluten (%)	26.6	28.6	29.7	29.6
Gluten Index	95	98	95	99
Falling Number (sec)	392	352	427	406
Amylograph Viscosity: 65g (BU)	622	864	931	882
Damaged Starch (%)	9.1	6.6	8.3	6.6
SRC: Water/50% Sucrose (%)	68/106	66/103	65/100	68/106
5% Lactic Acid/5% Na ₂ CO ₃ (%)	132/88	131/83	135/79	138/84
Gluten Performance Index (GPI) (%)	0.68	0.70	0.75	0.73
DOUGH PROPERTIES:				
Farinograph: Peak Time (min)	5.4	6.2	7.0	6.5
Stability (min)	11.0	17.0	14.6	18.0
Absorption (%)	64.7	61.3	62.9	61.4
Alveograph: P (mm)	108	97	92	98
L (mm)	75	130	112	139
P/L Ratio	1.44	0.75	0.84	0.71
W (10 ⁻⁴ J)	287	372	327	431
Extensograph (45/135 min): Resistance (BU)	493/573	539/598	462/710	604/626
Extensibility (cm)	20.7/19.5	19.2/17.8	15.7/14.0	20.8/18.9
Area (cm ²)	132/138	133/136	97/121	160/151
BAKING EVALUATION:				
Pan Bread: Bake Absorption (%)	64.5	64.0	63.7	64.0
Crumb Grain and Texture (1-10)	7.0	8.0	8.0	8.5
Loaf Volume (cc)	850	900	902	945

¹California HRW protein range: Medium, 11.0 - 12.5%; High, >12.5%.



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

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



SURVEY METHODOLOGY

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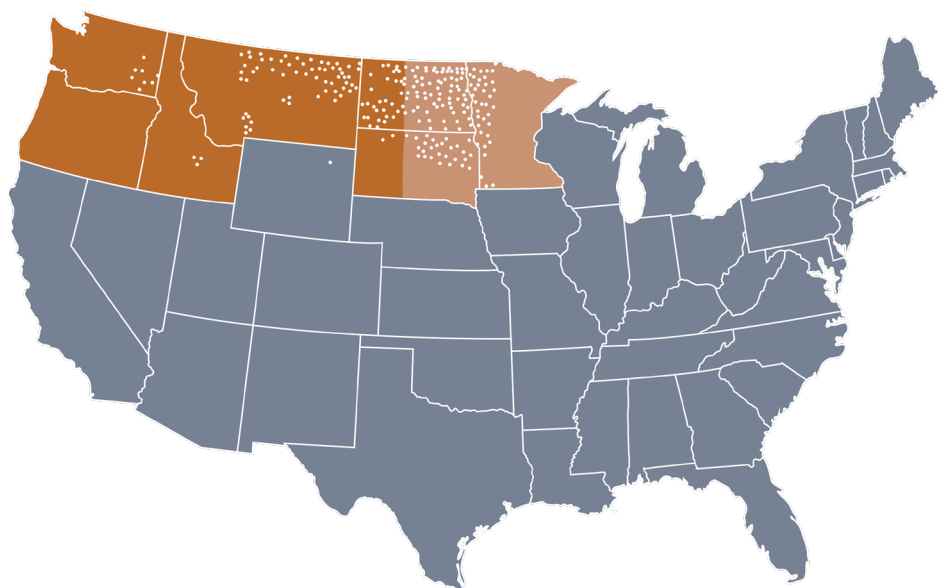
Samples collected from fields, on-farm bins sites or elevators, and separated by export region.

SAMPLE COLLECTION AND ANALYSIS

The HRS Wheat Quality Lab Department of Plant Sciences, North Dakota 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 Composite, Eastern and Western Region averages based on composite samples. The methods are described in the Analysis Methods section of this booklet.

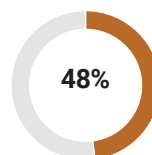


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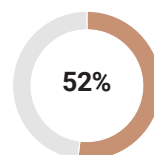
STATES SURVEYED

100%

OF TOTAL HRS PRODUCTION REPRESENTED



WESTERN REGION



EASTERN REGION

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

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)

	2022	2021	2020	2019	2018
Idaho	0.3	0.3	0.4	0.4	0.6
Minnesota	2.0	1.5	2.0	2.2	2.5
Montana	1.7	1.0	3.4	2.9	2.6
North Dakota	7.2	4.8	7.5	8.8	8.7
Oregon	0.0	0.0	0.0	0.0	0.1
South Dakota	0.9	0.5	1.0	0.7	1.1
Washington	0.1	0.1	0.2	0.2	0.4
Seven-State Total	12.1	8.1	14.4	15.2	16.0
Western-Tributary	5.8	3.6	7.5	7.6	7.9
Eastern-Tributary	6.3	4.5	6.9	7.6	8.1
Total HRS Production	12.1	8.1	14.4	15.2	16.0

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



PLANTING varied across the region, with a timely mid-April start and finish in western and southern areas, compared to a historically late start and sluggish progress across central and eastern areas. Excessive soil moisture pushed final planting into mid-June over a large area, about three weeks behind normal.

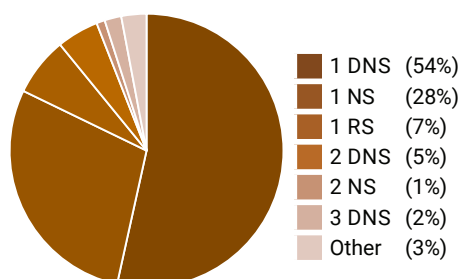
Crop **EMERGENCE** was hindered in parts of the region due to a prolonged cold, wet spring. By June, conditions shifted to warm and dry, benefiting the overly wet areas and later planted crops, but drier, western areas experienced some crop stress. The growing season was favorable with adequate moisture and no excessive heat, promoting strong yield potential, except for drier western areas.

HARVEST began later than normal, but by August, warm, dry conditions allowed for rapid progress and accelerated development of the later planted fields. Favorable conditions continued into September, allowing for a quick harvest; harvest in parts of the region extended into early October.

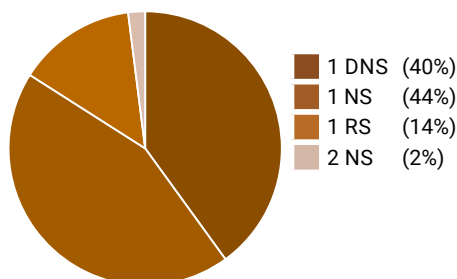
PRODUCTION of the U.S. HRS crop, at 12.1 MMT, is up 50%, following last year's severe drought.

DISTRIBUTION BY GRADE

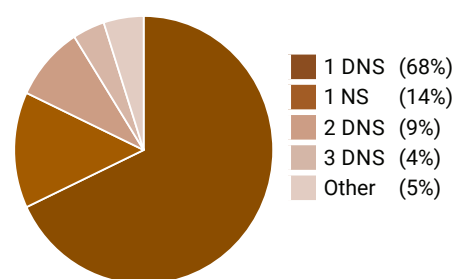
OVERALL



EASTERN REGION



WESTERN REGION



COMPOSITE REGIONAL HARVEST DATA

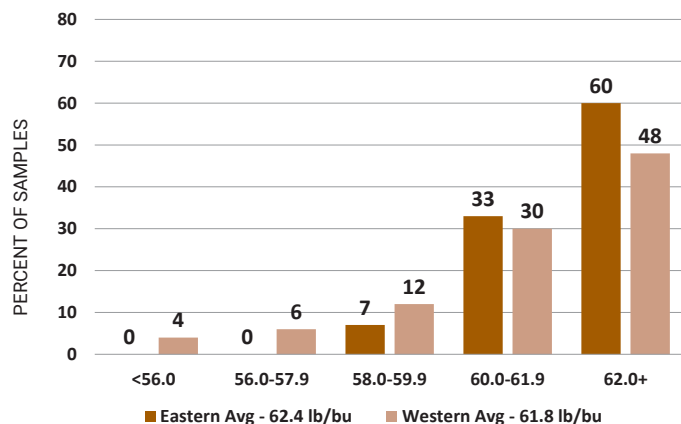
	2022 BY PROTEIN ¹			2022	2021	5-Year
	Low	Med	High	Avg	Avg	Avg
WHEAT GRADE DATA:						
Test Weight (lb/bu)	62.8	62.5	61.3	62.1	61.3	61.5
(kg/hl)	82.6	82.2	80.6	81.6	80.6	80.9
Damaged Kernels (%)	0.2	0.1	0.3	0.2	0.2	0.3
Foreign Material (%)	0.0	0.0	0.0	0.0	0.0	0.0
Shrunken & Broken (%)	0.9	0.9	1.2	1.0	1.1	0.9
Total Defects (%)	1.1	1.0	1.5	1.2	1.3	1.2
Vitreous kernels (%)	53	78	84	74	80	73
Grade	1 NS	1 DNS	1 DNS	1 NS	1 DNS	1 NS
WHEAT NON-GRADE DATA:						
Dockage (%)	0.6	0.6	0.7	0.6	0.6	0.5
Moisture (%)	11.8	11.7	11.4	11.6	11.6	12.0
Protein (%) 12%/0% mb	12.7/14.4	13.9/15.8	15.4/17.5	14.3/16.2	15.4/17.5	14.6/16.6
Ash (%) 14%/0% mb	1.54/1.79	1.55/1.81	1.60/1.87	1.57/1.83	1.51/1.76	1.55/1.80
1000 Kernel Weight (g)	32.0	30.8	29.1	30.4	29.3	30.7
Kernel Size (%) lg/md/sm	48/49/3	44/54/2	38/57/5	42/54/4	30/65/5	42/54/3
Sedimentation (cc)	53.6	63.3	65.3	61.9	68.3	66.3
Falling Number (sec)	393	376	390	386	377	375
DON (ppm)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
FLOUR DATA:						
Lab Mill Extraction (%)	66.7	66.9	65.5	66.2	66.0	68.2
Color: L*	90.6	90.4	90.2	90.4	90.4	90.3
a*	-1.3	-1.2	-1.2	-1.2	-1.2	-1.3
b*	9.3	9.4	9.5	9.4	9.6	9.4
Protein (%) 14%/0% mb	11.4/13.2	12.6/14.6	14.0/16.3	12.9/15.0	14.2/16.5	13.7/15.9
Ash (%) 14%/0% mb	0.49/0.56	0.49/0.56	0.50/0.59	0.49/0.57	0.49/0.57	0.53/0.61
Wet Gluten (%)	29.5	33.6	38.0	34.5	37.4	35.2
Gluten Index	96	93	91	93	91	91
Falling Number (sec)	395	395	398	397	400	394
Amylograph Viscosity: 65g (BU)	756	693	732	724	732	601
Damaged Starch (%)	6.0	5.9	5.7	5.8	5.9	7.3
SRC: Water/50% Sucrose	72/118	71/119	71/122	71/120	71/121	73/121
5% Lactic Acid/5% Na ₂ CO ₃	138/105	143/103	151/98	145/101	149/100	147/103
Gluten Performance Index (GPI)	0.62	0.65	0.69	0.66	0.68	0.66
DOUGH PROPERTIES:						
Farinograph: Peak Time (min)	6.6	7.6	9.0	8.0	9.2	8.1
Stability (min)	10.6	11.9	13.3	12.2	18.8	12.5
Absorption (%)	62.0	62.9	63.9	63.1	62.4	62.8
Alveograph: P (mm)	102	94	89	94	88	85
L (mm)	100	128	141	127	137	137
P/L Ratio	1.03	0.73	0.63	0.74	0.64	0.62
W (10 ⁻⁴ J)	354	401	424	400	430	383
Extensograph (45/135 min): Resistance (BU)	526/682	532/804	552/955	539/839	645/1344	522/893
Extensibility (cm)	15.9/14.2	17.5/15.7	16.4/13.0	16.6/14.2	15.1/12.0	16.2/13.4
Area (cm ²)	110/126	122/161	115/163	116/154	125/207	111/153
BAKING EVALUATION:						
Pan Bread: Bake Absorption (%)	67.5	70.9	73.9	71.4	66.4	67.6
Crumb Grain and Texture (1-10)	7.5	8.0	8.0	7.9	8.0	7.9
Loaf Volume (cc)	855	937	985	938	952	978
% OF SAMPLES:	24	34	42	100		

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

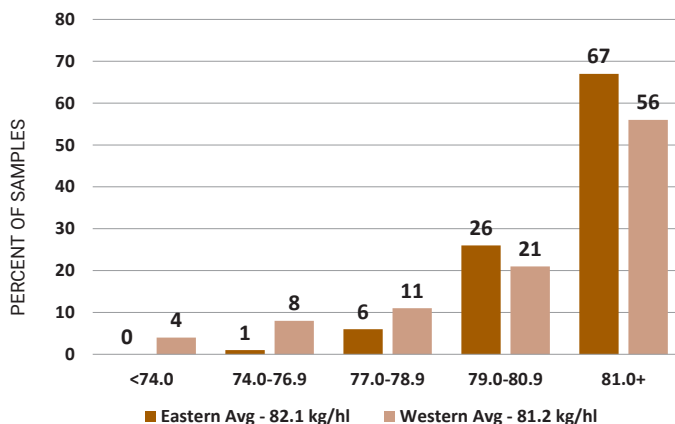


DISTRIBUTIONS

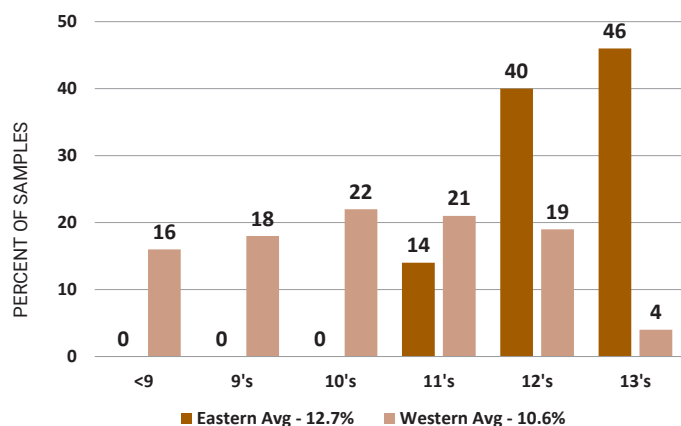
TEST WEIGHT | Pounds/Bushel



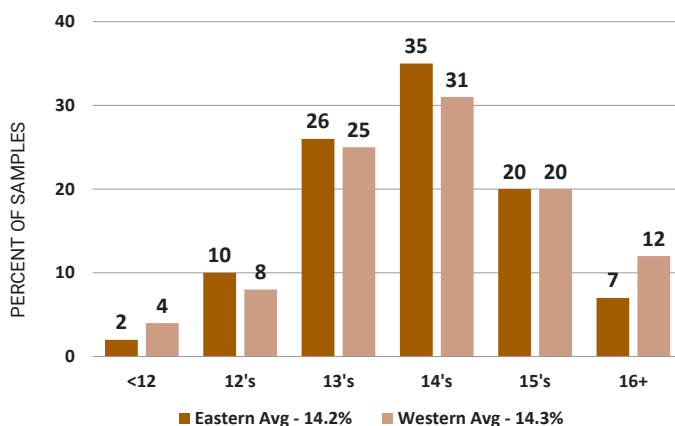
TEST WEIGHT | Kilograms/Hectoliter



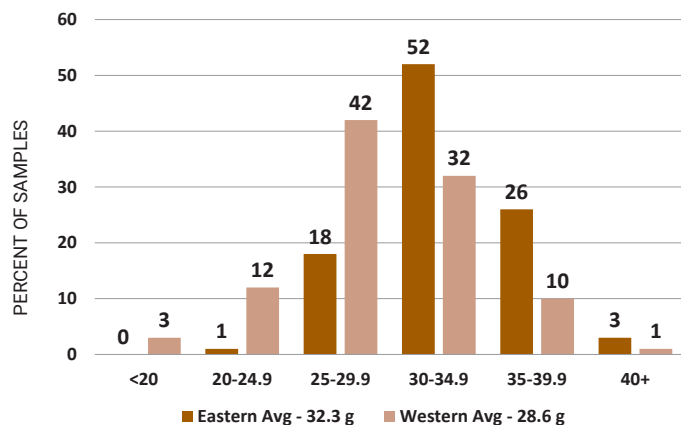
WHEAT MOISTURE | Percent



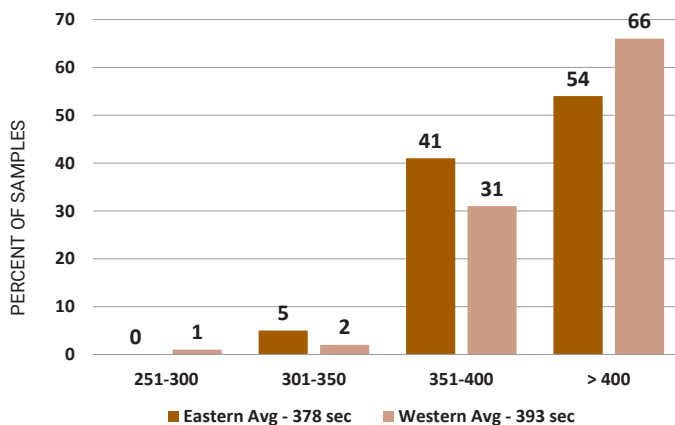
PROTEIN (12% MB) | Percent



1000 KERNEL WEIGHT | Grams



FALLING NUMBER | Seconds



EASTERN REGIONAL HARVEST SURVEY

The 2022 U.S. HRS crop grown in the Eastern region recovered from last year's historic drought. Plentiful spring moisture boosted soil conditions but resulted in historically late planting. Because of plentiful moisture, the crop was high yielding with lower-than-average protein and vitreous kernels. The Eastern-tributary HRS crop has sound kernel characteristics and functional performance. Overall, 2022 this crop offers excellent value to buyers.

2022 EASTERN REGIONAL CROP HIGHLIGHTS

The average **GRADE** for the 2022 Eastern-tributary HRS harvest survey is U.S. No. 1 Northern Spring (NS) due to lower vitreous kernel levels; 97% of Eastern-tributary samples grade U.S. No. 1.

Average **TEST WEIGHT** is 62.4 lb/bu (82.1 kg/hl), similar to 2021 but higher than the 5-year average.

Average **DAMAGE** is 0.1%, below 2021 and 5-year averages, while **SHRUNKEN AND BROKEN KERNELS** at 0.5%, is similar to 2021 and 5-year averages.

Average **VITREOUS KERNEL** content (DHV) is 59%, lower than last year's value of 76% but in line with average values, due to lower protein and lack of stress during the growing season.

PROTEIN averages 14.2% (12% mb), below 2021 and 5-year averages due to higher yields and lack of drought stress during the growing season.

Average **1000 KERNEL WEIGHT** (TKW) is 32.3 g, above 2021 and 5-year averages.

A dry harvest produced a very sound crop with an average **FALLING NUMBER** of 378 sec.

DON levels were near zero due to minimal disease pressures.

BUHLER LABORATORY MILL FLOUR YIELD averages 66.7%, below 2021 and 5-year averages. Lab mill settings are not adjusted to account for kernel parameter shifts between crop years and a wider variance in TKW and kernel size may have impacted milling yield.

Average **FLOUR ASH** is 0.48%, significantly lower than the 5-year average of 0.53%.

WET GLUTEN averages 33.9%, notably lower than 2021 and 5-year averages.

AMYLOGRAPH average of 657 BU for 65 g of flour, is down from 2021 but up notably from the 5-year average.

DOUGH PROPERTIES suggest a weaker, more extensible crop as compared to last year. Dough property values are more in line with five-year average values.

FARINOGRAPH peak and stability times of 6.9 and 11.9 min, respectively, indicate the Eastern-tributary crop is weaker than average. Absorption values average 62.8%, up slightly from 2021 and the 5-year average.

The average **ALVEOGRAPH** P/L ratio is 0.74 compared to 0.67 in 2021, and the W-value is 404 (10⁻⁴ J), down from 422 last year.

The overall extensibility and resistance to extension of the 135 min **EXTENSOGRAPH** are 15.6 cm and 743 BU, compared to 12.5 cm and 1268 BU last year indicating weaker, more extensible dough properties compared to last year.

The average **LOAF VOLUME** is 937 cc, lower than 2021 and 5-year averages.

Average **BAKE ABSORPTION** is 71.1%, significantly higher than 2021 and 5-year averages.

BREAD SCORE average is lower than 2021 but higher than the 5-year average.

"Because of spring rains, Minnesota's Hard Red Spring (HRS) wheat was seeded very late this year and harvest was also late. Despite the weather challenges, this year's crop turned out very good with average to above average yields, excellent test weights, average protein and no low falling numbers. We hope the 2022 HRS wheat crop will make millers and bakers very happy."

— Tim Dufault, Minnesota wheat farmer



North Dakota, August 2022, Aaron Kjelland

EASTERN REGIONAL HARVEST DATA

	2022 BY PROTEIN ¹			2022	2021	5-Year
	Low	Med	High	Avg	Avg	Avg
WHEAT GRADE DATA:						
Test Weight (lb/bu)	62.9	62.4	62.1	62.4	62.3	61.7
(kg/hl)	82.7	82.1	81.7	82.1	81.9	81.1
Damaged Kernels (%)	0.1	0.1	0.2	0.1	0.3	0.4
Foreign Material (%)	0.0	0.0	0.0	0.0	0.0	0.0
Shrunken & Broken (%)	0.4	0.5	0.6	0.5	0.5	0.7
Total Defects (%)	0.5	0.6	0.8	0.6	0.8	1.1
Vitreous kernels (%)	38	66	66	59	76	65
Grade	1 NS	1 NS	1 NS	1 NS	1 DNS	1 NS
WHEAT NON-GRADE DATA:						
Dockage (%)	0.5	0.4	0.7	0.6	0.4	0.5
Moisture (%)	12.7	12.7	12.6	12.7	12.4	12.6
Protein (%) 12%/0% mb	12.6/14.4	14.0/15.9	15.4/17.5	14.2/16.1	14.9/16.9	14.5/16.4
Ash (%) 14%/0% mb	1.53/1.78	1.55/1.80	1.63/1.90	1.58/1.83	1.47/1.71	1.57/1.83
1000 Kernel Weight (g)	33.8	32.1	31.4	32.3	31.7	31.9
Kernel Size (%) lg/md/sm	59/39/2	55/43/2	51/46/3	55/43/2	41/56/2	51/47/2
Sedimentation (cc)	54.1	64.0	64.8	61.8	67.4	65.8
Falling Number (sec)	393	367	380	378	379	369
DON (ppm)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
FLOUR DATA:						
Lab Mill Extraction (%)	67.2	67.0	66.0	66.7	67.5	68.8
Color: L*	90.5	90.3	90.2	90.3	90.2	90.3
a*	-1.2	-1.2	-1.1	-1.2	-1.1	-1.2
b*	9.2	9.3	9.3	9.3	9.4	9.1
Protein (%) 14%/0% mb	11.2/13.1	12.6/14.6	13.8/16.0	12.7/14.8	13.9/16.2	13.5/15.7
Ash (%) 14%/0% mb	0.49/0.57	0.48/0.56	0.49/0.57	0.48/0.56	0.49/0.57	0.53/0.62
Wet Gluten (%)	29.1	33.4	37.8	33.9	36.5	34.4
Gluten Index	96	95	93	95	95	94
Falling Number (sec)	386	383	376	381	395	386
Amylograph Viscosity: 65g (BU)	685	648	648	657	714	565
Damaged Starch (%)	6.2	5.7	5.3	5.7	5.9	7.0
SRC: Water/50% Sucrose	71/114	71/116	71/118	71/116	71/120	72/119
5% Lactic Acid/5% Na ₂ CO ₃	134/103	145/101	151/97	145/100	148/99	145/101
Gluten Performance Index (GPI)	0.62	0.67	0.71	0.67	0.68	0.66
DOUGH PROPERTIES:						
Farinograph: Peak Time (min)	5.5	7.0	7.9	6.9	8.4	7.6
Stability (min)	10.3	11.7	13.4	11.9	18.3	13.0
Absorption (%)	61.9	62.6	63.6	62.8	62.4	62.1
Alveograph: P (mm)	100	94	91	94	89	83
L (mm)	101	129	142	127	132	138
P/L Ratio	0.99	0.73	0.64	0.74	0.67	0.60
W (10 ⁻⁴ J)	344	407	440	404	422	380
Extensograph (45/135 min): Resistance (BU)	493/608	512/687	526/890	512/743	621/1268	545/859
Extensibility (cm)	16.4/15.1	18.3/16.8	18.7/14.6	18.0/15.6	15.4/12.5	16.3/14.6
Area (cm ²)	105/118	126/150	126/174	121/151	121/205	115/150
BAKING EVALUATION:						
Pan Bread: Bake Absorption (%)	67.5	71.0	73.7	71.1	66.6	66.8
Crumb Grain and Texture (1-10)	7.5	8.0	8.0	7.9	8.2	7.7
Loaf Volume (cc)	860	925	1000	937	970	984
% OF SAMPLES:	12	18	18	48		

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



WESTERN REGIONAL HARVEST SURVEY

The 2022 U.S. HRS crop grown in the Western region experienced drier conditions than the Eastern region, resulting in higher protein and variance in kernel characteristics due to moisture stress during kernel fill. Because of dryness, disease pressure did not affect quality. The Western-tributary HRS crop offers strong grading characteristics, good protein content and dough strength. Overall, buyers should be very happy with this crop.

2022 WESTERN REGIONAL CROP HIGHLIGHTS

The average **GRADE** for the 2022 Western-tributary HRS harvest survey is U.S. No. 1 Dark Northern Spring (DNS); 85% of Western-tributary samples grade U.S. No. 1.

Average **TEST WEIGHT** is 61.8 lb/bu (81.2 kg/hl), higher than the 2021 and 5-year averages.

Average **DAMAGE** is 0.2%, equal to the 5-year average, but **SHRUNKEN AND BROKEN KERNELS** at 1.5%, is above the 5-year average.

The Western-tributary crop has higher **VITREOUS KERNEL** content (DHV), averaging 88% compared to 84% in 2021.

PROTEIN averages 14.4% (12% mb), below 2021 and 5-year averages due to higher yields in areas and less stress during the growing season.

Average **1000 KERNEL WEIGHT** (TKW) is 28.6 g, above 2021 but below the 5-year average.

A dry harvest produced a very sound crop with an average **FALLING**

NUMBER of 393 sec.

DON levels were near zero due to minimal disease pressures.

BUHLER LABORATORY MILL FLOUR YIELD averages 65.8%, above last year but below the 5-year average. Lab mill settings are not adjusted to account for kernel parameter shifts between crop years and a wider variance in TKW, shrunken and broken kernels and kernel size may have impacted milling yield.

Average **FLOUR ASH** is 0.50%, the same as last year, but lower than the 5-year average of 0.53%.

WET GLUTEN averages 35.0%, notably lower than 2021 and 5-year averages.

AMYLOGRAPH average of 785 BU for 65 g of flour, is up notably from recent levels.

DOUGH PROPERTIES suggest a crop that performs similar to average, but weaker than last year's crop. This year's crop shows more extensibility as compared to last year.

FARINOGRAPH peak and stability

times of 8.9 and 12.4 min, respectively, indicate the Western-tributary crop is weaker than last year but similar to the 5-year average. Absorption values average 63.4%, up from 2021, and similar to the 5-year average.

The average **ALVEOGRAPH** P/L ratio is 0.74 compared to 0.62 in 2021, and the W-value is 396 (10⁻⁴ J), down from 437 last year.

The overall extensibility and resistance to extension of the 135 min **EXTENSOGRAPH** are 12.9 cm and 927 BU, compared to 11.5 cm and 1418 BU last year indicating weaker, more extensible dough properties compared to last year, although very similar to average values.

The average **LOAF VOLUME** is 940 cc, above 2021 but below the 5-year average.

Average **BAKE ABSORPTION** is 71.6%, significantly higher than 2021 and 5-year averages.

BREAD SCORES are similar to 2021 and the 5-year average.

"This year's Hard Red Spring wheat crop is one of the best I can remember, for both yield and quality. While we were quite concerned with the late planted crop, we had a tremendous growing season and great harvest conditions. We consume some of what we grow, so we strive to produce a quality product, not only for that purpose, but more importantly for our customers."

— Jim Pellman, North Dakota wheat farmer



Montana, August 2022, Leonard Schock

WESTERN REGIONAL HARVEST DATA

	2022 BY PROTEIN ¹			2022	2021	5-Year
	Low	Med	High	Avg	Avg	Avg
WHEAT GRADE DATA:						
Test Weight (lb/bu)	62.8	62.7	60.7	61.8	60.2	61.3
(kg/hl)	82.5	82.4	79.8	81.2	79.3	80.7
Damaged Kernels (%)	0.3	0.1	0.3	0.2	0.1	0.2
Foreign Material (%)	0.0	0.0	0.0	0.0	0.0	0.0
Shrunken & Broken (%)	1.4	1.3	1.7	1.5	1.8	1.1
Total Defects (%)	1.7	1.4	2.0	1.8	1.9	1.3
Vitreous kernels (%)	68	91	96	88	84	80
Grade	1 NS	1 DNS	1 DNS	1 DNS	1 DNS	1DNS
WHEAT NON-GRADE DATA:						
Dockage (%)	0.7	0.7	0.6	0.7	0.8	0.6
Moisture (%)	10.9	10.7	10.5	10.6	10.8	11.3
Protein (%) 12%/0% mb	12.7/14.4	13.9/15.8	15.5/17.6	14.4/16.3	15.8/18.0	14.8/16.9
Ash (%) 14%/0% mb	1.54/1.79	1.56/1.81	1.58/1.84	1.57/1.82	1.55/1.80	1.53/1.77
1000 Kernel Weight (g)	30.2	29.4	27.4	28.6	27.0	29.6
Kernel Size (%) lg/md/sm	37/59/4	31/66/3	29/64/7	31/64/5	20/73/7	35/61/4
Sedimentation (cc)	53.1	62.5	65.6	61.9	69.2	66.8
Falling Number (sec)	393	387	397	393	374	383
DON (ppm)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
FLOUR DATA:						
Lab Mill Extraction (%)	66.3	66.7	65.1	65.8	64.5	67.6
Color: L*	90.8	90.5	90.3	90.5	90.6	90.4
a*	-1.4	-1.3	-1.2	-1.3	-1.3	-1.4
b*	9.4	9.6	9.7	9.6	9.8	9.7
Protein (%) 14%/0% mb	11.5/13.4	12.6/14.6	14.2/16.6	13.1/15.3	14.4/16.7	13.8/16.1
Ash (%) 14%/0% mb	0.48/0.56	0.49/0.57	0.52/0.60	0.50/0.58	0.50/0.58	0.53/0.61
Wet Gluten (%)	29.9	33.8	38.2	35.0	38.3	36.0
Gluten Index	96	91	89	91	88	88
Falling Number (sec)	405	409	414	410	404	402
Amylograph Viscosity: 65g (BU)	829	743	792	785	750	639
Damaged Starch (%)	5.8	6.3	6.0	6.0	6.0	7.0
SRC: Water/50% Sucrose	72/121	70/123	72/124	71/123	71/122	74/123
5% Lactic Acid/5% Na ₂ CO ₃	142/107	142/105	150/98	146/102	151/101	149/106
Gluten Performance Index (GPI)	0.62	0.62	0.67	0.65	0.68	0.65
DOUGH PROPERTIES:						
Farinograph: Peak Time (min)	7.8	8.3	9.8	8.9	9.9	8.5
Stability (min)	10.9	12.1	13.3	12.4	19.2	12.1
Absorption (%)	62.1	63.3	64.2	63.4	62.4	63.6
Alveograph: P (mm)	105	93	88	93	88	88
L (mm)	98	126	141	127	142	136
P/L Ratio	1.07	0.74	0.62	0.74	0.62	0.64
W (10 ⁻⁴ J)	364	394	413	396	437	386
Extensograph (45/135 min): Resistance (BU)	560/758	555/935	571/1001	564/927	668/1418	498/927
Extensibility (cm)	15.3/13.2	16.5/14.4	14.7/11.8	15.4/12.9	14.8/11.5	16.1/13.2
Area (cm ²)	115/135	118/174	107/156	112/157	129/209	106/156
BAKING EVALUATION:						
Pan Bread: Bake Absorption (%)	67.5	70.8	74.0	71.6	66.1	68.5
Crumb Grain and Texture (1-10)	7.5	8.0	8.0	7.9	7.9	8.0
Loaf Volume (cc)	850	950	975	940	935	972
% OF SAMPLES:	12	16	25	52		

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



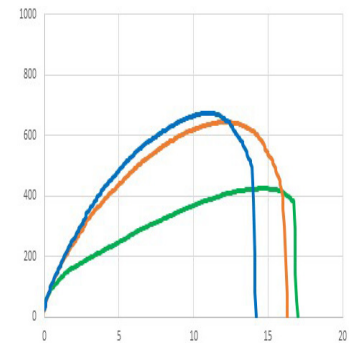
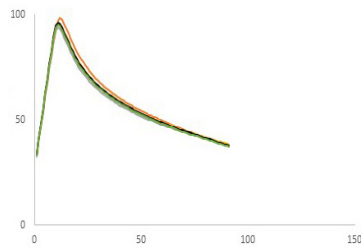
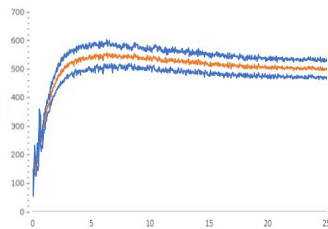
COMPOSITE DOUGH PROPERTIES

FARINOGRAMS

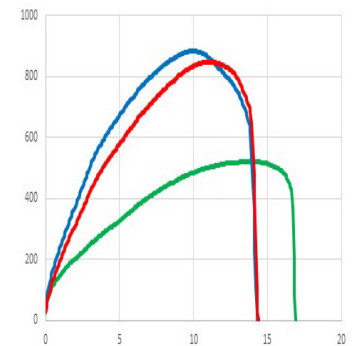
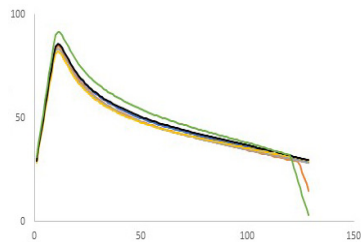
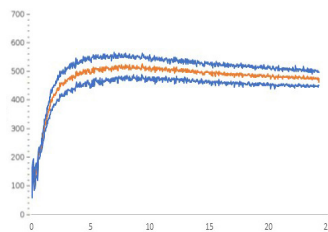
ALVEOGRAMS

EXTENSOGRAMS

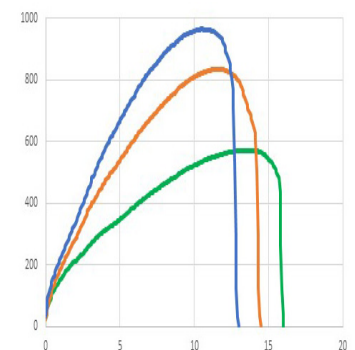
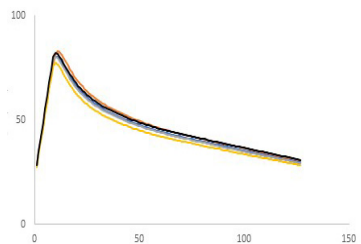
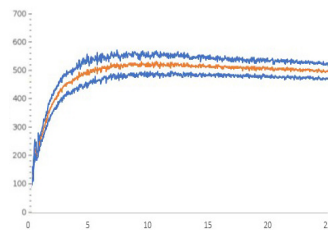
LOW
PROTEIN



MEDIUM
PROTEIN



HIGH
PROTEIN







SOFT WHITE



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



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 increasing the protein range 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 80 hectoliter mass and a low quantity of screenings, SW wheat provides the millers every opportunity for high flour extraction. The lower wheat moisture allows the miller to temper the wheat to a lower average target moisture optimizing flour extraction, particle size and color.

For the baker, low moisture content creates an advantage by optimizing water absorption and product quality to the consumer. The finer particle size may increase the rate of water absorption, decreasing mix time and improving 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 or Asian noodles 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
- Cakes
- Cereals and cereal bars
- Crackers
- Flat Breads
- Flours (cake, pastry, self-rising)
- Fried Spring Rolls
- Muffins
- Noodles, Asian-style
- Pastries
- Quick breads
- Snack foods
- Steamed bread, Chinese southern-type
- Sugar snap cookies
- Tempura batter
- Wafers/Ice cream cones
- Other confectionary products

SURVEY METHODOLOGY

404

SOFT WHITE

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

53

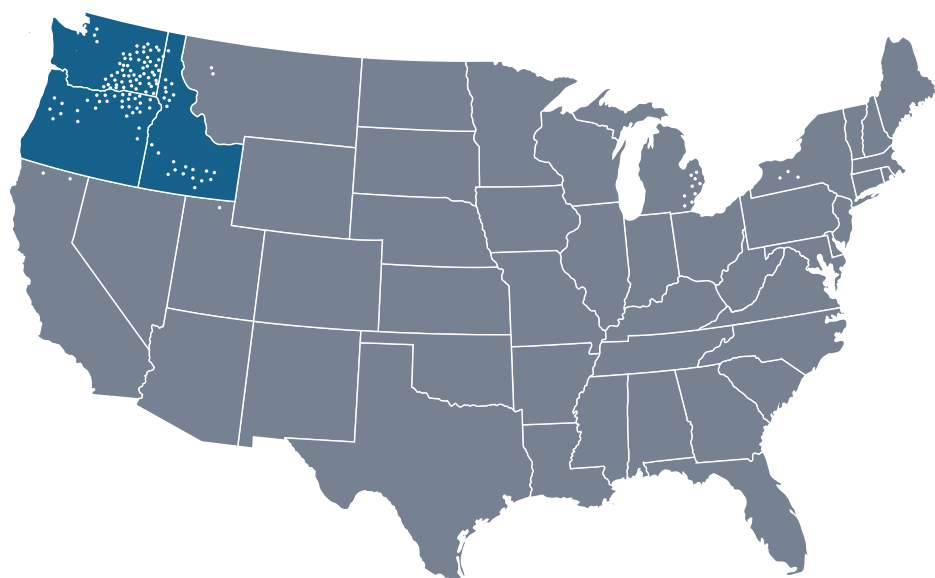
WHITE CLUB

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.

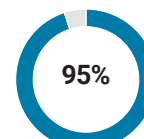


3

STATES SURVEYED

95%

OF TOTAL SW PRODUCTION REPRESENTED



PNW

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

SOFT WHITE PRODUCTION

FOR THE MAJOR PRODUCING STATES (MMT)

	2022		2021		2020		2019		2018	
	SW	CLUB	SW	CLUB	SW	CLUB	SW	CLUB	SW	CLUB
Washington	3.3	0.3	1.9	0.1	3.8	0.2	3.1	0.1	3.0	0.3
Oregon	1.3	0.0	0.8	0.0	1.2	0.0	1.2	0.0	1.2	0.0
Idaho	1.7	0.0	1.4	0.0	2.0	0.0	1.6	0.0	1.5	0.0
Three-State Total	6.3	0.3	4.1	0.2	6.9	0.3	5.9	0.2	5.7	0.4
Three-State SW Total	6.6		4.3		7.2		6.0		6.0	
Total SW Production	6.9		4.8		7.6		6.6		6.5	

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

HARVEST SURVEY

The Pacific Northwest (PNW) returned to more normal growing conditions marked by more moisture and a long, cool spring in the 2022 crop year, which resulted in a soft white (SW) wheat crop with characteristically lower protein. This year's SW crop has very weak to medium gluten strength and good finished product characteristics. SW is especially suited for use in cakes, pastries, cookies and snack foods. The high protein segment of the SW crop provides opportunities in blends for crackers, Asian noodles, steamed breads, flat breads and pan breads. The SW subclass Club wheat, with very weak gluten strength, is typically exported as the subclass Western White, a blend of more than 10% club with SW, for cakes and delicate pastries.

WEATHER AND HARVEST

WINTER PLANTING and emergence was delayed, particularly in the southern portion of the region, due to the continuation of drought conditions. Normal to below normal temperatures and significant snow coverage following planting improved conditions for winter crops.

SPRING PLANTING conditions were drier than average. However, much needed moisture arrived in April and May, resulting in improved growing conditions as well as challenges for fieldwork in wetter than normal fields.

As the crop **DEVELOPED**, late moisture and cooler than average conditions allowed for good crop

development during heading and filling. This pattern also delayed harvest across most of the region by 10-14 days.

PRODUCTION of the 2022 PNW SW crop is estimated at 6.6 MMT, higher than the five-year average.

2022 CROP HIGHLIGHTS

The overall average **GRADE** of the 2022 SW crop is U.S. No. 1, with Club also grading as U.S. No. 1.

TEST WEIGHT SW averages range from 60.7 to 61.4 lb/bu (79.8 to 80.7 kg/hl) with an average of 61.0 lb/bu (80.2 kg/hl); Club averages 60.6 lb/bu (79.8 kg/hl).

WHEAT MOISTURE ranges from 8.8 to 9.1% for SW with a weighted average of 8.9%. Club averages 7.8%.

WHEAT PROTEIN (12% mb) ranges from 8.1 to 11.5% for SW, with a weighted average of 9.5%. Club averages 10.1%.

WHEAT FALLING NUMBER average is 327 sec or higher for all SW composites and 356 sec for Club.

WET GLUTEN SW flour wet gluten content ranges from 13.1 to 31.1% depending on flour protein content. Club averages 14.5%.

AMYLOGRAPH SW peak viscosities are between 576 and 607 BU for all composite samples. Club has an average amylograph peak viscosity of 580 BU.

SOLVENT RETENTION CAPACITY SW lactic acid values range 78 to 102%,

indicating very weak to medium gluten strength. Water SRC values range from 54 to 58% for SW. Lactic acid and water SRC values for Club are 71% and 55%, respectively, and are indicative of very weak gluten with low water holding capacity.

FARINOGRAPH SW water absorptions range from 50.0 to 52.8% with stability times of 1.1 to 3.2 min, showing desirably weak dough characteristics. The low farinograph water absorptions are typical for SW and in line with the water SRC values. Average Club Farinograph water absorption is 50.0% with a stability of 1.1 min, showing very weak dough characteristics typical for Club.

ALVEOGRAPH SW ranges include P values of 38 to 41 mm; L values from 61 to 90 mm; and W values of 71 to 91 (10^{-4} J). Average Club Alveograph P, L and W values are 25 mm, 49 mm, and 33 (10^{-4} J), respectively.

EXTENSOGRAPH SW data at 45 min show maximum resistance in the range of 211 to 250 BU, extensibility of 13.5 to 17.1 cm and area from 47 to 51 cm². Club Extensograph 45 min maximum resistance, extensibility, and area are 115 BU, 15.3 cm, and 26 cm², respectively.

SPONGE CAKE SW volumes range 1101 to 1157 cc, depending on protein content, with a weighted average of 1137 cc. Total sponge cake scores are 54 to 60 with a weighted average of 59. Club sponge cake volume is 1150 cc with an average score of 56. Some scores exceeded the control (a commercial Japanese cake flour from the 2021 crop) this year due to softer textures.

Average **COOKIE** SW diameters are 8.2 to 8.3 cm with spread factors of 7.9 to 8.7. Club diameter and spread factor are 8.7 cm and 9.8, respectively.

Average **PAN BREAD** bake absorptions are 55.3 to 58.0% with loaf volumes from 605 to 727 cc, depending on protein content. Average scores are 4.0 to 5.0.

CHINESE SOUTHERN-TYPE STEAMED BREAD specific volumes are 2.2 to 2.6 mL/g with total scores of 64.6 to 70.9. Club specific volume is 2.9 mL/g with an average score of 69.0. Most scores were similar to the control this year due to better specific volume, smoother skin, and whiter external color.

HARVEST DATA

	2022					2021		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)	61.2	61.4	60.7	61.0	60.6	59.3	59.7	61.1	60.5
(kg/hl)	80.5	80.7	79.8	80.2	79.8	77.9	78.5	80.3	79.6
Damaged Kernels (%)	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0
Foreign Material (%)	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.1
Shrunken & Broken (%)	0.4	0.4	0.7	0.5	1.1	1.0	1.6	0.6	0.9
Total Defects (%)	0.4	0.5	0.8	0.6	1.1	1.1	1.7	0.7	1.0
Grade	1 SW	1 SW	1 SW	1 SW	1 WC	2 SW	1 WC	1 SW	1 WC
WHEAT NON-GRADE DATA:									
Dockage (%)	0.5	0.4	0.5	0.5	0.8	0.5	0.5	0.5	0.5
Moisture (%)	8.8	9.1	8.8	8.9	7.8	8.8	8.0	9.1	8.5
Protein (%) 12%/0% mb	8.1/9.2	9.6/10.9	11.5/13.1	9.5/10.8	10.1/11.5	11.3/12.3	11.5/12.5	10.0/11.3	9.9/11.1
Ash (%) 14%/0% mb	1.45/1.69	1.48/1.72	1.48/1.72	1.47/1.71	1.36/1.58	1.48/1.63	1.35/1.47	1.37/1.58	1.30/1.49
1000 Kernel Weight (g)	35.3	35.1	33.3	34.8	30.2	29.0	27.1	34.6	31.2
Kernel Size (%) lg/md/sm	90/9/1	87/13/0	79/20/1	87/12/1	68/31/1	67/32/1	54/45/1	84/15/1	74/25/1
Single Kernel: Hardness	26.7	27.5	32.3	28.0	31.1	32.7	38.3	28.8	29.6
Weight (mg)	39.7	39.5	36.2	39.0	34.6	31.8	33.0	37.8	34.1
Diameter (mm)	2.79	2.73	2.68	2.74	2.55	2.54	2.42	2.72	2.55
Sedimentation (cc)	12.8	15.2	19.3	14.9	13.1	18.1	11.4	17.5	11.4
Falling Number (sec)	327	344	357	340	356	344	345	327	337
FLOUR DATA:									
Lab Mill Extraction (%)	71.8	71.9	71.0	71.7	72.9	70.1	72.0	72.2	74.1
Color: L*	93.8	93.2	93.3	93.4	93.4	92.5	92.9	92.6	92.5
a*	-2.2	-2.1	-1.9	-2.1	-2.0	-2.1	-1.9	-2.1	-2.0
b*	7.4	7.3	7.0	7.3	7.1	8.3	8.1	8.3	8.2
Protein (%) 14%/0% mb	7.4/8.6	8.7/10.1	10.1/11.7	8.4/9.8	9.0/10.5	10.3/12.0	10.5/12.2	8.9/10.4	8.9/10.3
Ash (%) 14%/0% mb	0.39/0.45	0.41/0.48	0.42/0.49	0.40/0.47	0.43/0.50	0.45/0.52	0.42/0.49	0.43/0.50	0.44/0.50
Wet Gluten (%)	13.1	21.9	31.1	19.9	14.5	23.7	5.1	22.9	15.5
Gluten Index	97	80	56	83	48	86	31	80	38
Falling Number (sec)	329	372	352	351	378	392	387	358	367
Amylograph Viscosity: 65g (BU)	576	597	607	590	580	530	529	491	490
Damaged Starch (%)	3.9	3.8	3.2	3.8	3.4	4.0	3.6	3.7	3.4
SRC: Water/50% Sucrose (%)	54/94	54/95	58/101	55/96	55/93	53/94	49/86	53/93	51/91
5% Lactic Acid/5% Na ₂ CO ₃ (%)	88/71	78/71	102/69	87/70	71/67	104/69	75/63	103/77	78/73
Gluten Performance Index (GPI) (%)	0.53	0.47	0.60	0.52	0.44	0.54	0.51	0.59	0.48
DOUGH PROPERTIES:									
Farinograph: Peak Time (min)	1.1	1.2	2.5	1.4	1.1	2.0	1.2	2.1	1.3
Stability (min)	1.1	2.4	3.2	2.0	1.1	2.5	1.1	2.6	1.3
Absorption (%)	50.0	50.8	52.8	50.8	50.0	52.5	51.1	52.1	50.0
Alveograph: P (mm)	38	39	41	39	25	39	27	36	24
L (mm)	61	82	90	75	49	66	43	100	76
P/L Ratio	0.62	0.48	0.46	0.53	0.51	0.60	0.63	0.38	0.37
W (10 ⁻⁴ J)	71	81	91	79	33	74	29	84	35
Extensograph (45 min): Resistance (BU)	250	242	211	240	115	260	107	232	124
Extensibility (cm)	13.5	15.6	17.1	15.0	15.3	18.0	17.2	18.1	16.1
Area (cm ²)	51	57	52	54	26	71	23	63	27
BAKING EVALUATION:									
Sponge Cake: Volume (cc)	1157	1131	1101	1137	1150	1081	1070	1098	1126
Score	60	60	54	59	56	35	34	44	47
Cookie: Diameter (cm)	8.3	8.3	8.2	8.3	8.7	8.6	9.1	8.9	9.3
Spread Ratio (width/thickness)	8.7	8.2	7.9	8.3	9.8	10.3	12.6	10.1	11.8
Pan Bread: Bake Absorption (%)	55.3	55.9	58.0	56.0		57.9			
Crumb Grain and Texture (1-10)	4.0	4.0	5.0	4.2		5.5			
Loaf Volume (cc)	605	641	727	641		694			
CHINESE SOUTHERN-TYPE STEAMED BREAD EVALUATION:									
Specific Volume (ml/g)	2.2	2.5	2.6	2.4	2.9	2.3	2.3	2.1	2.2
Total Score	64.6	70.9	70.7	68.2	69.0	55.1	53.5	65.2	61.8
% OF PRODUCTION:	42	40	18	100	100				

¹Protein Range: Low, <9.0%; Medium, 9.0 - 10.5%; High, >10.5%.

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)

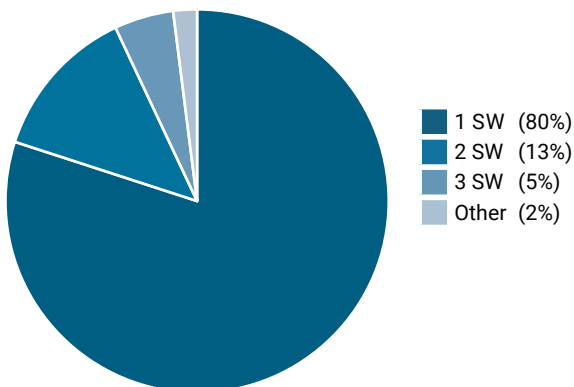
- Contains not more than 10% of other soft white wheats.
- *Triticum compactum* (club wheat) has a white bran and very soft endosperm and is known as the softest class of U.S. wheat. Club wheat has very weak gluten and its use results in excellent cake quality (high ratio sponge cake). It is normally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



WESTERN WHITE (WW)

- Contains more than 10% of white club wheat.
- 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.

DISTRIBUTION BY GRADE

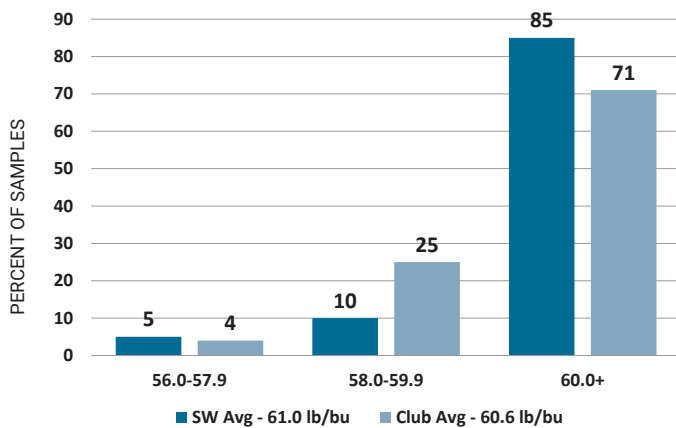


“Idaho is known for its exceptional quality, in part due to adequate water and warm, dry summers. This year we almost had too much of a good thing with extreme heat during grain fill. It is truly a testament to modern farming practices and varieties that, despite the heat, most of the Soft White crop came in with good test weights and protein numbers.”

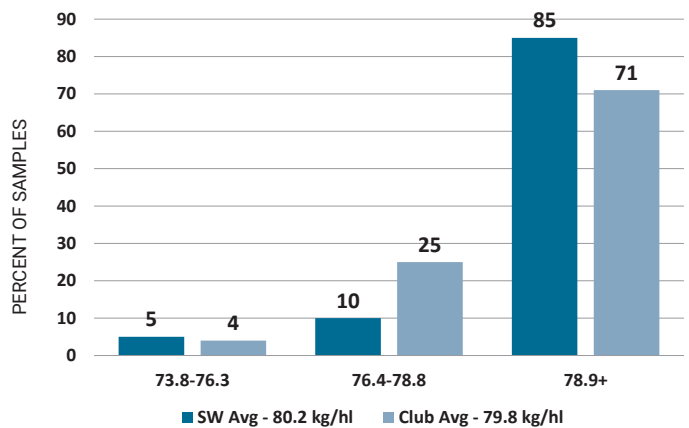
— Cory Kress, Idaho wheat farmer

DISTRIBUTIONS

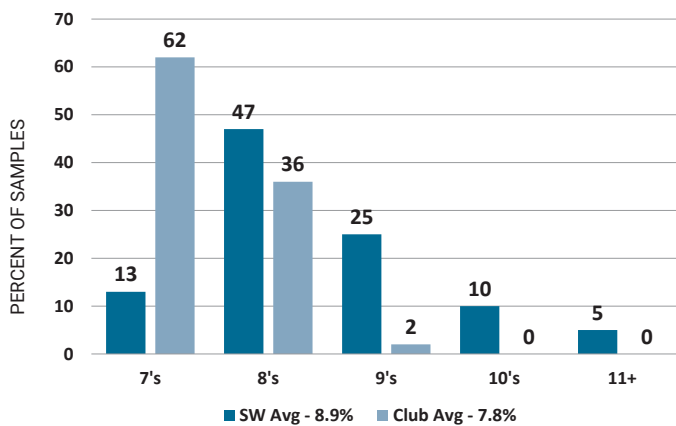
TEST WEIGHT | Pounds/Bushel



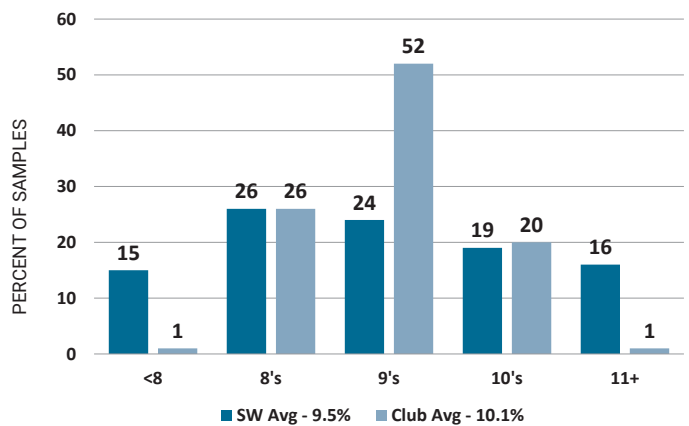
TEST WEIGHT | Kilograms/Hectoliter



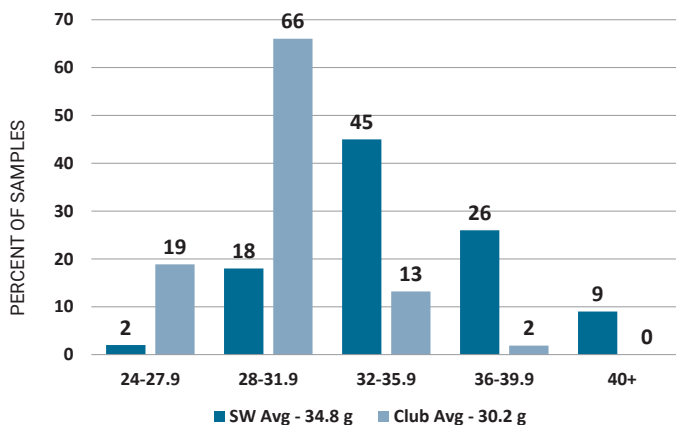
WHEAT MOISTURE | Percent



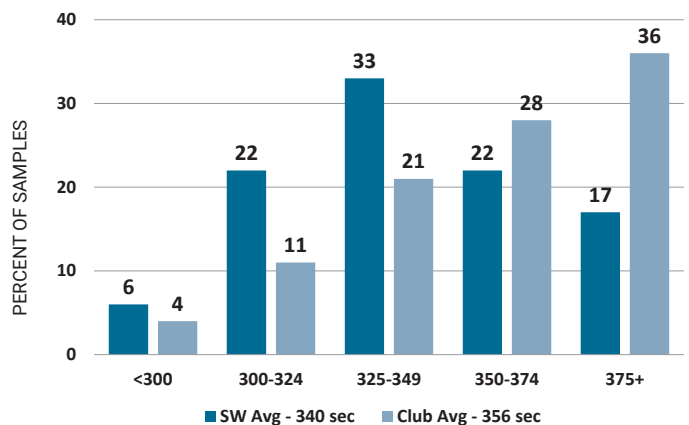
PROTEIN (12% MB) | Percent



1000 KERNEL WEIGHT | Grams



FALLING NUMBER | Seconds



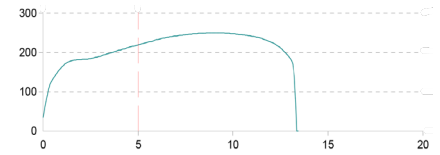
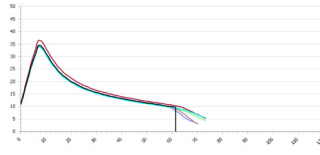
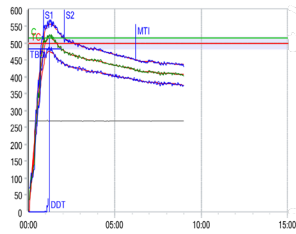
DOUGH PROPERTIES

FARINOGRAMS

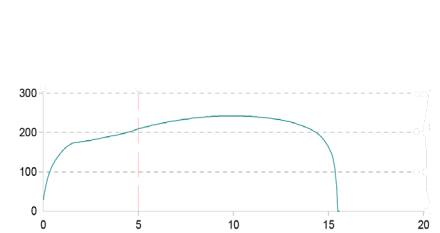
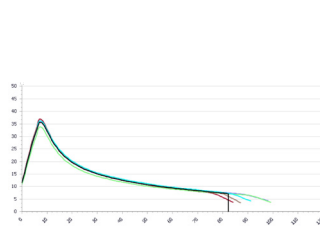
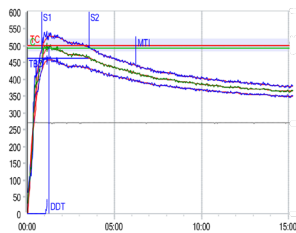
ALVEOGRAMS

EXTENSOGRAMS

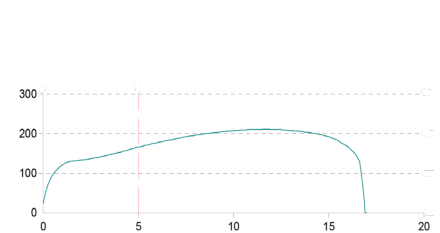
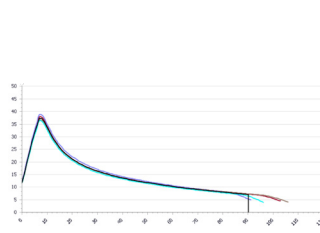
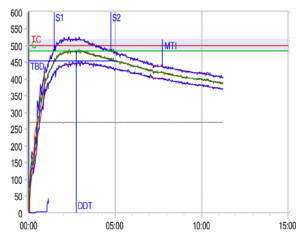
**LOW
PROTEIN**



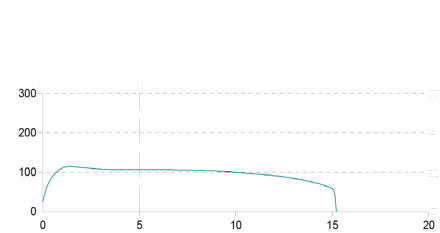
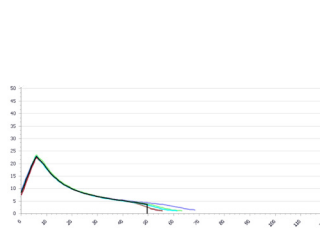
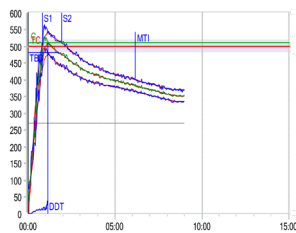
**MEDIUM
PROTEIN**



**HIGH
PROTEIN**



CLUB



Washington Grain Commission, August 2022



Oregon Wheat Commission, August 2022





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:

- Baguette
- Blending wheat
- Cakes
- Cereals or cereal bars
- Cookies
- Crackers
- Empanadas
- Flat breads
- Flours (cake, pastry, self-rising)
- Fried Spring Rolls
- Pastries
- Pretzels
- Snack foods
- Other confectionary products

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



SURVEY METHODOLOGY

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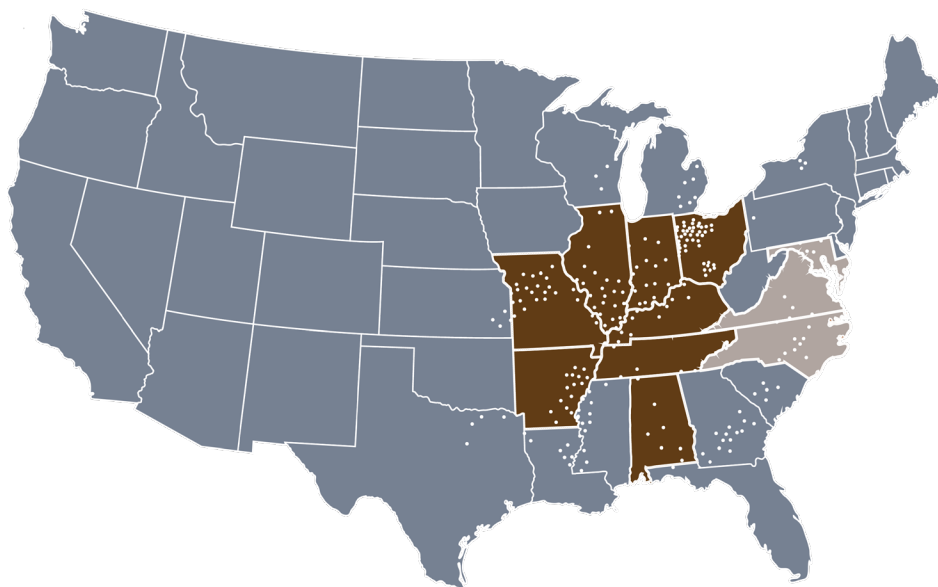
Samples collected from elevators in 18 reporting areas.

SAMPLE COLLECTION AND ANALYSIS

Great Plains Analytical Laboratory 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 Composite, East Coast and Gulf averages. The methods are described in the Analysis Methods section of this booklet.

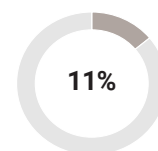


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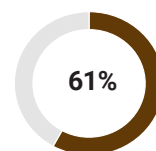
STATES SURVEYED

72%

OF TOTAL SRW PRODUCTION
REPRESENTED



EAST COAST



GULF

PERCENTAGE OF TOTAL U.S. SRW
SAMPLED CROP PRODUCTION BY
EXPORT TRIBUTARY



HARVEST SURVEY

Soft Red Winter (SRW) is grown over a wide area of the eastern United States. The production region experienced generally good growing conditions in the 2022 crop year. The crop is very sound with high test weight and falling number values, lower moisture, good milling characteristics, and is relatively free of DON. Processors will find a versatile crop with good qualities for cookies, cakes and crackers. With higher protein and good extensibility, the crop should also be valuable in blending for baking applications. Buyers are encouraged to review their quality specifications to ensure that purchases meet their expectations.

WEATHER AND HARVEST

PLANTING started at a normal pace in mid-September 2021 with similar progress as the 5-year average. The area seeded to SRW in fall 2021 for the 2022 harvest is estimated by USDA at 2.78 million hectares, up from 2.67 million hectares seeded for the 2021 harvest and up from the 5-year average.

As the crop **DEVELOPED** much of the SRW growing area received plentiful moisture through the winter and spring with only Maryland seeing a decrease in soil moisture. Overall, timely mild temperatures and rainfall benefited critical kernel development.

HARVEST began slowly in late-May but picked up pace mid-June as

temperatures turned hot and dry. By July, much of the growing region experienced heat, humidity and above average rainfall with pockets of favorable harvest weather.

PRODUCTION of the 2022 SRW crop is estimated to be 9.2 million metric tons (MMT), down from 9.8 MMT in 2021 but up from the 5-year average of 8.1 MMT.

2022 CROP HIGHLIGHTS

The overall **GRADE** sample average collected for the 2022 SRW harvest survey is U.S. No. 1 SRW.

TEST WEIGHT averages trended higher and are indicative of a sound crop with Composite average 60.1 lb/bu (79.1 kg/hl), East Coast 59.7 lb/bu (78.5 kg/hl) and Gulf average 60.3 lb/bu (79.3 kg/hl).

1000 KERNEL WEIGHT, KERNEL DIAMETER and **WHEAT PROTEIN** values reflect a relatively consistent crop.

WHEAT FALLING NUMBER averages trended well above average indicating this is a sound crop with very little sprout damage: Composite (327 sec), East Coast (336 sec) and Gulf (325 sec) are all above 2021 and 5-year averages.

AMYLOGRAPH data indicates enhanced starch characteristics that are well suited for batter-based products. The 2022 averages for Composite (666 BU), East Coast (574 BU) and Gulf (687 BU) reinforce the high falling numbers and indicate very low levels of amylase activity.

SOLVENT RETENTION CAPACITY

capacity values generally indicate excellent quality for cookies and crackers. Sucrose values indicate cookies and crackers will benefit from reduced baking time.

DOUGH PROPERTIES suggest that this crop is more extensible than the 5-year average and is typical for SRW.

ALVEOGRAPH data indicate a crop that is more extensible, less resistant than last year and is suitable for blending bread-type products. P values: Composite (36 mm), East Coast (41 mm) and Gulf (35 mm); L values: Composite (82 mm), East Coast (91 mm) and Gulf (80 mm).

The **COOKIE SPREAD RATIOS** for Composite (10.7), East Coast (10.6) and Gulf (10.7) are all similar to last year and higher than the 5-year averages, indicating good spreadability.

Average **LOAF VOLUMES** are higher than last year and indicate this crop is excellent for blending: Composite (624 cc), East Coast (610 cc) and Gulf (627 cc).

"International customers should be very pleased with the U.S. Soft Red Winter wheat crop this year. Across the production region yields were excellent with very good quality and good test weights. In Maryland, we had an increase in acres and yields, averaging 80 bushels per acre (5.5 tons per hectare). On our Eastern Shore farm, we had the best crop in at least four years."

— Jason Scott, Maryland wheat farmer

HARVEST DATA

	COMPOSITE			EAST COAST ¹			GULF ¹		
	2022 Avg	2021 Avg	5-Year Avg	2022 Avg	2021 Avg	5-Year Avg	2022 Avg	2021 Avg	5-Year Avg
WHEAT GRADE DATA:									
Test Weight (lb/bu)	60.1	59.8	58.9	59.7	58.8	58.0	60.3	60.0	59.1
(kg/hl)	79.1	78.6	77.5	78.5	77.4	76.4	79.3	78.9	77.8
Damaged Kernels (%)	0.2	0.3	0.5	0.5	0.3	1.1	0.1	0.3	0.4
Foreign Material (%)	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1
Shrunken & Broken (%)	0.6	0.5	0.6	0.5	0.6	0.8	0.6	0.5	0.5
Total Defects (%)	0.9	0.9	1.2	1.1	0.9	1.8	0.8	0.9	1.0
Grade	1 SRW	2 SRW	2 SRW	2 SRW	2 SRW	2 SRW	1 SRW	2 SRW	2 SRW
WHEAT NON-GRADE DATA:									
Dockage (%)	0.4	0.3	0.3	0.3	0.2	0.3	0.4	0.3	0.3
Moisture (%)	12.4	13.6	13.3	12.7	14.2	13.5	12.3	13.4	13.2
Protein (%) 12%/0% mb	9.6/10.9	9.3/10.6	9.5/10.8	10.1/11.5	9.6/10.9	9.6/10.9	9.4/10.7	9.3/10.6	9.5/10.8
Ash (%) 14%/0% mb	1.46/1.70	1.60/1.86	1.62/1.89	1.38/1.61	1.53/1.78	1.59/1.84	1.48/1.72	1.61/1.87	1.63/1.90
1000 Kernel Weight (g)	32.9	34.2	32.7	34.6	35.7	33.8	32.6	33.9	32.5
Kernel Size (%) lg/md/sm	85/14/01	88/11/01	85/14/01	87/13/00	87/12/01	85/14/02	85/14/01	88/11/01	85/14/01
Single Kernel: Hardness	23.4	24.5	21.8	24.1	27.1	21.3	23.3	24.0	22.0
Weight (mg)	32.5	34.3	34.2	34.4	33.9	35.1	32.1	34.3	34.0
Diameter (mm)	2.60	2.65	2.63	2.64	2.61	2.64	2.59	2.65	2.63
Sedimentation (cc)	11.1	10.0	11.0	12.1	12.3	11.4	10.9	9.5	11.0
Falling Number (sec)	327	299	309	336	260	286	325	307	315
DON (ppm)	0.7	0.8	0.7	0.4	0.2	0.6	0.8	0.9	0.8
FLOUR DATA:									
Lab Mill Extraction (%)	66.4	66.0	67.4	66.6	65.4	67.2	66.4	66.1	67.5
Color: L*	91.1	91.2	91.4	90.5	91.1	91.3	91.3	91.2	91.4
a*	-2.4	-2.3	-2.3	-2.3	-2.3	-2.3	-2.4	-2.3	-2.3
b*	9.3	9.1	8.9	9.3	8.6	8.8	9.3	9.1	8.9
Protein (%) 14%/0% mb	7.6/8.9	7.4/8.6	7.7/9.0	8.0/9.3	7.6/8.8	7.9/9.2	7.6/8.8	7.4/8.6	7.7/8.9
Ash (%) 14%/0% mb	0.41/0.48	0.41/0.48	0.43/0.50	0.41/0.48	0.44/0.51	0.44/0.51	0.41/0.47	0.40/0.47	0.43/0.50
Wet Gluten (%)	20.7	20.2	21.2	22.8	19.4	21.7	20.3	20.3	21.1
Gluten Index	82	84	83	80	91	85	83	83	83
Falling Number (sec)	326	283	306	313	260	288	329	288	310
Amylograph Viscosity: 65g (BU)	666	459	527	574	302	377	687	489	563
Damaged Starch (%)	3.4	5.0	4.5	4.4	4.2	4.5	3.2	5.1	4.5
SRC: Water/50% Sucrose (%)	51/90	54/95	56/101	50/86	54/100	58/103	52/91	54/94	56/101
5% Lactic Acid/5% Na ₂ CO ₃ (%)	102/71	106/73	112/77	104/68	112/76	113/81	102/72	105/72	111/77
Gluten Performance Index (GPI) (%)	0.64	0.63	0.63	0.67	0.64	0.62	0.63	0.63	0.63
DOUGH PROPERTIES:									
Farinograph: Peak Time (min)	1.2	1.2	1.2	1.4	1.4	1.3	1.1	1.1	1.2
Stability (min)	1.6	1.6	1.8	2.0	2.0	1.8	1.5	1.6	1.8
Absorption (%)	51.2	52.2	52.4	52.2	52.3	52.9	51.0	52.2	52.3
Alveograph: P (mm)	36	44	39	41	43	40	35	44	39
L (mm)	82	56	80	91	57	78	80	56	81
P/L Ratio	0.44	0.78	0.49	0.45	0.74	0.52	0.44	0.79	0.48
W (10 ⁻⁴ J)	85	79	83	103	78	83	81	79	83
Extensograph (45 min): Resistance (BU)	200	177	175	194	185	165	202	175	177
Extensibility (cm)	15.3	15.9	15.9	16.6	16.4	16.4	15.0	15.8	15.8
Area (cm ²)	53	50	48	58	54	47	52	49	49
BAKING EVALUATION:									
Cookie: Diameter (cm)	8.9	8.9	8.9	8.8	8.9	8.8	8.9	8.9	8.9
Spread Factor (diameter/height)	10.7	10.6	9.8	10.6	10.9	9.3	10.7	10.5	9.9
Pan Bread: Bake Absorption (%)	54.0	53.5	54.1	54.6	53.2	54.5	53.8	53.6	54.0
Crumb Grain and Texture (1-10)	4.4	4.4	4.9	5.0	4.5	5.1	4.3	4.4	4.9
Loaf Volume (cc)	624	607	675	610	602	676	627	608	675
% OF PRODUCTION:	100			16			84		

¹East 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)

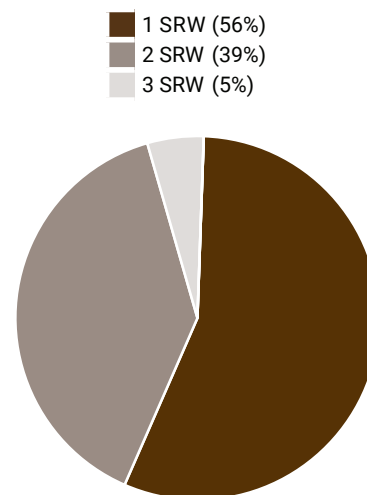
DISTRIBUTION BY GRADE

(BASED ON 18 COMPOSITE SAMPLES)

	2022	2021	2020	2019	2018
<i>Alabama</i>	0.2	0.2	0.1	0.2	0.2
<i>Arkansas</i>	0.2	0.2	0.1	0.1	0.1
Georgia	0.2	0.2	0.1	0.1	0.1
<i>Illinois</i>	1.2	1.3	1.0	1.0	1.0
<i>Indiana</i>	0.5	0.6	0.5	0.4	0.5
<i>Kentucky</i>	0.8	0.8	0.6	0.7	0.5
<i>Maryland</i>	0.4	0.3	0.3	0.3	0.3
Michigan	0.6	0.8	0.6	0.6	0.6
<i>Missouri</i>	0.7	0.9	0.6	0.7	0.8
<i>North Carolina</i>	0.7	0.5	0.6	0.3	0.6
New York	0.2	0.2	0.2	0.1	0.2
<i>Ohio</i>	1.0	1.2	0.9	0.6	0.9
Pennsylvania	0.4	0.4	0.4	0.3	0.3
<i>Tennessee</i>	0.7	0.6	0.4	0.4	0.5
<i>Virginia</i>	0.3	0.2	0.2	0.2	0.3
Wisconsin	0.5	0.5	0.2	0.3	0.4
Surveyed-States Total*	6.6	7.0	5.3	4.8	5.8
East Coast-Tributary	1.3	1.1	1.1	0.8	1.2
Gulf-Tributary	5.3	5.9	4.2	4.0	4.6
Sixteen-State Total	8.5	9.1	6.8	6.1	7.3
Total SRW Production	9.2	9.8	7.2	6.5	7.8

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

*Eleven states denoted by italics were surveyed accounting for 72% of 2022 SRW production.



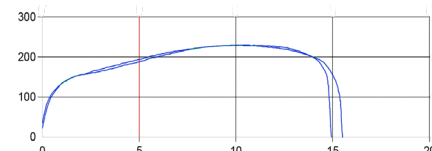
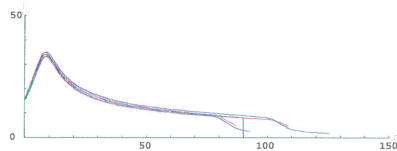
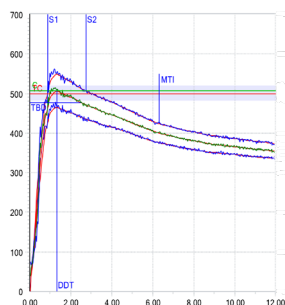
COMPOSITE DOUGH PROPERTIES

FARINOGRAMS

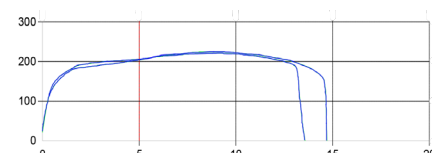
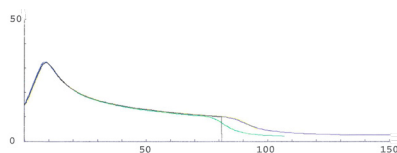
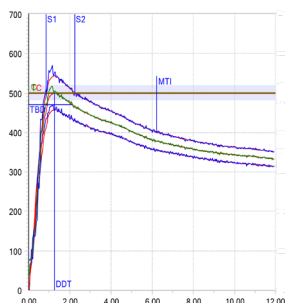
ALVEOGRAMS

EXTENSOGRAMS

EAST
COAST

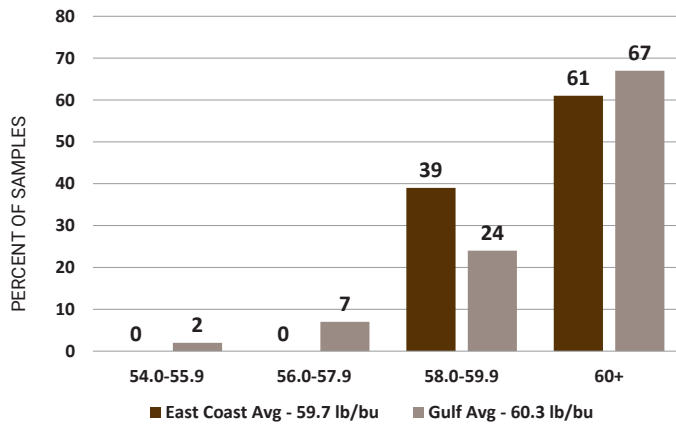


GULF

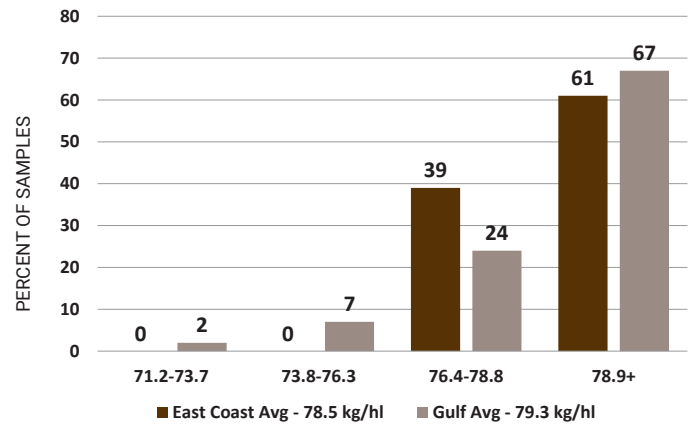


DISTRIBUTIONS

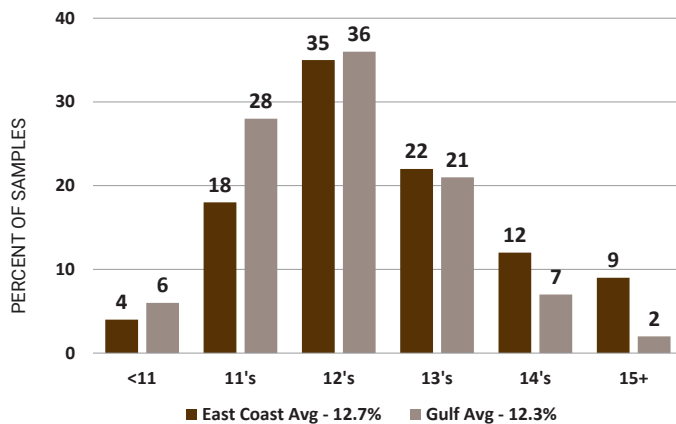
TEST WEIGHT | Pounds/Bushel



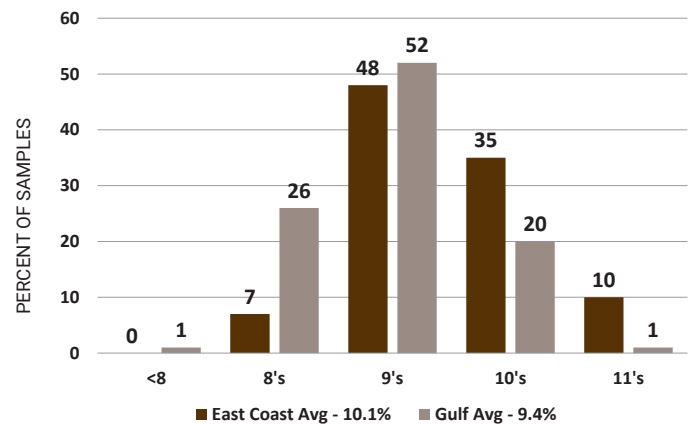
TEST WEIGHT | Kilograms/Hectoliter



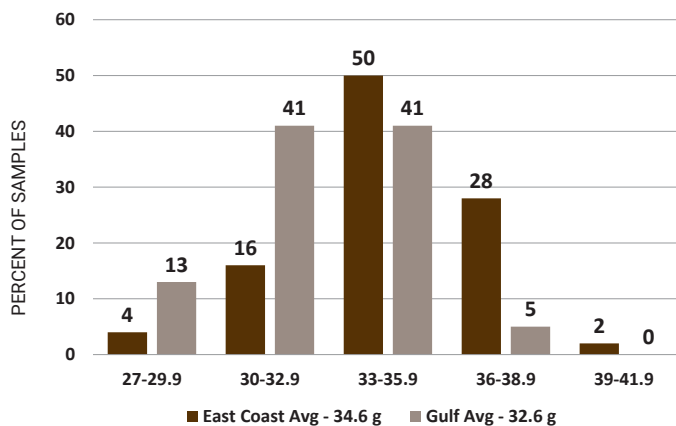
WHEAT MOISTURE | Percent



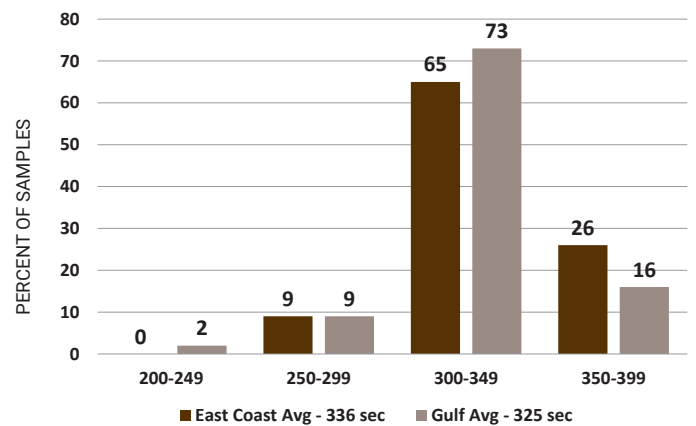
PROTEIN (12% MB) | Percent



1000 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.

Applications include:

- Couscous
- Mediterranean breads and cakes
- Pastas
- Pizza doughs
- Semolina flour

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



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) – at least 75% hard, vitreous kernels of amber color
- Amber Durum (AD) – between 60-74% hard, vitreous kernels of amber color
- Durum (D) – less than 60% hard, vitreous kernels of amber color

DURUM PRODUCTION

FOR THE MAJOR PRODUCING STATES (MMT)

	2022	2021	2020	2019	2018
Arizona	0.3	0.1	0.1	0.1	0.2
California	0.1	0.1	0.0	0.1	0.1
Montana	0.5	0.3	0.7	0.6	0.6
North Dakota	0.8	0.5	1.0	0.8	1.2
Four-State Total	1.7	1.0	1.9	1.6	2.1
Northern Durum	1.4	0.8	1.7	1.4	1.8
Desert Durum®	0.4	0.2	0.2	0.2	0.3
Total Durum Production	1.7	1.0	1.9	1.6	2.1

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



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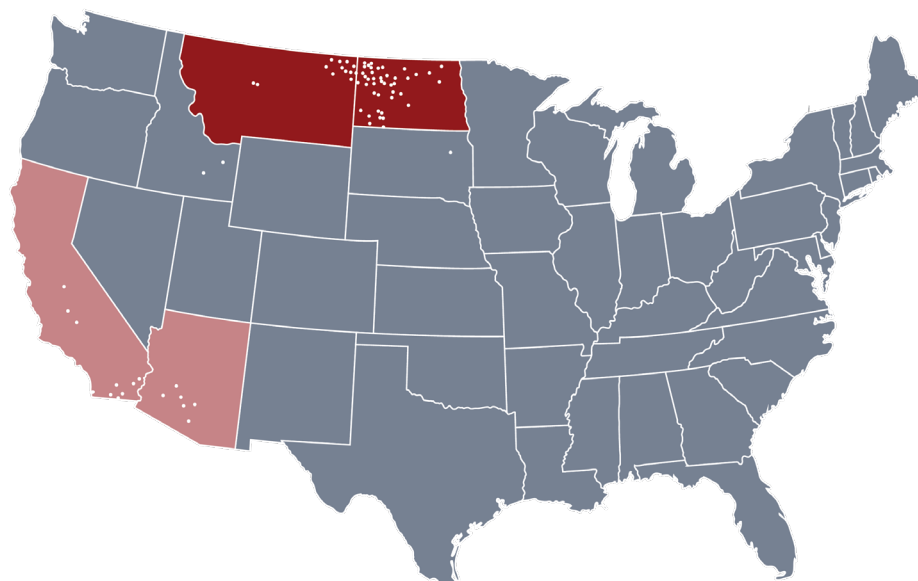
Northern durum samples collected from fields, farm bins and local elevators by the National Agricultural Statistics Service.

SAMPLE COLLECTION AND ANALYSIS

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

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.

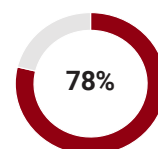


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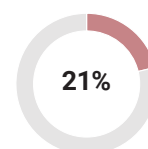
STATES SURVEYED

99%

OF TOTAL DURUM PRODUCTION REPRESENTED



NORTHERN DURUM



DESERT DURUM®

PERCENTAGE OF TOTAL U.S. DURUM PRODUCTION BY REGION

13

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

SAMPLE COLLECTION AND ANALYSIS

California Wheat Commission Laboratory conducted the quality analyses.

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.

NORTHERN DURUM HARVEST SURVEY

Buyers will find a larger supply of durum from the northern part of the United States in 2022. This high-quality crop boasts excellent grading and kernel characteristics and high falling numbers. While there are pockets of lower-than-average protein, lighter 1000 kernel weights and smaller kernels, the overall crop should meet the needs of customers. Dough properties are slightly weaker than 2021, but compare well to 5-year averages, along with cooked pasta characteristics. With high vitreous levels, low moisture, high test weights, little to no damage, sound kernel characteristics, and high semolina and pasta color scores, this crop will provide tremendous value to buyers.

WEATHER AND HARVEST

PLANTING was delayed until mid-May, later than normal, due to snow and colder temperatures and excess soil moisture. Progress remained slow and planting was completed in the last half of June.

The **GROWING SEASON** brought warmer, drier conditions which

limited disease pressure. Ample soil moisture from spring precipitation sustained crop development during drier periods. Timely rains boosted yield potential in northwest North Dakota and portions of Montana.

HARVEST began in early August, later than normal, but made steady progress with favorable weather.

Harvest of the last 10% of the crop, primarily in the more northern areas, was slow due to periodic rain and delayed crop ripening. Harvest was not complete until mid-October.

Durum **PRODUCTION** in the U.S. Northern Plains, at 1.4 MMT is up nearly 70%, a significant recovery from last year's severe drought.

2022 CROP HIGHLIGHTS

The average **GRADE** of the 2022 crop is U.S. No. 1 Hard Amber Durum (HAD); 75% of the crop grades U.S. No. 1 HAD, up from 39% in 2021.

Average **TEST WEIGHT** of 61.8 lb/bu (80.4 kg/hl), above last year and 5-year averages.

DAMAGE was quite low at 0.1% due to minimal disease pressure.

SHRUNKEN AND BROKEN KERNELS were at 1.0% with pockets of slightly higher levels due to dryness during kernel fill.

The average **VITREOUS KERNEL (HVAC)** content is 92%, higher than last year and 5-year averages. Nearly two-thirds of the samples were above 90% HVAC, but pockets of the crop saw lower HVAC levels due to low protein levels.

For the second year, **KERNEL MOISTURE** was lower, at 11.0%, than average due to a mostly dry harvest period.

PROTEIN averages 13.7% (12% mb), lower than last year's drought impacted crop, and is a result of above-average yields in parts of the region, and heat and moisture induced higher protein levels in other areas. Nearly 70% of the samples are above 13.0% protein.

The average **1000 KERNEL WEIGHT** is 40.4 g, slightly lower than last year. This year has a wider than normal distribution of 1000 kernel weights and kernel sizes across the growing region.

FALLING NUMBER values are high, with the average being 433 sec, with 99% of the crop above 300 sec.

For a second consecutive year, **DON** is nearly non-existent in all production regions in 2022.

LABORATORY MILLING for the 2022 survey was performed on a Quadromat® Junior mill, the same as the previous three years. Semolina extraction is 53.9%, indicating a reduction in extraction from last year; commercial mills are likely to see higher extraction values.

Some adjustment for smaller kernel size and lighter 1000 kernel weight in portions of the crop may be required.

SEMOLINA COLOR shows a notable improvement in the b* value (yellowness) at 31.2, and a similar L* value (brightness) to the 5-year average.

SEMOLINA PROTEIN is 12.0%, well below recent years due to lower kernel protein.

ASH is similar to last year at 0.64%, with **SPECK COUNTS** higher than last year but similar to the 5-year average.

Similarly, **GLUTEN INDEX** (72) and **WET GLUTEN** (33.4%) are both lower than last year and 5-year averages.

MIXING PROPERTIES reveal a slightly weaker crop, due in part to the lower protein content.

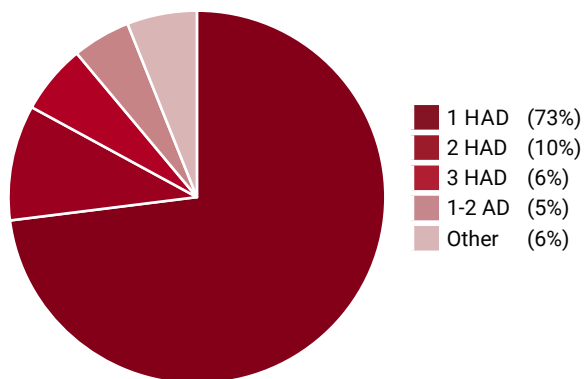
COOKED SPAGHETTI DATA show improved color, with less cooking loss, but slightly lower cooked weight and firmness.

NORTHERN DURUM HARVEST DATA

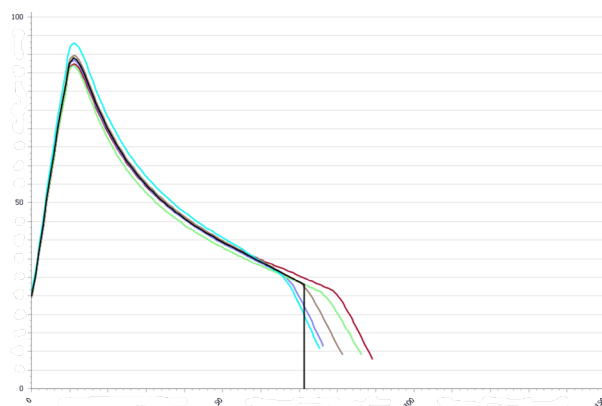
	2022 Avg	2021 Avg	5-Year Avg
WHEAT GRADE DATA:			
Test Weight (lb/bu)	61.8	60.5	61.1
(kg/hl)	80.4	78.8	79.5
Damaged Kernels (%)	0.1	0.1	0.7
Foreign Material (%)	0.0	0.1	0.0
Shrunken & Broken (%)	1.0	1.0	0.9
Total Defects (%)	1.1	1.2	1.6
Contrasting Classes (%)	0.2	0.9	0.3
Vitreous kernels (%)	92	86	83
Grade	1 HAD	1 HAD	1 HAD
WHEAT NON-GRADE DATA:			
Dockage (%)	1.1	0.5	0.9
Moisture (%)	11.0	10.9	11.3
Protein (%) 12%/0% mb	13.7/15.6	15.5/17.6	14.4/16.3
Ash (%) 14%/0% mb	1.64/1.91	1.69/1.96	1.55/1.80
1000 Kernel Weight (g)	40.4	41.2	42.3
Kernel Size (%) lg/md/sm	43/52/5	36/59/5	49/47/4
Falling Number (sec)	433	428	399
Sedimentation (cc)	61	79	70
DON (ppm)	<0.5	<0.5	<0.5
SEMOLINA DATA:			
Lab Mill Extraction (%)	n/a	n/a	n/a
Semolina Extraction (%)	53.9	54.6	n/a
Color: L*	83.3	83.3	83.4
a*	-2.5	-2.3	-2.4
b*	31.2	30.3	29.8
Protein (%) 14%/0% mb	12.0/14.0	14.2/16.5	13.2/15.4
Ash (%) 14%/0% mb	0.64/0.74	0.65/0.76	0.66/0.77
Specks (no/10 in ²)	27	21	28
Wet Gluten (%)	33.4	37.1	34.5
Gluten Index	72	81	73
Mixograph: Classification	6.5	6.7	6.0
Peak Time (min)	3.9	3.2	3.0
Peak Height (MU)	3.9	4.9	5.3
Alveograph: P (mm)	94	107	84
L (mm)	67	66	73
P/L Ratio	1.4	1.6	1.3
W (10 ⁻⁴ J)	222	260	204
SPAGHETTI PROCESSING DATA:			
Color Score	8.5	8.3	8.5
Cooked Weight (g)	29.7	32.4	31.4
Cooking Loss (%)	6.7	8.0	6.8
Cooked Firmness (g cm)	4.5	4.8	4.3
SAMPLE COUNT:	234	226	



NORTHERN DURUM GRADE DISTRIBUTION



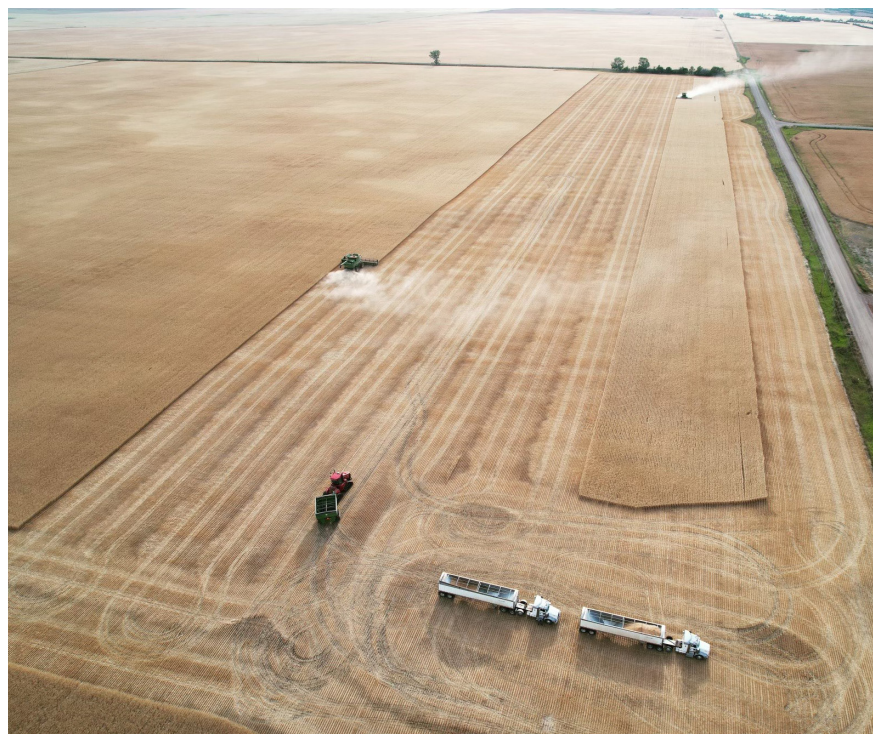
NORTHERN DURUM REGIONAL AVERAGE ALVEOGRAM



North Dakota, July 2022, Erica Olson



Montana, September 2022, Terry Angvick

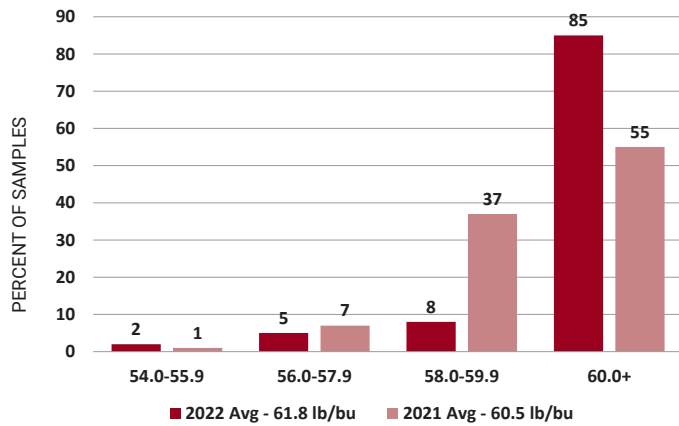


"The Northern durum 2022 harvest finished nicely this year. Following an exceptionally dry, cold spring and delayed planting, timely rain provided good growing conditions through spring and summer. Yields were average to above average at 30-40 bushels per acre (2.0-2.7 tons per hectare) and a very dry harvest helped protect quality. Test weight and protein are good. Color is excellent. The only downside is we are entering the fall in very dry condition again. Still, an overall good year."

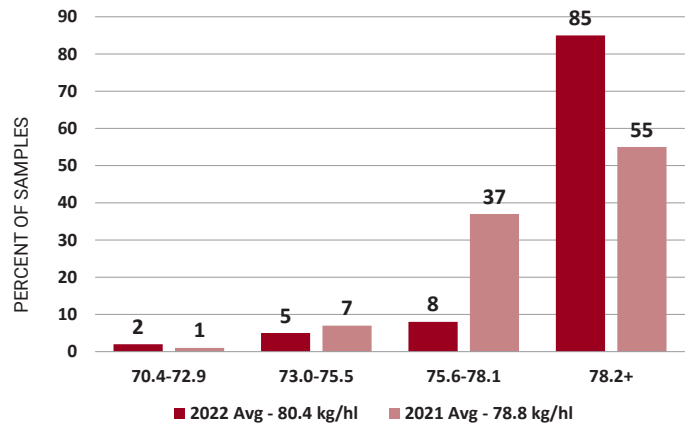
— Terry Angvick, Montana wheat farmer

NORTHERN DURUM DISTRIBUTIONS

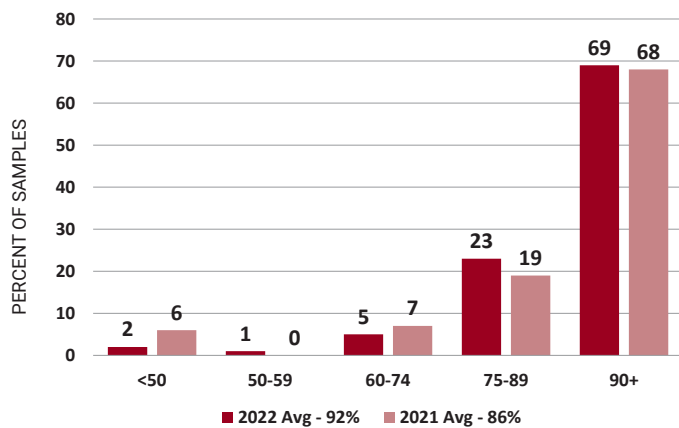
TEST WEIGHT | Pounds/Bushel



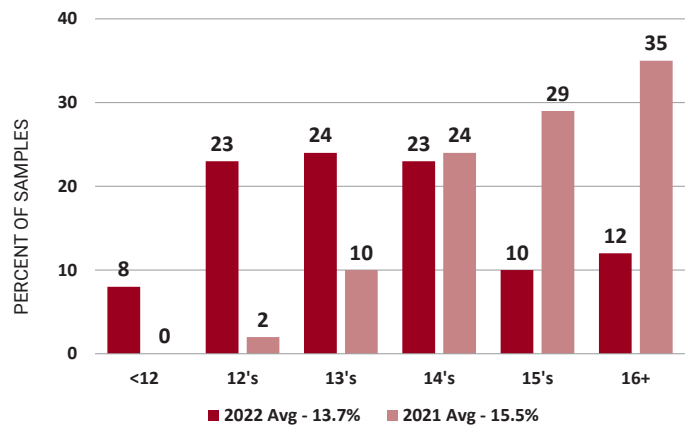
TEST WEIGHT | Kilograms/Hectoliter



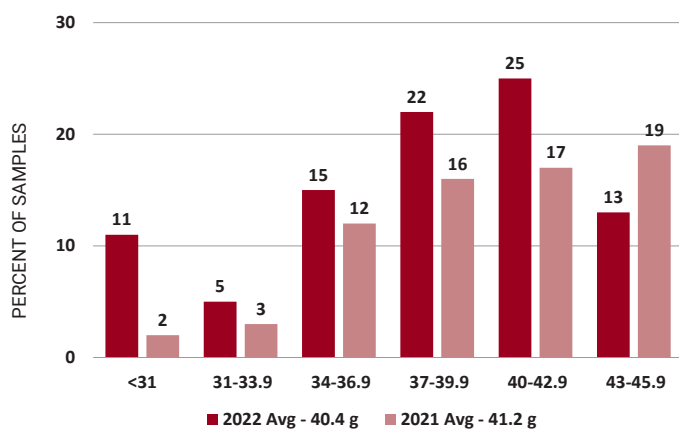
VITREOUS KERNELS | Percent



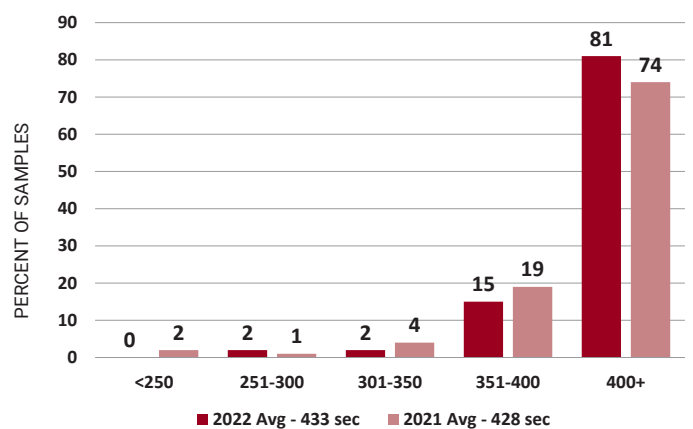
PROTEIN (12% MB) | Percent



1000 KERNEL WEIGHT | Grams



FALLING NUMBER | Seconds



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 designated 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® exhibits consistently large kernels and low moisture, traits that contribute to efficient transportation costs and high extraction rates. The 2022 crop will deliver the valuable milling, semolina and pasta quality traits that customers have learned to expect and appreciate.

2022 CROP HIGHLIGHTS

Desert Durum® **PRODUCTION** acreage in 2022 was higher than 2021. According to USDA, yields were 3.36 tons/acre, and quality was uniformly good. Powell was the most widely grown variety in California. Alberto was the second most grown durum variety.

The overall **GRADE** sample average for the 2022 Desert Durum® harvest survey is U.S. No. 1 Hard Amber Durum (HAD).

TEST WEIGHT is indicative of sound

wheat and a uniform crop with an average of 64.1 lb/bu (83.4 kg/hl).

Average **DAMAGED KERNELS** are 0.0% and **TOTAL DEFECTS** are 0.5%.

The average **VITREOUS KERNEL (HVAC)** content is 98%, a high average typical of Desert Durum®.

WHEAT PROTEIN content average is 13.2% (12% mb), lower than the 5-year average.

Kernel **MOISTURE** content is low at 7.3%, a characteristic of Desert Durum®.

The **SEMOLINA COLOR b*** value is 30.9, slightly lower than last year’s 32.5.

WET GLUTEN average is 33.4% and **GLUTEN INDEX** average is 62.

Semolina **MIXOGRAPH** score is 7.0 and indicates high gluten strength.

The **SPAGHETTI COLOR SCORE** is 10.

Spaghetti **COOKED FIRMNESS** average is 6.8, slightly lower than last year’s 7.2.



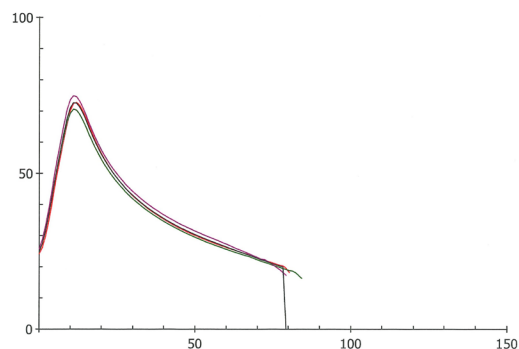
“Desert Durum® producers were happy to see better than average yields this year from some new varieties. Our protein average of 13.2% (12% mb) is less than last year, but every other functional characteristic is typical of Desert Durum® – consistently ideal for making excellent pasta.”

– Michael Edgar, Arizona wheat farmer

DESERT DURUM® HARVEST DATA

	2022 Avg	2021 Avg	5-Year Avg
WHEAT GRADE DATA:			
Test Weight (lb/bu)	64.1	63.9	62.8
(kg/hl)	83.4	83.2	81.8
Damaged Kernels (%)	0.0	0.0	0.1
Foreign Material (%)	0.0	0.1	0.0
Shrunken & Broken (%)	0.4	0.5	0.5
Total Defects (%)	0.5	0.6	0.7
Contrasting Classes (%)	0.0	0.0	0.0
Vitreous kernels (%)	98	99	98
Grade	1 HAD	1 HAD	1 HAD
WHEAT NON-GRADE DATA:			
Dockage (%)	0.2	0.2	0.3
Moisture (%)	7.3	7.5	6.9
Protein (%) 12%/0% mb	13.2/15.0	13.9/15.8	13.8/15.7
Ash (%) 14%/0% mb	1.58/1.84	1.62/1.88	1.68/1.94
1000 Kernel Weight (g)	51.9	49.3	47.1
Kernel Size (%) lg/md/sm	96/4/0	94/6/0	91/9/0
Falling Number (sec)	713	503	665
Sedimentation (cc)	59	72	64
DON (ppm)	-	-	-
SEMOLINA DATA:			
Lab Mill Extraction (%)	79.7	78.5	77.1
Semolina Extraction (%)	74.2	72.9	71.3
Color: L*	86.5	86.2	86.1
a*	-3.9	-4.0	-3.6
b*	30.9	32.5	31.2
Protein (%) 14%/0% mb	11.9/13.9	12.6/14.7	12.8/14.8
Ash (%) 14%/0% mb	0.79/0.92	0.78/0.91	0.83/0.96
Specks (no/10 in ²)	21	14	21
Wet Gluten (%)	33.4	36.1	34.2
Gluten Index	62	69	75
Mixograph: Classification	7.0	7.0	7.4
Peak Time (min)	2.6	2.5	3.1
Peak Height (MU)	5.2	5.6	5.3
Alveograph: P (mm)	74	67	96
L (mm)	87	114	82
P/L Ratio	0.9	0.6	1.2
W (10 ⁻⁴ J)	180	191	239
SPAGHETTI PROCESSING DATA:			
Color Score	10.0	10.1	9.6
Cooked Weight (g)	29.6	31.1	29.7
Cooking Loss (%)	6.3	5.9	5.5
Cooked Firmness (g cm)	6.8	7.2	6.7
SAMPLE COUNT:	13	7	

DESERT DURUM® REGIONAL AVERAGE ALVEOGRAM





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. (See conversion table 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, and can 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 kernels will not determine numeric grade value but will affect subclass designation.

Scan this QR code with the camera application on your smart phone to access more information on the USW website at www.uswheat.org/working-with-buyers/wheat-glossary.



WHEAT NON-GRADE FACTORS

NON-GRADE FACTORS do not affect numerical grades but can be used to determine the suitability 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.

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. Moisture is measured with dockage. 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](#)).

- **Methods:** Moisture content for HRW (Midwestern, CA), HRS, SW is determined by Official USDA conductance method; Durum (Northern) AACCI 44-11.01, Motomco Moisture Meter; Desert Durum® and SRW AACCI 44-15.02, air oven method (flour) DICKEY-john GAC® 2500-UGMA Grain Analysis Computer (wheat).

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



PHOTO TAKEN AT THE FEDERAL GRAIN INSPECTION SERVICE

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 is usually desired for products such as snacks or cakes.

- **WHEAT** (12% mb) measured for HRW (Midwestern, CA), HRS, SW – AACCI 39-25.01 (NIR method); all other classes – AACCI 46-30.01 (Dumas combustion nitrogen analysis or CNA method) on ground wheat.
- **FLOUR/SEMOLINA** (14% mb) measured for HRW (Midwestern, CA), HRS – AACCI 39-10.01 (NIR method); all other classes – AACCI 46-30.01 (Dumas CNA method) on flour or semolina.

ASH content is the percentage of minerals by weight in wheat or flour. In wheat, ash is primarily concentrated in the bran and is an indication of the expected flour yield during milling. In flour, ash content indicates milling performance by indirectly revealing the amount of

bran contamination in flour. Ash in flour can impart a darker color to finished products. Products requiring white color call for low ash content, while whole wheat flour has higher ash content.

- **Method:** AACCI 08-01.01 expressed on a 14% mb.

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.

- **Methods:** HRS, Durum (Northern) – Cereal Foods World (Cereal Science Today) 5:(3), 71 (1960). HRW (Midwestern), SW, SRW – Wheat is sifted with a RoTap sifter using Tyler No. 7 (2.82 mm) and No. 9 (2.00 mm) screens. HRW (CA), Desert Durum® – use U.S. Standard Sieves No. 7 (2.80 mm) and No. 10 (2.00 mm). Kernels remaining on the No. 7 screen are “Large,” passing through the No. 7 screen but not the No. 9 or No. 10, are “Medium,” and passing through the No. 9 or No. 10 screen are “Small.”

WHEAT NON-GRADE FACTORS CONTINUED

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.

- **Method:** AACCI 54-31.01 using Perten SKCS 4100.

1000 KERNEL WEIGHT is the weight in grams of 1000 kernels of wheat and may indicate grain size and expected milling yield.

- **Methods:** HRS, Durum (Northern, Desert Durum®), SRW, HRW (CA) – based on a 10 g clean wheat sample counted by an electronic counter, results converted to express weight by 1000 kernels; SW – based on the average weight of three 100-kernel samples multiplied by 100, expressed on

a 14% mb; HRW (Midwestern) – average of SKCS kernel weight in mg x 1000 equals in g.

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:** HRS, HRW (Midwestern), SRW, SW – AACCI 56-61.02; Durum (Northern, Desert Durum®) – AACCI 56-70.01; HRW (CA) – AACCI 56-63.01.

FALLING NUMBER is the time required for a plunger to fall through a 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. SW, SRW, HRW (Midwestern) and HRS use the 2019 FGIS barometric pressure correction procedure; average value is a simple mean of sample results. Methodology is same for flour and wheat falling numbers.

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

- **Methods:** All analysis is on ground wheat. HRS, Durum (Northern) – gas chromatograph with electron capture detector as described in the Journal of AOAC International 79,472 (1996). SRW, HRW (CA) – Neogen ELISA; HRW (Midwestern) – Charm ROSA DonQ2 Quantitative Test.

FLOUR AND SEMOLINA FACTORS

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 than can be obtained on a commercial mill. Lab milling is done mainly to obtain flour/semolina for other tests and settings are not optimized.

- **Methods:** Laboratory samples are cleaned and tempered according to AACCI 26-10.02. All extraction rates are calculated against total products on an “as is” mb. Samples for the following are milled on a Buhler Laboratory mill (MLU



PHOTO TAKEN AT THE WHEAT MARKETING CENTER

202): SW – AACCI 26-31.01; HRW (Midwestern), SRW, HRS – AACCI 26-21.02; SRW – uses a 183-micron (μ) sieve. HRW (CA) is milled on a Brabender® Quadrumat Senior Mill using the Brabender® procedure; Durum (Northern) is milled using a Brabender® Quadromatic Junior Semolina Mill; grain is tempered to 15.5% moisture one day before milling. Desert Durum® is milled on a 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. Flour color is influenced by endosperm color, particle size and ash content and often affects finished product color. Durum semolina color is heavily influenced by particle size.

- **Methods:** CIE 1976 $L^*a^*b^*$ color system. The following use the Minolta method using Minolta Chroma Meter with Granular-Materials attachment CR-A50: CR-200 colorimeter, HRW (CA), Desert Durum®; CR-410 colorimeter, HRW (Midwestern), Durum (Northern), HRS, SW, SRW.

WET GLUTEN is a measure of the quantity of gluten in wheat or flour samples as determined using the Glutomatic System. Wet gluten forms when water is added to the protein in wheat or flour and is responsible for the elasticity and extensibility characteristics of flour dough.

- **Methods:** HRW (Midwestern, CA), HRS, SRW – AACCI 38-12.02; SW – AACCI 38-12.02 (water reduced from 4.8 to 4.2 ml); Semolina (Northern, Desert Durum®) AACCI 38-12.02 (Glutomatic procedure).

GLUTEN INDEX is also determined by the Glutomatic System and is a



PHOTO TAKEN AT THE CALIFORNIA WHEAT LABORATORY

measure of gluten strength regardless of the quantity of gluten present. Gluten index is used commercially to select durum samples with strong gluten characteristics. In bread (hard) wheat, a variety of factors can affect the results, though very low gluten index may be an indication of protein damage from insect or disease activity.

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:** AACCI 22-10.01 modified to use 65 g flour (14% mb) and 450 ml distilled water with paddle (HRS) or pins (all other classes).

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, starch damage is important for interpreting other reported results.

- **Methods:** SRW – AACCI 76-30.02; all other classes – AACCI 76-33.01 (SDmatic method).

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.

- **Method:** A random sample is pressed under a clear plate and the specks (brown and black particles) within a 1 in² area marked on the plate are counted. Average of three determinations is expressed as specks per 10 in².

FLOUR AND SEMOLINA FACTORS CONTINUED

SOLVENT RETENTION CAPACITY

(SRC) is the weight, expressed as percentages, of four solvents held by flour after centrifugation to the original flour weight on a 14% mb. The solvents – deionized water (measuring overall water absorption/control solvent), sucrose (measuring pentosans), lactic acid (glutenins) and sodium carbonate (damaged starch) – indicate the ability of flour to absorb water during mixing and either sequester or release water during dough handling. 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:** Determined by SRC machine (Chopin) for SW and AACCI 56-11.02 for all other classes.

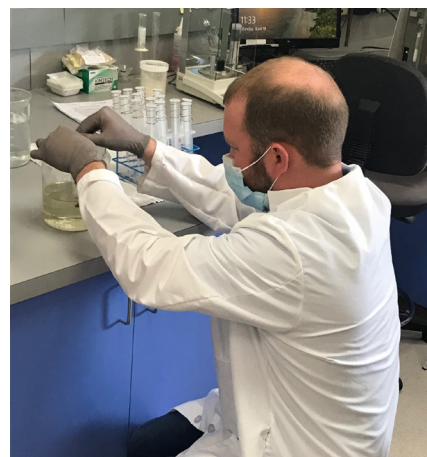


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SUGGESTED SOLVENT RETENTION CAPACITY (SRC) VALUES ARE AS FOLLOWS:

Type of SRC Solvent:	100% Water	50% Sucrose	5% Sodium Carbonate (pH 11)	5% Lactic Acid (pH 2)
Cracker	50 - 70	80 - 110	60 - 85	100 - 120
Cookie	50 - 70	80 - 110	60 - 85	85 - 100
Wafer	50 - 70	80 - 110	60 - 85	80 - 100
Cake	50 - 70	80 - 110	60 - 85	60 - 80

DOUGH PROPERTY FACTORS

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

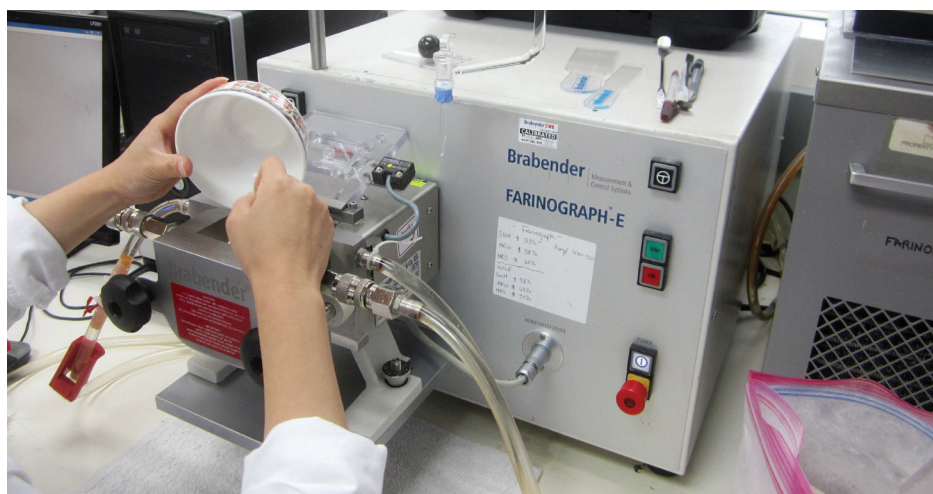


PHOTO TAKEN AT THE WHEAT MARKETING CENTER

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.

- **Method:** AACCI 54-21.02 (constant flour weight method) with 50 g bowl.

EXTENSOGGRAPH generates 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:

- **Methods:** AACCI 54-10.01, modified 45 and 135-min rest for HRS, HRW (Midwestern, CA); 45 min rest for SW and SRW.



ALVEOGRAPH generates a curve indicating the air pressure necessary to inflate a piece of dough like a bubble to the point of rupture and indicates the gluten strength and extensibility of dough. Values reported include:

- **P** ("overpressure" or resistance), measured in millimeters 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



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

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.

CRUMB GRAIN AND TEXTURE is determined on a scale of 1 to 10 by visual comparison to a standard using a constant illumination source. Higher scores are preferred.

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

METHODS:

- **MIDWESTERN 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 with two punches, then molded, panned and proofed for 60 min before baking at 220°C (425°F) for 18 min. Loaf volume is



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measured immediately after baking by rapeseed displacement. Crumb grain and texture are evaluated on a 0 to 6 scale, which for this booklet is converted to a 1 to 10 scale.

- **CA 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, 2.12% active dry yeast and 0.10% malted barley flour) in a 200 g Swanson

pin mixer with head speed of 100 to 120 rpm and 90 min fermentation. Loaf volume is measured 1 hour after baking. Grain and texture are scored on a scale of 1 to 10 with higher numbers indicating preferred quality.

- **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 immediately after baking by rapeseed displacement.

- **HRS:** AACCI 10-09.01 (long fermentation method) modified: 15 SKB units (fungal amylase/100 g flour, 1% instant dry yeast, 10 ppm ammonium phosphate, 2% added shortening). Dough is mechanically punched, molded and baked in "Shogren-type" pans. Scoring is based on a 1 to 10 scale with higher numbers indicating preferred quality attributes.

- **SW:** AACCI 10-10.03 ("pup loaf" method) with 180 min fermentation. Volume measured with Laser light using a Tex Vol Instrument (BVM-L370).



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SPAGHETTI

COLOR SCORE is based on the relative brightness and yellowness of spaghetti as measured by a reflectance colorimeter. Higher values (scale 1 to 12) are preferred.

COOKED WEIGHT is best used in conjunction with firmness values to determine the cooking qualities of a spaghetti sample; high weight and high firmness values indicate high quality while high weight and low firmness indicate poor quality.

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

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

- **Method:** Durum pasta is made using the laboratory procedure described by Walsh, Ebeling and Dick, Cereal Foods World: 16: (11) 385 (1971). Water (Desert Durum® – adjusted to optimum hydration based on P-value from alveograph test; Northern – 32%)



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is added to semolina and mixed in a Hobart mixing bowl for 5 min. Semolina-water mixture is extruded using a DeMaco laboratory pasta extruder. Spaghetti is dried using modified Buhler low-temperature drying cycle as described by P. Yue, P. Rayas-Duarte, and E. Elias, Cereal Chemistry 76(4):541-547. Color scores as described by

AACCI 14-22.01 are determined by the procedure described by Walsh, Macaroni Journal 52: (4) 20 (1970), using a Minolta Color Difference Meter (Northern CR-410, Desert Durum® CR-210). Cooked weight, cooking loss and firmness are determined by AACCI 16-50.01.

SPONGE CAKE

VOLUME is measured by Tex-Vol Volumeter (BVM-L370). Large volume indicates better flour.

TEXTURE SCORE: Each cake is measured by TA-XT Plus texture analyzer for softness and compared to the control. The maximum score is 30 and the control is set at 70%, which is 21.

EXTERNAL SCORE: Each cake is subjectively evaluated against the control. The maximum score is 20 and the control is set at 70%, which is 14.

INTERNAL SCORE: Each cake is subjectively evaluated against the control. The maximum score is 30 and the control is set at 70%, which is 21.

TOTAL SCORE comprises texture, external factors, and internal factors. The control flour is scored 56; maximum score is 80.

- **Method:** Sponge cake volume and score are measured by the Japanese standard method described by Nagao in Cereal Chemistry 53(6):988-997, 1976. Sponge cake control flour is Japanese commercial "western white." Flour with low protein content, low ash content, and weak gluten characteristics make good quality sponge cake.

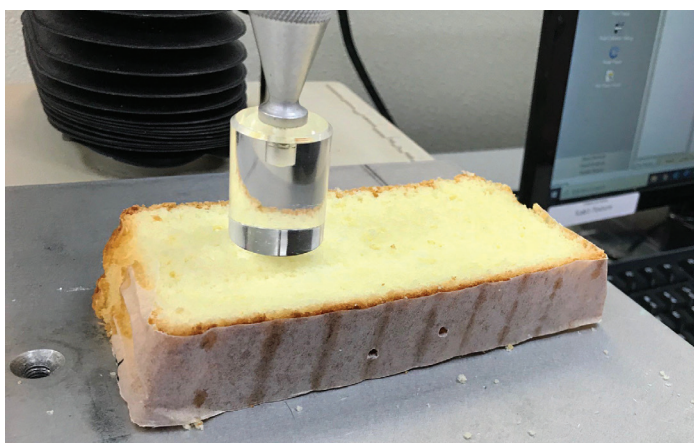


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EVALUATION OF END-PRODUCTS CONTINUED

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.

TOTAL SCORE comprises volume, external characteristics, internal characteristics, eating quality and flavor. Each property is rated compared with a control sample. The control flour is scored 70.

- **Method:** Prepared using no-time dough method (WMC procedure):

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. Volume measured with Laser light using a Tex Vol Instrument (BVM-L370).



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SUGAR-SNAP COOKIES (BISCUITS)

DIAMETER (d), or width, is a static measurement of spread 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 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.

- **Methods:** SW: ACCI 10-52.02, micro-method; SRW: ACCI 10-50.05, macro-method.



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



**DEPENDABLE
PEOPLE.
RELIABLE WHEAT.**

*High-quality wheat for
every need.*



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. Today, U.S. Wheat Associates (USW) and the entire U.S. wheat industry remain fixed on the mission of the farmers who created an enduring legacy of commitment and partnership to provide the highest quality wheat for almost every customer need, backed by transparent pricing, trusted third-party certification and unmatched service before and after the sale. 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.



THE SUPPLY CHAIN FOLLOWS UNIFORM GRAIN SEGREGATION AND INSPECTION PROCEDURES.

U.S. country elevators and export elevators inspect and test wheat as it arrives and segregate 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. Those inspections yield valuable data down to the sub-lot level of 1,000 to 2,000 metric tons that customers can use, with assistance from USW, to get even more value from their purchases.

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. Export tariffs are forbidden in the U.S. Constitution, fully adhering to World Trade Organization disciplines, and the United States will not use food as a weapon.

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.

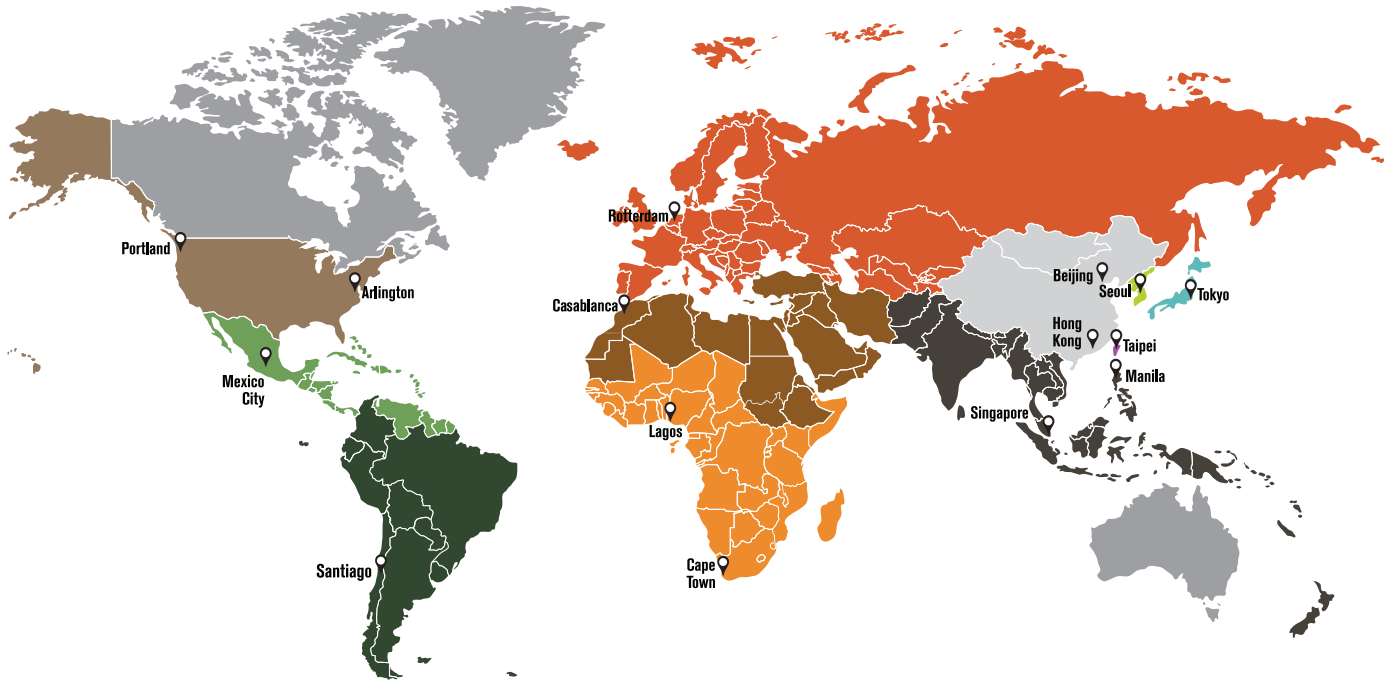
FOSTERING TRADE.

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.





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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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