U.S. PACIFIC NORTHWEST

2021 HARVEST SOFT WHITE WHEAT QUALITY REPORT

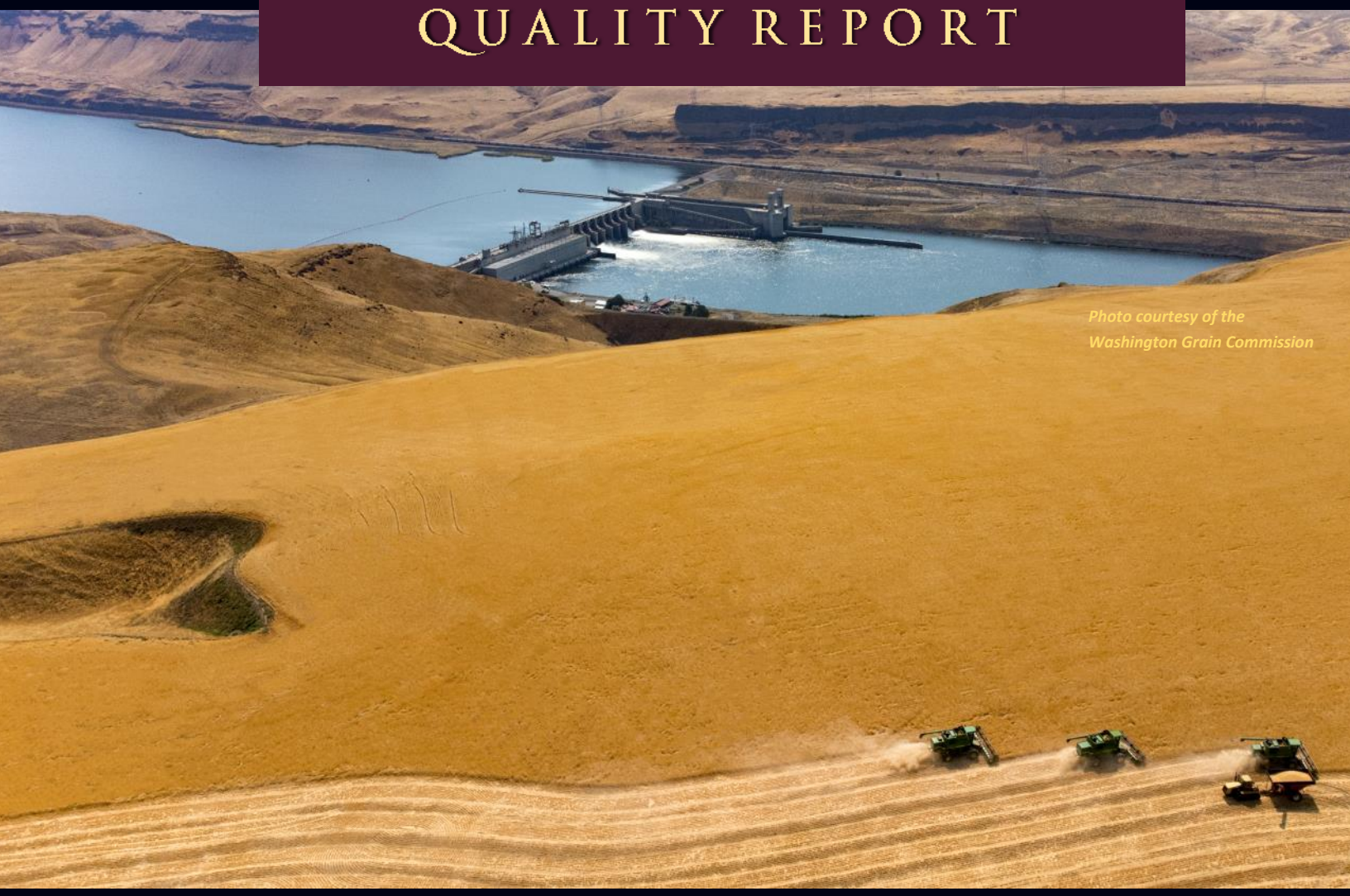


Photo courtesy of the Washington Grain Commission

Project is funded by

Idaho Wheat Commission | Oregon Wheat Commission | Washington Grain Commission

U.S. Wheat Associates | Wheat Marketing Center

Pacific Northwest
Executive Summary

The Pacific Northwest (PNW) experienced challenging drought conditions in the 2021 crop year, which resulted in a wheat crop with higher protein and lower yields. In general, the crop had lower moisture and higher falling number values. Overall, the crop graded #2, primarily due to lower test weights. Production of soft white (SW) and white club (WC) wheat is estimated at 4.27 MMT, compared to last year's 7.2 MMT. The overall quality is characterized by weak to medium gluten strength with acceptable potential to produce soft wheat flour products and other products made from blends of soft and hard wheat. Flour characteristics align with protein contents and show good color and falling number values; flour yield is slightly lower than the 5-year average. Farinograph water absorptions are desirably low for both SW and WC with weak to medium gluten characteristics for SW and very weak gluten for WC.

Finished product quality did not align with protein content this year. Some low protein composites did not produce good sponge cakes and higher protein composites did not make good Chinese southern-style steamed breads.

Throughout the year, PNW state commissions and U.S Wheat Associates provided regular updates to their customers to apprise them of growing conditions including the lack of rainfall in much of the PNW region. The communication intensified once harvest began, with multiple virtual updates provided in lieu of the usual crop survey teams. There was also a sharpened interest in the WMC weekly harvest reports. The communication throughout the year combined with this detailed annual report demonstrate the U.S. wheat industry's commitment to transparency in both good and challenging years. Ongoing wheat utilization research and technical training at WMC and other research centers, wheat breeding focused on quality, yield and enhanced drought resistance, and the technical assistance provided by USW staff – working in concert with U.S. wheat producers – deliver on the promise to be a dependable supplier of high quality wheat to all customers.

Contents

Pacific Northwest Soft White Wheat Class & Subclasses

U.S. soft white wheat grown in the Pacific Northwest includes the states of Idaho, Oregon, and Washington.

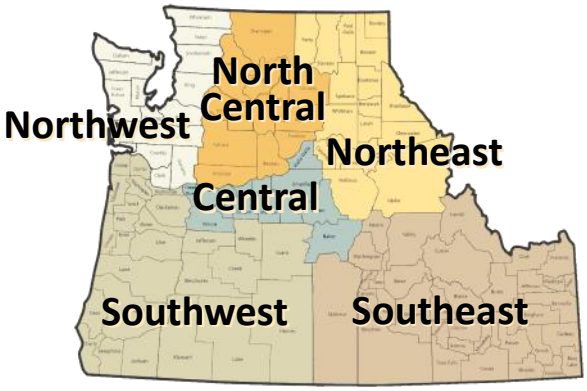
Pacific Northwest soft white wheat is valued for its white bran, low moisture content, and weak gluten characteristics. Consequently, SW is well suited for products such as cakes, cookies, pancakes, and snack foods. Soft white wheat with stronger gluten can be used in crackers, flat breads, and Chinese southern-type steamed breads by itself or in blends with hard wheat.

The soft white wheat class includes the subclasses of white club wheat and western white wheat. White club wheat has very weak gluten characteristics. Western white wheat is a blend of white club and soft white wheat. The amount of white club wheat in western white ranges from 10 to 90 percent. The minimum percentage of white club in western white is 10 percent; higher amounts are determined by contract specifications negotiated between buyers and sellers (typically 10-30%).

Soft White and White Club Wheat Summary

	Soft White		White Club	
	2021	5 yr av	2021	5 yr av
Test Weight (lb/bu)	**59.3**	61.4	**59.7**	60.6
Hectoliter Weight (kg/hl)	**78.0**	**80.7**	**78.6**	**79.7**
Grade	**2SWH**	1SWH	**1WHCB**	1WHCB
Dockage (%)	**0.5**	0.5	**0.5**	0.6
Whole Kernel Moisture (%)	**8.8**	9.3	**8.0**	8.6
Wheat Protein (%, 12% mb)	**11.3**	9.7	**11.5**	9.7
Wheat Ash (%, 14% mb)	**1.48**	1.34	**1.35**	1.29
1000 Kernel Weight (g, 14% mb)	**29.0**	36.0	**27.1**	32.1
Wheat Falling Number (seconds, 14% mb)	**344**	321	**345**	334
Flour Extraction (%)	**70.1**	73.1	**72.0**	74.7
Flour Ash (%, 14% mb)	**0.45**	0.42	**0.42**	0.45
Flour Wet Gluten (%, 14% mb)	**23.7**	22.9	**6.1**	19.1
Farinograph: Absorption (%, 14% mb)	**52.5**	52.4	**51.1**	50.4
Peak Time (minutes)	**2.0**	2.2	**1.2**	1.4
Stability Time (minutes)	**2.5**	2.7	**1.1**	1.3
Alveograph: L (mm)	**66**	104	**43**	83
W (10^{-4} joules)	**74**	86	**29**	40
Production (mmt)	**4.11**	5.97	**0.16**	0.32

Photo courtesy of Washington Grain Commission



Production Zones

2021 Soft White and White Club Wheat Production

Production Zone	Million Metric Tons (mmt)	Million Bushels
North Central	1.15	42.4
Northeast	1.39	51.0
Central	0.88	32.2
Southeast	0.66	24.3
Southwest	0.17	6.3
Northwest	0.02	0.8
Total	4.27	157.0

Source: USDA Small Grains Summary, NASS 9/30/21, and Washington Grain Commission 10/4/21.

Weather & Production

The majority of the wheat growing region in the Pacific Northwest (PNW) faced drought conditions for the 2021 soft white wheat (SW) crop. Seeding conditions for 2021 winter wheat were generally good including sufficient moisture overall to develop a strong stand; however, less winter moisture impacted crop development coming out of dormancy. Furthermore, a prolonged period of extremely dry conditions and excessive heat extended through the spring and summer months leading to poor spring planting and growing conditions throughout much of the PNW and put most of the SW crop in severe drought status prior to harvest. In many areas, extreme sustained heat in late June accelerated crop maturity which put the harvest timeframe generally ahead of average. Drought stress and hot weather impacted crop conditions and led to below-average yields for both winter and spring wheat in the PNW. USDA estimates the total PNW SW production at 4.27 MMT, which is lowest production for the region since 1966. Of that, white club (WC) is estimated to account for 0.16 MMT.

Wheat Samples

At harvest, wheat samples were collected from a number of sources, including state and private grain inspection agencies and commercial wheat handling operations throughout the Pacific Northwest. Sample collection was based on wheat production in each location. For the 2021 harvest, Wheat Marketing Center (WMC) received and tested 375 SW and 67 WC samples from Idaho, Oregon, and Washington. Federal Grain Inspection Service (FGIS) graded and ran wheat protein on each sample. WMC conducted wheat, flour, solvent retention capacity (SRC), dough, and finished product tests on the composites based on production zones and protein levels.

The top SW varieties planted in Oregon this year were Magic, Assure and Rosalyn. Tandem dropped down the list but is still in the top ten. Idaho's top SW winter varieties were SY Ovation and Norwest Tandem; the top SW spring variety was Ryan. Washington's top SW varieties were UI Magic CL+, Ryan, Northwest Duet, Curiosity CL+, and Norwest Tandem. Pritchett was the top white club variety planted in the PNW.

WHEAT QUALITY

Production Zone	Wheat Protein Range 12% mb %	Grade	Test Weight lb/bu	Dockage %	Whole Kernel Moisture %	Wheat Falling Number 14% mb sec	Wheat Ash 14% mb %	Thousand Kernel Weight 14% mb g	SKCS Kernel Hardness Index	Whole Meal Wet Gluten 14% mb %
North Central	<9.5	1SWH	60.7	0.5	7.7	350	1.28	28.3	40	17.4
	9.5-10.4	1SWH	60.9	0.3	8.1	321	1.23	29.6	37	21.1
	10.5-12.0	2SWH	59.5	0.3	7.8	347	1.29	28.3	39	27.8
	>12.0	2SWH	59.1	0.2	7.8	372	1.36	27.3	39	30.7
	2021 Average	**2SWH**	**59.5**	**0.3**	**7.8**	**355**	**1.31**	**28.0**	**39**	**27.7**
	2020 Average	1SWH	62.2	0.5	8.9	334	1.26	35.3	32	26.0
	5 Year Average	1SWH	61.6	0.4	9.0	323	1.26	34.9	29	23.0
Northeast	9.5-10.4	2SWH	59.3	0.8	8.8	333	1.51	28.0	28	22.6
	10.5-12.0	2SWH	59.2	0.6	8.9	346	1.41	25.7	30	27.9
	>12.0	3SWH	57.9	0.7	9.2	351	1.55	23.0	32	32.0
	2021 Average	**2SWH**	**58.7**	**0.7**	**9.0**	**346**	**1.47**	**25.0**	**30**	**28.8**
	2020 Average	1SWH	62.9	0.5	9.8	329	1.33	38.6	33	20.5
	5 Year Average	1SWH	62.3	0.5	9.3	326	1.32	36.9	29	21.5
Central	<9.5	2SWH	59.6	0.6	8.5	325	1.46	30.7	33	20.1
	9.5-10.4	1SWH	60.1	0.3	8.7	346	1.41	30.1	34	22.8
	10.5-12.0	1SWH	60.0	0.5	8.5	347	1.38	28.4	37	26.9
	>12.0	2SWH	58.3	0.7	8.6	367	1.51	25.1	34	33.2
	2021 Average	**2SWH**	**59.5**	**0.5**	**8.6**	**350**	**1.43**	**28.1**	**35**	**27.1**
	2020 Average	1SWH	61.4	0.5	9.4	318	1.55	37.5	32	22.4
	5 Year Average	1SWH	60.7	0.5	9.3	323	1.34	35.2	28	23.0
Southeast	<9.5	1SWH	61.4	0.4	9.7	329	1.62	38.2	21	15.3
	9.5-10.4	1SWH	60.1	0.8	10.1	331	1.63	36.0	24	19.2
	10.5-12.0	2SWH	58.7	0.6	10.1	325	1.66	35.4	19	22.7
	>12.0	3SWH	57.9	0.6	10.1	334	1.77	30.8	23	24.7
	2021 Average	**2SWH**	**59.4**	**0.6**	**10.0**	**329**	**1.66**	**35.3**	**21**	**20.9**
	2020 Average	2SWH	58.9	0.5	10.6	320	1.45	38.0	28	20.1
	5 Year Average	1SWH	60.8	0.5	9.9	328	1.48	39.0	29	20.0
Southwest	<8.5	1SWH	61.3	0.4	10.5	326	1.43	37.8	32	16.4
	9.5-10.4	1SWH	61.5	0.6	10.4	339	1.42	36.2	33	20.7
	2021 Average	**1SWH**	**61.4**	**0.5**	**10.5**	**333**	**1.43**	**37.0**	**33**	18.6
	2020 Average	2SWH	58.9	0.5	10.6	320	1.45	38.0	28	20.1
	5 Year Average	2SWH	59.9	0.5	10.9	324	1.39	38.7	23	18.2
White Club Wheat	**2021 Average**	**1WHCB**	**59.7**	**0.5**	**8.0**	**345**	**1.35**	**27.1**	**38**	**25.9**
	2020 Average	1WHCB	61.6	0.5	8.5	322	1.27	32.3	31	18.0
	5 Year Average	1WHCB	60.9	0.6	8.8	320	1.26	32.5	29	18.4

Flour Quality

Production Zone	Wheat Protein Range 12% mb %	Flour Yield %	Flour Ash 14% mb %	Flour Protein 14% mb %	Flour Color L*	Flour Color a*	Flour Color b*	Flour Wet Gluten 14% mb %	Flour Falling Number 14% mb sec	Amylograph Peak Viscosity BU
North Central	<9.5	70.9	0.46	8.7	92.5	-2.4	9.2	15.8	381	566
	9.5-10.4	71.7	0.45	9.4	92.6	-2.4	9.2	18.7	353	552
	10.5-12.0	69.1	0.46	10.8	92.6	-2.3	8.8	28.9	381	568
	>12.0	66.1	0.46	11.8	92.7	-2.1	8.5	34.9	430	587
	2021 Average	**68.3**	**0.46**	**11.0**	**92.6**	**-2.2**	**8.8**	**29.6**	**398**	**574**
	2020 Average	72.3	0.42	9.3	92.8	-2.2	8.2	22.7	337	486
	5 Year Average	73.4	0.41	8.8	92.9	-2.1	8.2	21.7	348	466
Northeast	9.5-10.4	70.7	0.50	9.1	92.5	-2.2	8.6	16.8	380	624
	10.5-12.0	69.2	0.47	10.3	93.1	-2.1	8.3	25.5	375	596
	>12.0	67.5	0.48	11.7	92.8	-1.9	7.9	28.9	396	606
	2021 Average	**68.7**	**0.48**	**10.7**	**92.9**	**-2.0**	**8.2**	**25.7**	**383**	**603**
	2020 Average	74.4	0.42	8.0	92.4	-2.2	8.7	18.1	332	456
	5 Year Average	74.5	0.41	8.4	92.6	-2.1	8.1	20.8	350	448
Central	<9.5	72.4	0.49	8.5	92.5	-2.1	8.4	19.9	355	574
	9.5-10.4	71.2	0.46	9.0	92.6	-2.1	8.4	16.0	383	555
	10.5-12.0	68.7	0.48	10.0	92.8	-2.2	8.6	25.8	391	584
	>12.0	66.6	0.47	11.8	92.6	-2.0	8.0	35.7	400	506
	2021 Average	**69.0**	**0.48**	**10.2**	**92.7**	**-2.1**	**8.4**	**25.9**	**388**	**556**
	2020 Average	72.4	0.42	8.9	92.7	-2.0	7.8	23.4	329	468
	5 Year Average	73.2	0.41	8.8	92.8	-2.1	7.9	23.2	342	501
Southeast	<9.5	71.5	0.48	8.3	92.7	-2.0	7.7	15.8	355	486
	9.5-10.4	72.8	0.50	8.8	92.6	-2.1	8.2	16.0	337	531
	10.5-12.0	71.9	0.47	9.8	92.7	-1.9	7.5	21.9	351	448
	>12.0	70.7	0.53	10.9	92.6	-2.0	7.8	27.7	353	413
	2021 Average	**71.9**	**0.49**	**9.5**	**92.6**	**-2.0**	**7.8**	**20.2**	**348**	**473**
	2020 Average	73.9	0.46	9.1	92.5	-2.0	7.9	21.6	316	432
	5 Year Average	74.5	0.46	8.5	93.0	-2.0	7.7	20.6	344	442
Southwest	<8.5	73.5	0.46	7.3	92.8	-2.6	10.3	11.1	333	425
	9.5-10.4	73.3	0.44	8.8	92.6	-2.2	9.0	20.4	354	478
	2021 Average	**73.4**	**0.45**	**8.1**	**92.7**	**-2.4**	**9.7**	**15.8**	**344**	**452**
	2020 Average	72.0	0.50	7.9	92.3	-2.2	8.9	19.4	324	296
	5 Year Average	74.1	0.47	7.5	92.6	-2.1	8.0	17.3	337	423
White Club Wheat	**2021 Average**	**72.0**	**0.42**	**10.5**	**92.9**	**-1.9**	**8.1**	**6.1**	**387**	**472**
	2020 Average	74.7	0.48	8.9	92.6	-2.0	8.0	13.1	365	439
	5 Year Average	75.1	0.42	8.5	92.2	-2.1	8.0	17.9	348	444

Solvent Retention Capacity (SRC)

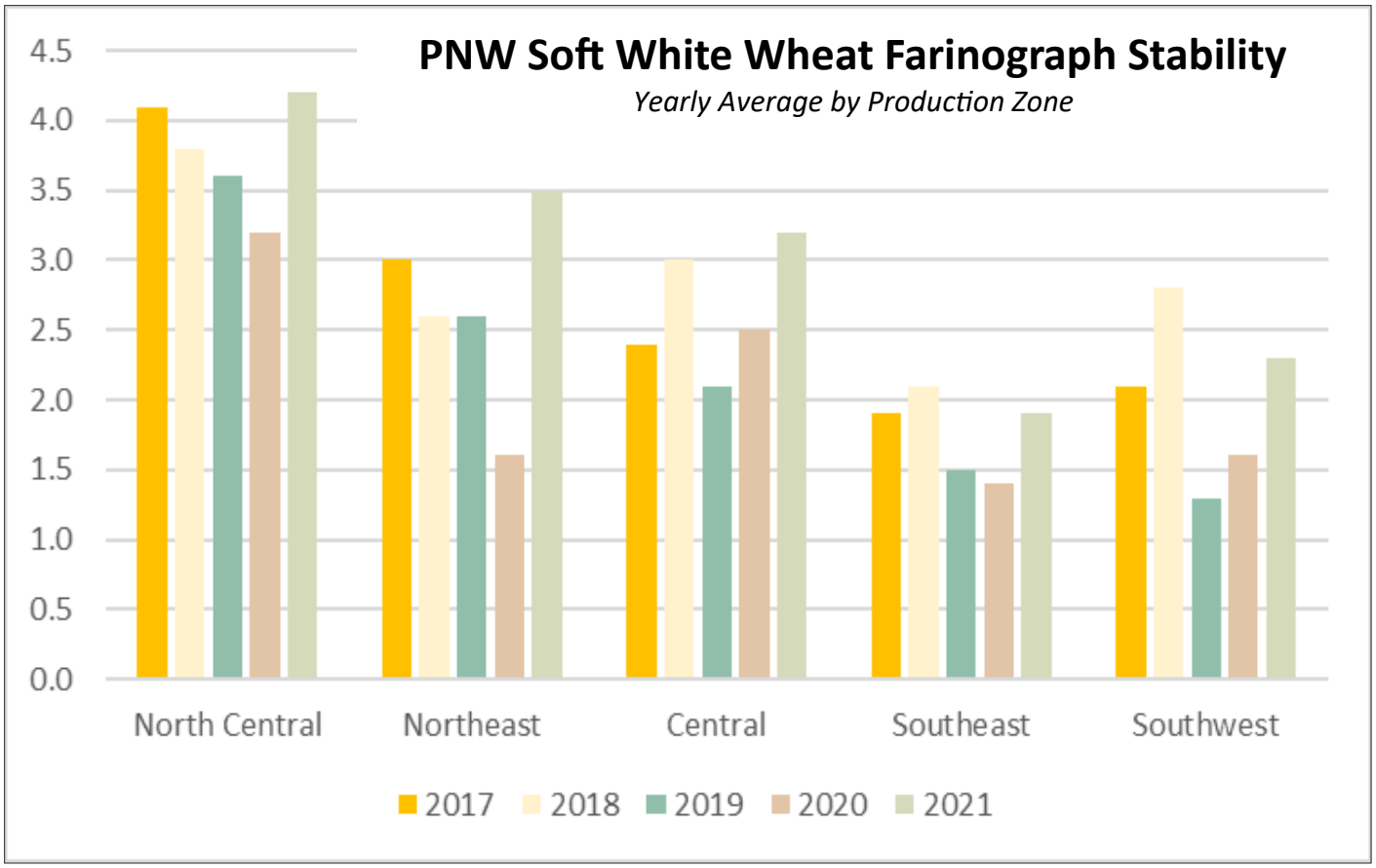
Production Zone	Wheat Protein Range 12% mb %	Water 14% mb %	50% Sucrose 14% mb %	5% Lactic Acid 14% mb %	5% Sodium Carbonate 14% mb %	Gluten Performance Index
North Central	<9.5	51	94	101	67	0.63
	9.5-10.4	51	90	113	65	0.73
	10.5-12.0	53	86	121	68	0.78
	>12.0	53	100	131	62	0.80
	2021 Average	**53**	**92**	**123**	**66**	**0.78**
	2020 Average	55	99	122	77	0.69
	5 Year Average	57	92	117	82	0.68
Northeast	9.5-10.4	49	88	96	66	0.62
	10.5-12.0	49	94	110	64	0.70
	>12.0	49	97	114	64	0.70
	2021 Average	**49**	**94**	**110**	**64**	**0.69**
	2020 Average	52	94	98	76	0.60
	5 Year Average	55	85	104	82	0.63
Central	<9.5	51	92	99	68	0.62
	9.5-10.4	51	93	105	65	0.66
	10.5-12.0	51	97	111	67	0.67
	>12.0	51	98	126	64	0.78
	2021 Average	**51**	**96**	**112**	**66**	**0.69**
	2020 Average	55	96	114	74	0.67
	5 Year Average	56	89	104	78	0.62
Southeast	<9.5	49	91	79	65	0.51
	9.5-10.4	49	91	79	65	0.51
	10.5-12.0	48	92	83	65	0.53
	>12.0	49	92	78	66	0.50
	2021 Average	**49**	**92**	**81**	**65**	**0.52**
	2020 Average	51	87	78	71	0.50
	5 Year Average	54	89	84	75	0.52
Southwest	<8.5	55	94	86	72	0.52
	9.5-10.4	54	100	104	72	0.60
	2021 Average	**54**	**97**	**95**	**72**	**0.56**
	2020 Average	54	97	94	80	0.53
	5 Year Average	56	89	99	82	0.58
White Club Wheat	**2021 Average**	**49**	**86**	**75**	**63**	**0.51**
	2020 Average	54	96	79	74	0.47
	5 Year Average	52	92	78	75	0.47

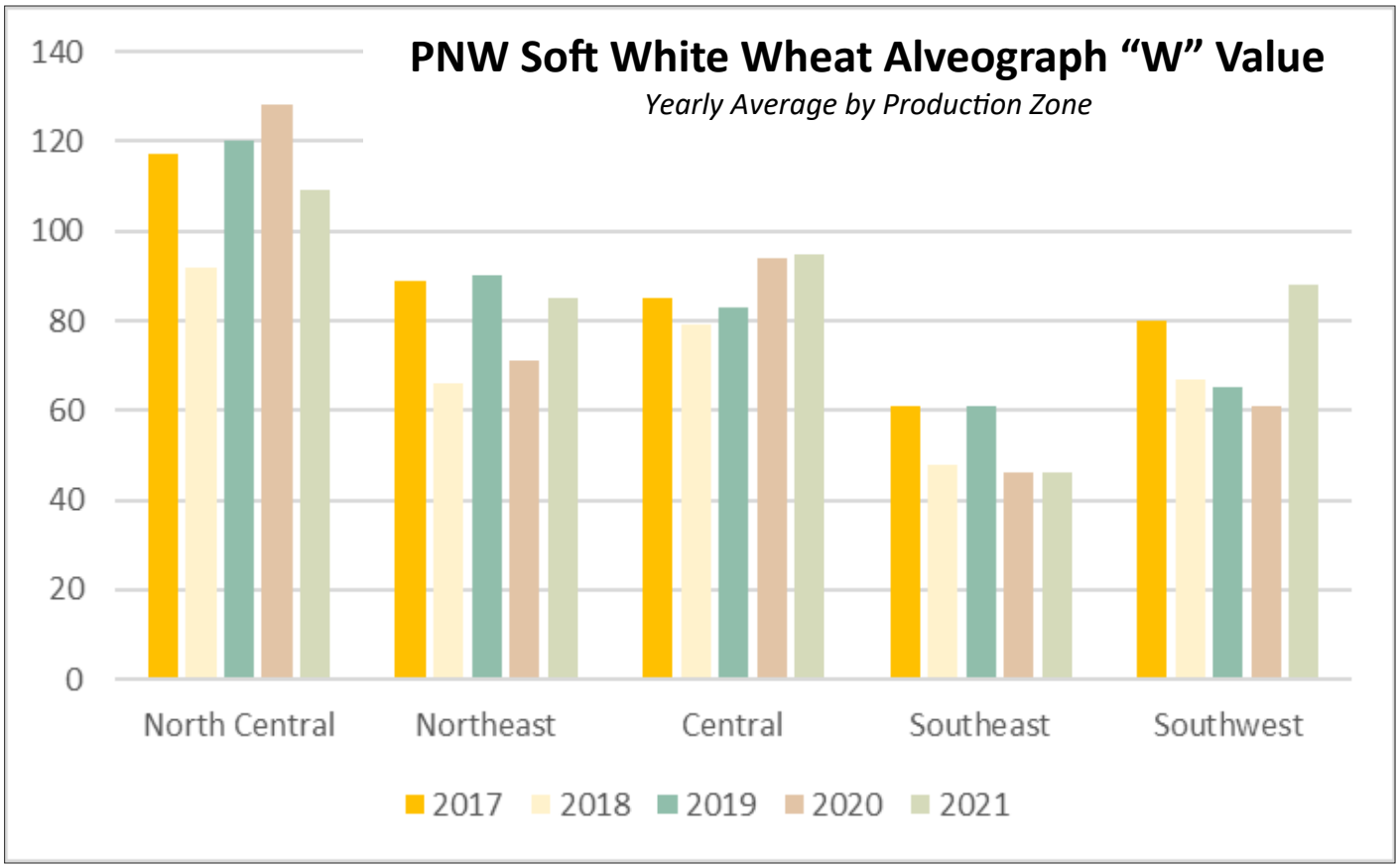
Background photo by Tom & Marie Linehan; courtesy of Idaho Wheat Commission

Physical Dough Properties

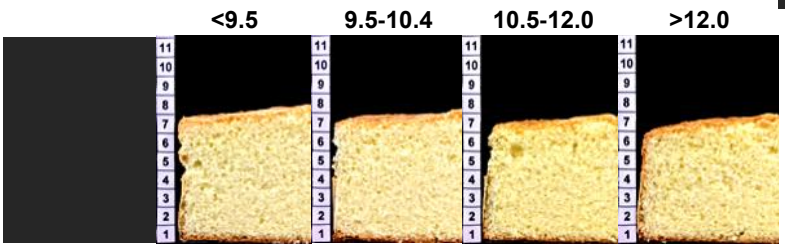
Production Zone	Wheat Protein Range	Farinograph			Alveograph			
	12% mb	Absorption 14% mb	Peak Time	Stability	P	L	P/L	W
	%	%	min	min	mm	mm		10^{-4} J
North Central	<9.5	50.7	1.3	4.4	43	69	0.62	82
	9.5-10.4	51.5	2.6	3.5	44	80	0.55	93
	10.5-12.0	53.4	2.5	4.2	48	84	0.57	107
	>12.0	54.6	3.3	4.3	47	104	0.45	118
	2021 Average	**53.5**	**2.7**	**4.2**	**47**	**90**	**0.53**	**109**
	2020 Average	52.3	2.7	3.2	41	142	0.29	128
	5 Year Average	52.4	2.5	3.7	42	113	0.42	118
Northeast	9.5-10.4	50.9	1.2	2.4	36	75	0.48	70
	10.5-12.0	51.8	2.4	3.3	36	89	0.40	83
	>12.0	53.1	2.4	4.0	40	88	0.45	92
	2021 Average	**52.2**	**2.3**	**3.5**	**37**	**87**	**0.43**	**85**
	2020 Average	52.2	1.3	1.6	36	80	0.47	71
	5 Year Average	52.3	1.9	2.6	36	92	0.41	82
Central	<9.5	50.7	1.4	2.5	36	62	0.58	66
	9.5-10.4	51.2	1.2	2.5	37	85	0.44	79
	10.5-12.0	52.7	2.1	3.5	43	80	0.54	94
	>12.0	53.9	3.1	3.4	46	102	0.45	121
	2021 Average	**52.5**	**2.1**	**3.2**	**42**	**85**	**0.50**	**95**
	2020 Average	51.4	1.7	2.5	32	123	0.28	94
	5 Year Average	51.5	1.9	2.5	33	109	0.34	86
Southeast	<9.5	51.1	1.0	1.1	32	55	0.58	46
	9.5-10.4	50.8	1.1	2.1	33	52	0.63	46
	10.5-12.0	51.5	1.3	2.2	29	71	0.41	47
	>12.0	52.2	1.3	1.4	27	62	0.44	40
	2021 Average	**51.3**	**1.2**	**1.9**	**30**	**62**	**0.50**	**46**
	2020 Average	51.4	1.5	1.4	25	111	0.23	46
	5 Year Average	51.9	1.6	1.7	29	93	0.35	55
Southwest	<8.5	52.0	1.2	1.5	48	61	0.79	77
	9.5-10.4	51.8	1.5	3.1	45	88	0.51	98
	2021 Average	**51.9**	**1.3**	**2.3**	**47**	**75**	**0.65**	**88**
	2020 Average	51.0	1.4	1.6	32	94	0.36	61
	5 Year Average	50.9	1.5	2.2	33	90	0.40	71
White Club Wheat	**2021 Average**	**51.1**	**1.2**	**1.1**	**27**	**43**	**0.63**	**29**
	2020 Average	49.2	1.3	1.1	21	101	0.21	37
	5 Year Average	50.4	1.4	1.3	23	83	0.31	39

Physical Dough Properties

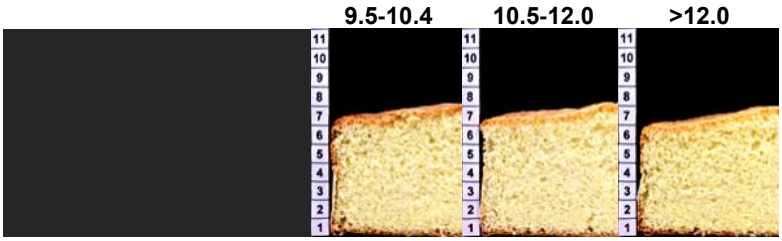




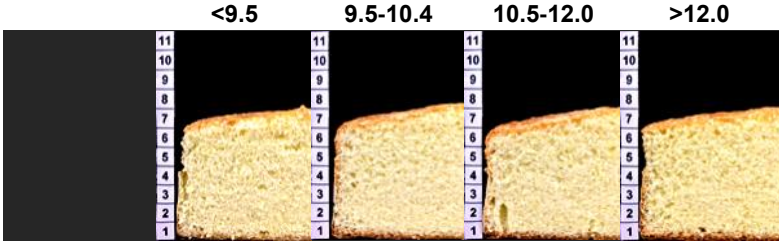
Finished Products: Sponge Cake



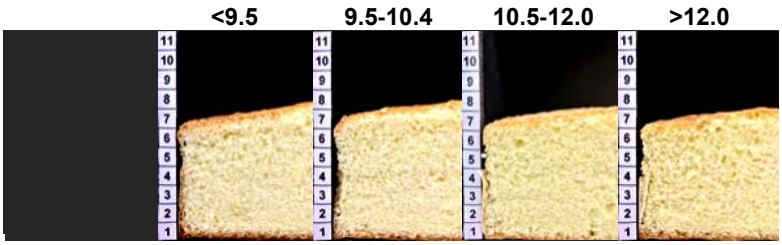
Production Zone	Wheat Protein Range 12% mb %	Sponge Cake Volume cc	Sponge Cake Total Score (Control is 56)
North Central			
	<9.5	1180	44
	9.5-10.4	1096	38
	10.5-12.0	1055	30
	>12.0	1072	40
	2021 Average	**1073**	**35**
	2020 Average	1101	44
	5 Year Average	1128	45



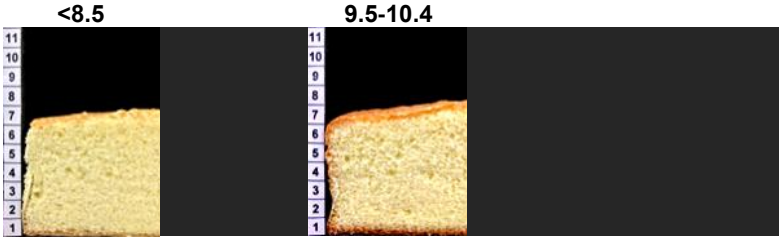
Northeast			
	9.5-10.4	1132	35
	10.5-12.0	1115	34
	>12.0	1074	31
	2021 Average	**1102**	**33**
	2020 Average	1119	51
	5 Year Average	1139	48



Central			
	<9.5	1087	48
	9.5-10.4	1124	46
	10.5-12.0	1075	36
	>12.0	1049	33
	2021 Average	**1079**	**38**
	2020 Average	1122	51
	5 Year Average	1135	48



Southeast			
	<9.5	1082	41
	9.5-10.4	1149	50
	10.5-12.0	1113	46
	>12.0	1063	42
	2021 Average	**1112**	**46**
	2020 Average	1112	48
	5 Year Average	1148	52

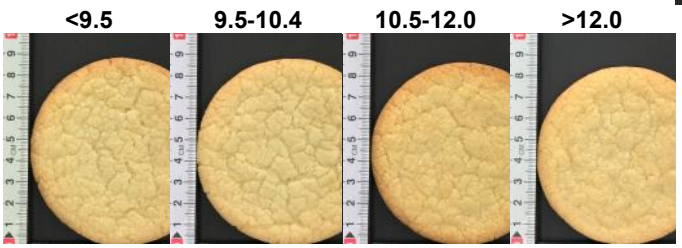


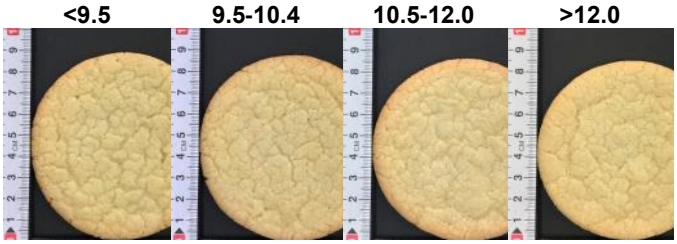
Southwest			
	<8.5	1057	37
	9.5-10.4	1114	43
	2021 Average	**1086**	**40**
	2020 Average	1136	52
	5 Year Average	1166	53

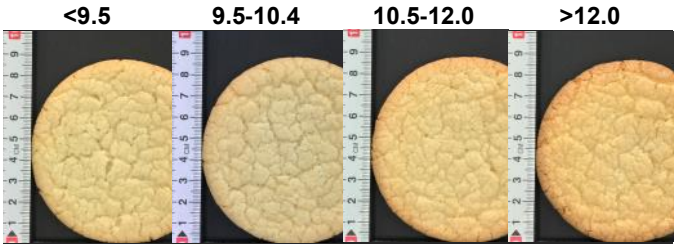
White Club Wheat	**2021 Average**	**1070**	**34**
	2020 Average	1129	47
	5 Year Average	1159	50

Finished Products: Sugar Snap Cookie

Production Zone	Wheat Protein Range 12% mb %	Sugar Snap Cookie Spread cm	Spread Factor width height	Top Grain Score
North Central				
<9.5		9.0	11.6	3.5
9.5-10.4		9.0	11.7	3.5
10.5-12.0		8.7	11.2	3.0
>12.0		8.5	10.1	1.5
2021 Average		**8.7**	**10.8**	**2.5**
2020 Average		8.6	10.1	4.2
5 Year Average		8.7	9.6	3.9
Northeast				
9.5-10.4		8.7	10.9	4.5
10.5-12.0		8.8	11.0	3.5
>12.0		8.6	10.6	3.5
2021 Average		**8.7**	**10.8**	**3.6**
2020 Average		8.6	9.7	4.0
5 Year Average		8.7	9.4	3.7
Central				
<9.5		8.7	10.7	5.0
9.5-10.4		8.8	10.8	4.5
10.5-12.0		8.7	11.1	3.5
>12.0		8.5	10.0	3.0
2021 Average		**8.7**	**10.7**	**3.7**
2020 Average		8.6	9.5	4.9
5 Year Average		8.7	9.6	3.9
Southeast				
<9.5		8.9	10.8	5.0
9.5-10.4		8.8	10.8	5.0
10.5-12.0		8.9	10.9	4.0
>12.0		8.8	9.8	4.0
2021 Average		**8.8**	**10.7**	**4.4**
2020 Average		8.8	10.2	4.4
5 Year Average		8.9	10.0	4.0
Southwest				
<8.5		8.6	10.0	3.5
9.5-10.4		8.6	9.4	3.5
2021 Average		**8.6**	**9.7**	**3.5**
2020 Average		8.6	9.0	4.0
5 Year Average		8.8	9.4	4.1
White Club Wheat				
2021 Average		**9.1**	**12.7**	**4.0**
2020 Average		9.2	11.5	5.5
5 Year Average		9.1	11.2	5.3

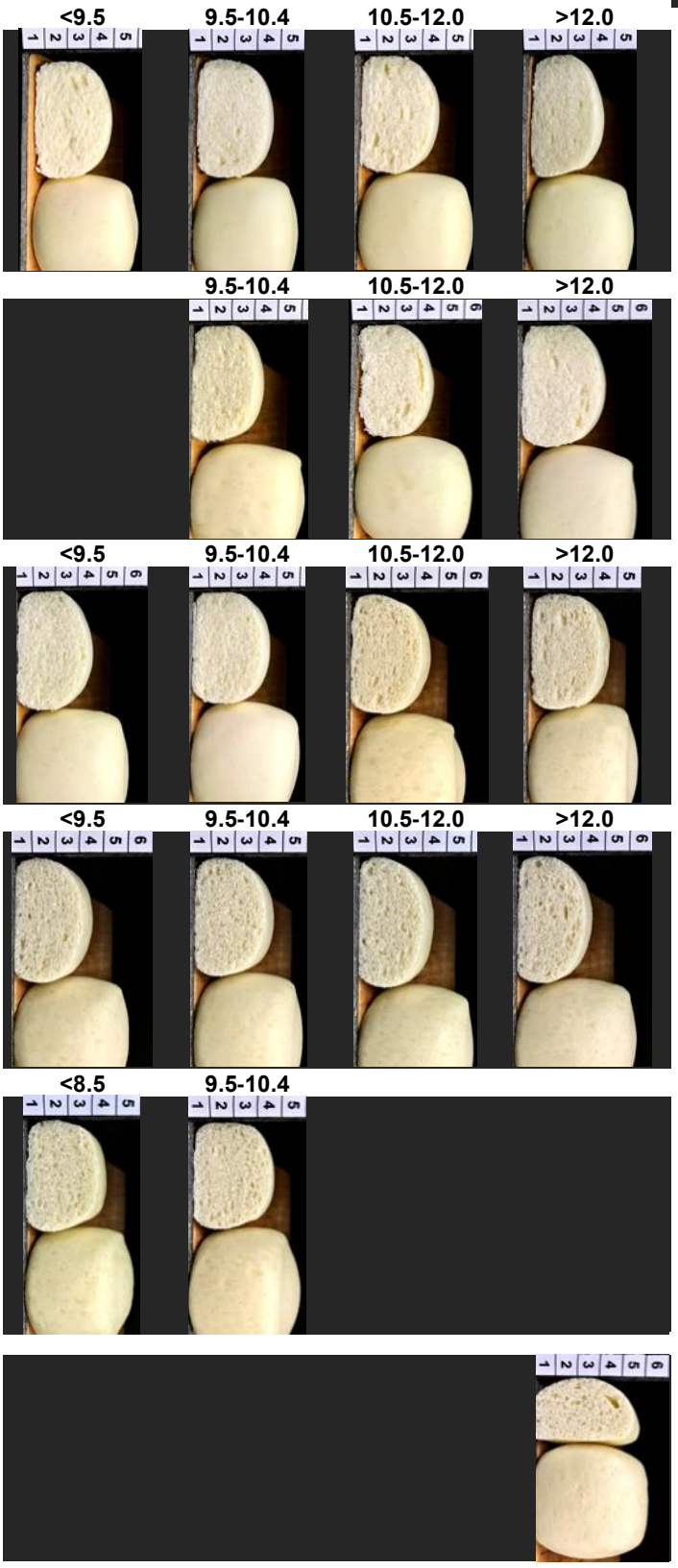




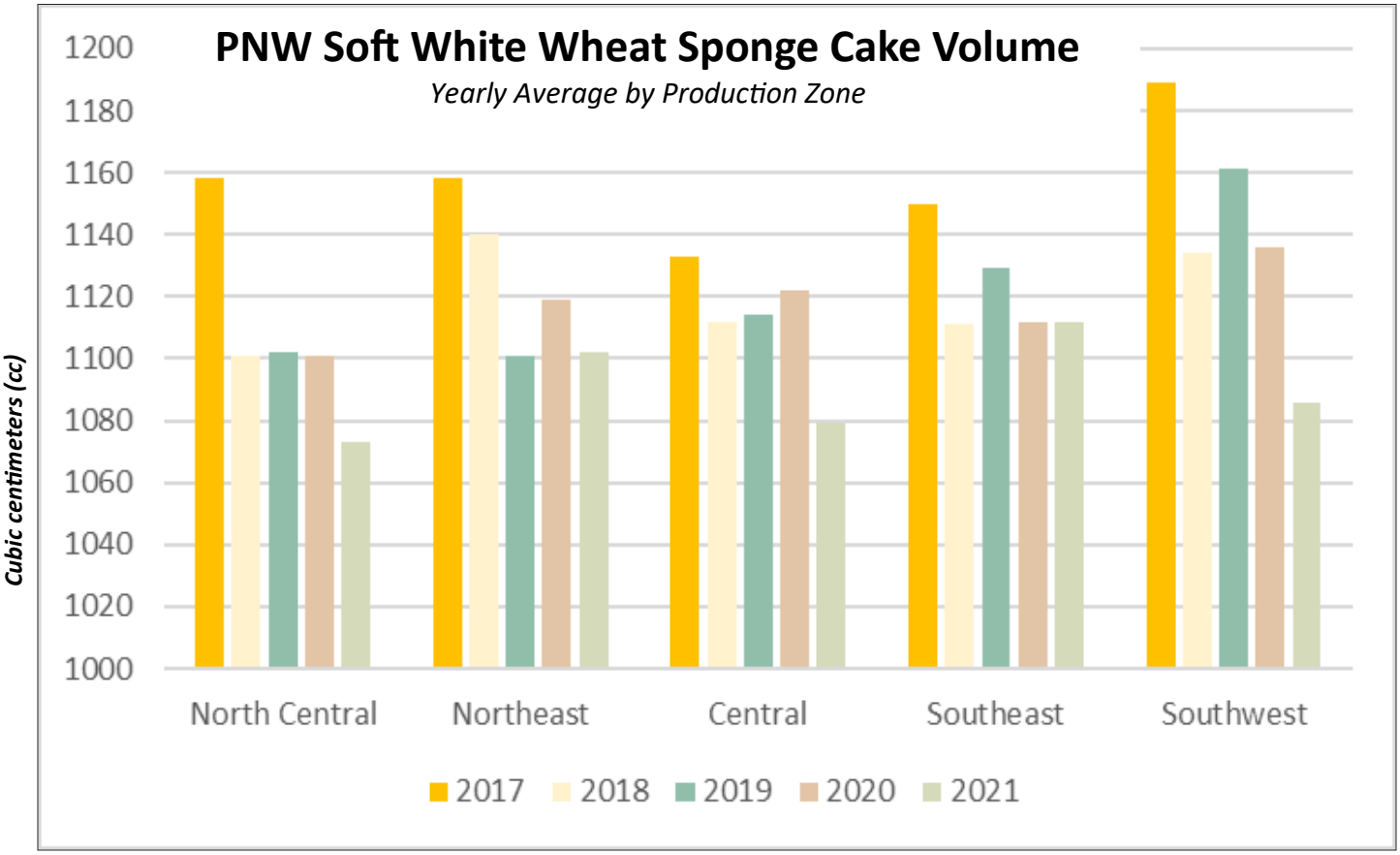


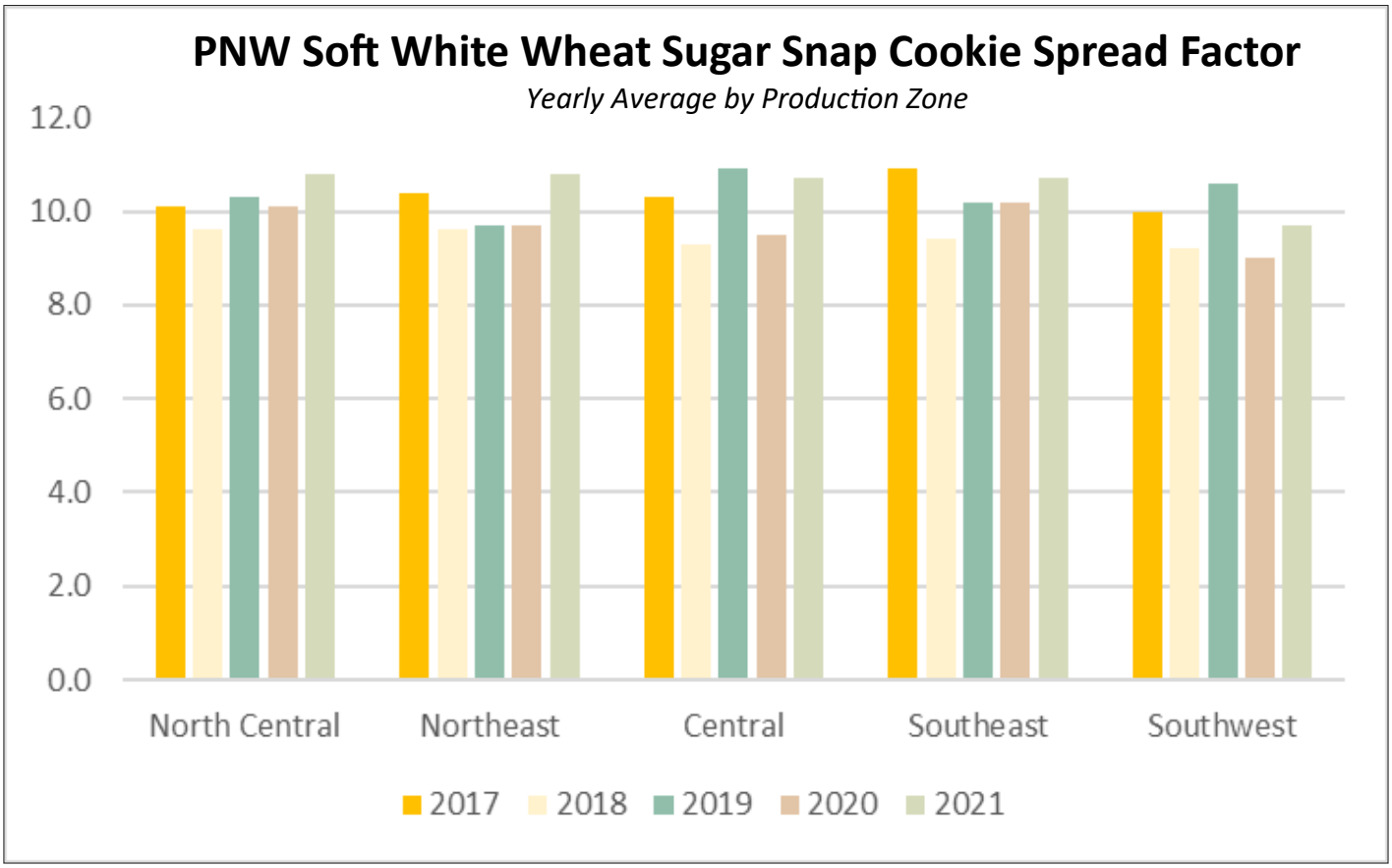
Finished Products: Steamed Bread

Production Zone	Wheat Protein Range 12% mb %	Chinese Southern Type Steamed Bread Specific Volume cc/g	Chinese Southern Type Steamed Bread Total Score (Control is 70)
North Central			
	<9.5	2.07	60
	9.5-10.4	2.22	65
	10.5-12.0	2.23	61
	>12.0	2.33	60
	2021 Average	**2.26**	**61**
	2020 Average	1.70	70
	5 Year Average	1.91	68
Northeast			
	9.5-10.4	2.27	62
	10.5-12.0	2.45	62
	>12.0	2.59	63
	2021 Average	**2.48**	**63**
	2020 Average	1.83	69
	5 Year Average	1.97	67
Central			
	<9.5	2.34	65
	9.5-10.4	2.37	66
	10.5-12.0	2.37	59
	>12.0	2.35	61
	2021 Average	**2.36**	**62**
	2020 Average	1.80	69
	5 Year Average	2.02	67
Southeast			
	<9.5	2.04	55
	9.5-10.4	2.14	54
	10.5-12.0	2.26	52
	>12.0	2.36	55
	2021 Average	**2.21**	**53**
	2020 Average	1.99	67
	5 Year Average	1.97	66
Southwest			
	<8.5	2.02	54
	9.5-10.4	2.32	58
	2021 Average	**2.17**	**56**
	2020 Average	1.74	67
	5 Year Average	1.86	66
White Club Wheat			
	2021 Average	**2.27**	**53**
	2020 Average	2.05	66
	5 Year Average	2.12	64



Finished Products





SUMMARY

These results were derived from composite samples from the 2021 Pacific Northwest soft white (SW) and white club (WC) wheat harvest. SW composites were prepared by production zone and protein levels. All WC samples were blended into one composite. The composite samples were analyzed for wheat quality, flour quality, solvent retention capacity, physical dough properties, and finished product characteristics. Harvest results are summarized as follows:

Wheat Quality

Test Weight

- SW test weights are ≥ 58.3 pounds per bushel (lbs/bu) across all production zones with the exception of the >12.0% protein composites in the Southeast and Northeast production zones, which had test weights of 57.9 lbs/bu.
- WC test weight is 59.7 lbs/bu.

Wheat Moisture

- SW wheat weighted average moistures are 10% or lower except for the Southwest zone, which has an average wheat moisture of 10.5%.
- WC wheat moisture is 8.0%.

Falling Number

- SW falling number values are ≥ 321 sec in all production zones.
- WC falling number is 345 sec.

Wheat Ash

- SW wheat ash weighted averages are between 1.23% to 1.77% (14% mb).
- WC wheat ash average is 1.32% (14% mb).

Thousand Kernel Weight (TKW)

- SW TKW ranges from 23.0 g to 38.2 g across the production zones.
- WC TKW is 27.1 g.

SKCS Kernel Hardness Index

- SW SKCS hardness weighted averages range from 30 to 39 except for the Southeast production zone, which has an average hardness of 21.
- WC SKCS hardness average is 36.

Whole Meal Wet Gluten

- SW weighted average whole meal wet gluten is 18.6% to 28.8%, with the lower values coming from the Southwest and Southeast zones.
- WC whole meal wet gluten is 25.9%.

Flour Quality

Flour Yields

- SW flour yields exceed 70% for all protein composites in all production zones with the exception of the 10.5 – 12.0% and >12% protein composites from the Northeast, North Central, and Central zones. Weighted average flour yields range from 68.3% to 73.4%.
- WC flour yield is 72.0%.

Flour Ash

- SW straight grade flour ash weighted average values are less than 0.50% (14% mb) across all production zones.
- WC straight grade flour ash is 0.42% (14% mb).

Flour Color

- SW flour L* (whiteness) values exceed 92.0 across all protein composites and production zones. Weighted average values range from 92.6 to 92.9.
- WC flour L* is 92.9.

Wet Gluten

- SW wet gluten ranges from 11.1% to 35.7% with weighted averages of ≥ 15.8% across all production zones. These values are typical for samples with very weak to medium gluten strength.
- WC wet gluten is 6.1%, indicating very weak gluten strength.

Flour Falling Number

- SW flour falling number weighted average values are all ≥ 333 sec.
- WC flour falling number is 387 sec.

Amylograph

- SW Amylograph peak viscosity weighted averages are all ≥ 452 BU.
- WC Amylograph peak viscosity is 472 BU.

Solvent Retention Capacity (SRC)

Water SRC

- SW water SRC values are < 55% for all protein composites across all production zones.
- WC water SRC is 49%.

Sucrose SRC

- SW sucrose SRC values are ≤ 100% for all protein composites in all production zones.
- WC sucrose SRC is 86%.

Lactic Acid SRC

- SW lactic acid SRC weighted averages range from 81% to 123%. These values are typical for weak to medium gluten strength.
- WC lactic acid SRC is 75%, indicative of very weak gluten.

Sodium Carbonate SRC

- SW sodium carbonate SRC weighted average values are ≤ 72% for all protein composites in all production zones.
- WC sodium carbonate SRC is 63%.

Gluten Performance Index (GPI)

- SW GPI weighted averages range from 0.52 to 0.78. This is in line with the lactic acid SRC results and indicates that gluten strength is weak to medium.
- WC GPI is 0.51, which is typical for very weak gluten .

Physical Dough Properties

Farinograph

- SW Farinograph water absorption values are less than 55.0% for all protein composites across all production zones with weighted average peak times and stabilities of < 3.0 min and ≤ 4.2 min, respectively. Peak times and stabilities were longer for higher protein composites. Low water absorption values are desirable for products like cookies and crackers.
- WC Farinograph water absorption is 51.1% with a peak time of 1.2 min and a stability of 1.1 min.

Alveograph

- SW Alveograph P value weighted averages range from 30 mm to 47 mm with L value weighted averages of 62 mm to 90 mm and P/L averages of 0.43 to 0.65. W value weighted averages range from 46 (10^{-4} J) to 109 (10^{-4} J). These values align with Farinograph data for gluten strength ranging from weak to medium.
- WC Alveograph P, L, P/L and W values are 21 mm, 43 mm, 0.63 and 29 (10^{-4} J), respectively. These values are typical for very weak gluten strength.

Finished Products

Sponge Cake

SW sponge cake volume weighted averages are over 1070 cc in all production zones with total scores ≤50. Scores of 50 or higher from Buhler laboratory mill straight grade flours are acceptable relative to the Japanese commercial control (low ash patent cake flour) score of 56.

WC sponge cake volume is 1070 cc with a total score of 34.

Sugar Snap Cookies

SW cookie diameter weighted averages range from 8.6 cm to 8.8 cm, with spread factors of 9.7 to 10.8 and top grain scores of 2.5 to 4.4. All composites show fair cookie quality.

WC has an average cookie diameter of 9.1 cm with a spread factor of 12.7 and a top grain score of 4.0. These values are indicative of acceptable cookie quality.

Steamed Bread

SW steamed bread specific volume weighted averages are 2.17 g/cc or greater in all production zones with total scores ranging from 53 to 63.

WC steamed bread specific volume is 2.27 g/cc with a total score of 53.

In summary, the overall quality of the crop can be described as acceptable, characterized by weak to medium gluten strength with suitable potential to produce soft wheat flour products and other products made from blends of soft and hard wheat when milling and flour stream selection are implemented appropriately.

Photo courtesy of the Oregon Wheat Commission

Wheat Marketing Center thanks the many individuals and organizations that provided samples for the 2021 Annual Pacific Northwest Crop Quality Survey, and recognizes with gratitude the project's funding partners:

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