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## SUMMARY OF CLASSES

	Hard Red Winter		Hard Red Spring		Soft Red Winter		Soft White		Durum*	
	2003	5-Year Avg	2003	5-Year Avg	2003	5-Year Avg	2003	5-Year Avg	2003	5-Year Avg
Test Weight (lb/bu)	60.4	59.6	60.9	59.7	58.9	58.6	59.4	60.1	61.0	59.5
(kg/hl)	79.4	78.4	80.1	78.6	77.5	77.2	78.2	79.1	79.4	77.5
Grade	1 HRW	2 HRW	1 DNS	1 NS	2 SRW	2 SRW	2 SW	1 SW	1 HAD	2 HAD
Dockage (%)	0.6	0.7	1.0	1.3	0.8	0.7	0.7	0.6	0.7	1.8
Wheat Moisture (%)	11.7	11.5	11.5	11.8	13.0	13.2	9.0	9.4	10.5	11.6
Wheat Protein (%)**	12.0	12.2	14.2	14.5	9.9	10.0	10.4	10.3	14.5	14.1
Wheat Ash (%)**	1.52	1.54	1.62	1.68	1.60	1.54	1.39	1.39	1.53	1.67
1000 Kernel Weight (g)	29.7	28.6	29.6	29.7	33.0	32.6	31.7	34.7	33.8	36.8
Wheat Falling Number (sec)	409	397	411	360	339	336	362	345	391	296
Flour/Semolina Extraction (%)	70.6	70.3	68.9	69.1	68.2	69.6	65.0	67.9	62.9	63.6
Flour/Semolina Ash (%)**	0.47	0.49	0.45	0.45	0.42	0.43	0.36	0.36	0.66	0.68
Wet Gluten (%)	28.6	28.4	36.2	35.6	20.6	21.5	24.1	23.1	37.2	37.6
Farinograph:										
Peak Time (min)	5.7	5.8	15.0	11.7	1.4	1.7	1.6	1.6	n/a	n/a
Stability (min)	10.2	10.8	26.4	19.8	2.8	3.4	2.7	2.6	n/a	n/a
Absorption (%)	59.8	59.5	66.6	64.2	52.5	52.8	50.6	50.0	n/a	n/a
Alveograph WV (10-4 joules)	302	289	395	378	78	89	124	117	92	n/a
Loaf Volume (cc)	809	838	1081	1047	722	735	n/a	n/a	n/a	n/a
Production (mmt)	28.9	22.3	13.6	12.1	10.3	11.3	7.0	6.9	2.6	2.7

\* Great Plains durum only, extraction and ash values are for semolina.

\*\* Protein - 12% moisture basis; ash - 14% moisture basis

# Hard Red Winter Wheat

## Midwestern Harvest Survey

Most U.S. hard red winter (HRW) wheat is grown in the Great Plains (Colorado, Kansas, Montana, Nebraska, Oklahoma, South Dakota and Texas). In 2002, dry conditions in many areas during the late summer and fall again delayed planting and germination and slowed growth before winter. Part of the HRW growing region experienced drought conditions throughout the winter and spring. However, many areas received adequate rainfall during April and May accompanied by mild temperatures, conditions which allowed for development of large, completely filled heads and record to near record yields in many areas.

Kernel size and kernel weight were significantly greater than last year and also above the five-year average. Test weight averaged 1.5 lb/bu (1.9 kg/hl) above the average for the 2002 HRW crop. Increased yields are generally associated with reduced protein content which has proven to be the case with the 2003 crop. The overall protein content averaged 1.4 percentage points lower than last year but remained equal to the five-year average.

Wet gluten values (percent) per unit of protein were equal to last year and slightly above the five-year average. Predominantly dry conditions during harvest produced a very sound crop.

**Survey Methods:** Information on the 2003 HRW crop is based on testing by CII Laboratory Services of Kansas City, Missouri. A total of 569 samples were collected in 22 crop production zones during harvest. Data on protein content, test weight, moisture, thousand-kernel weight, wheat ash, and falling number were recorded for individual samples. Samples were composited into three protein ranges (below 11.5%, 11.5% - 12.5%, and above 12.5%) within each crop production zone for the remaining tests. After FGIS established the grade on the composites, single kernel characteristics were determined and laboratory milling was carried out using a Buhler experimental mill (Model MLU-202). Milled composites were tested for flour and dough quality factors and baking performance. Data are weighted by production based on the USDA "Small Grains Summary" of September 30, 2003. These data are presented as composite (overall) averages and the projected averages that can be expected at Pacific Northwest and Gulf of Mexico ports. Testing conforms to the American Association of Cereal Chemists Approved Methods (2002).

**Milling and Flour Use:** Flour millers have indicated that the transition to the new crop wheat was fairly smooth, but occurred rapidly due to a lack of 2002 wheat with consistent quality. They also reported increased milling yields with acceptable flour quality to meet their customers' requirements. Most milling laboratories found that farinograph absorption decreased by 0.5 to 2.0 percentage

points and found lower mix times and slightly reduced stability. The baking quality is reported to be above average, although some bakeries may need to optimize formulation and processing controls in order to satisfy high speed commercial production.

**Summary:** The 2003 HRW wheat crop has improved milling quality over the 2002 crop and acceptable to good baking performance. A wide range of protein contents is more readily available this year to supply bakers of traditional and non-traditional products. Falling number values averaged 409 seconds, compared with the five-year average of 399 seconds, which indicates that the crop is very sound and did not suffer sprout damage from harvest time weather conditions. Wheat and flour buyers alike should always set meaningful specifications concerning important quality requirements before contracting for purchases.

The 2003 harvest data was compiled by the International Grains Program (IGP) at Kansas State University, Manhattan, Kansas, with contract support from Stevens Technical Services.

## California Harvest Survey

Approximately 85% of the California hard wheat crop is grown on land that can be irrigated, which normally provides very consistent growing conditions. This year as a result of susceptible varieties and a cool wet spring approximately one third of the crop was affected by stripe rust and had low test weights and shriveled kernels. This wheat was directed away from the milling industry. The remaining two thirds of the crop graded US No. 1 on average and had excellent end-use qualities.

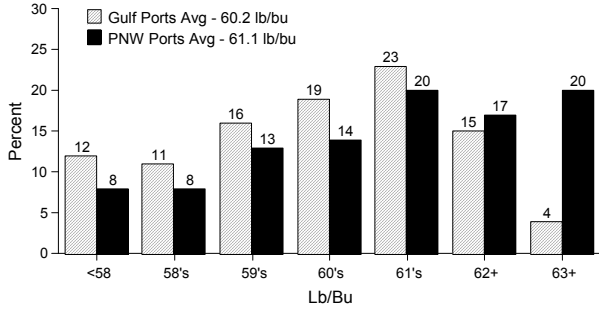
California wheat is exported from the Port of Stockton through a grain handling facility owned and operated by a California company. Wheat that goes into this facility is locally grown and trucked in, often directly from the field. Most California wheat is traded on a variety-known basis.

California red wheats are harvested in June and July. As there is strong demand for new crop wheat in the domestic market, export buyers are encouraged to express their interest in purchasing California wheat in early spring.

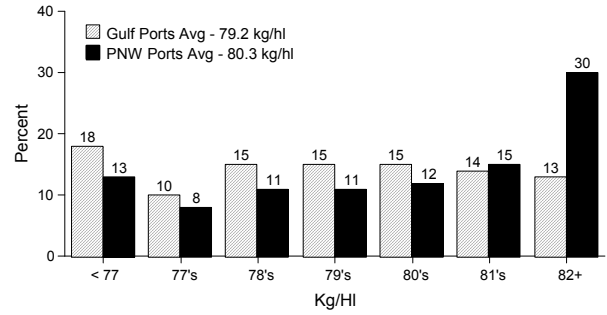
## Export Cargo Survey

The export cargo data show the results of analysis of 492 individual subplot samples for marketing years 2003 and 2002. Of the 124 2003 samples collected in August and September, 109 are from Gulf ports and 15 from PNW ports. Of the 368 2002 samples, 280 were drawn at Gulf ports and 88 at PNW ports. Samples were randomly selected from official Federal Grain Inspection Service samples. Grade data are the actual official grades on the individual subplots. Milling and baking analyses were conducted by CII Laboratory Services.

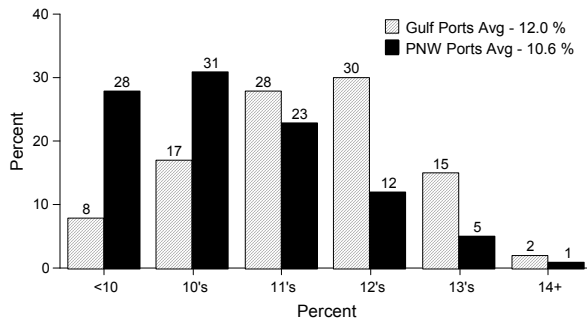
### Test Weight



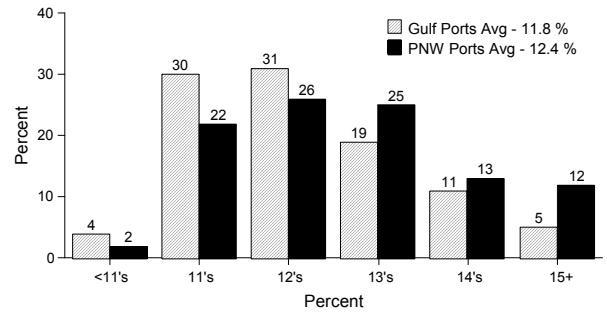
### Hectoliter Weight



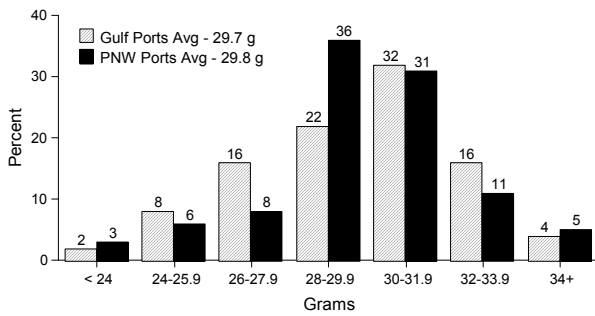
### Wheat Moisture



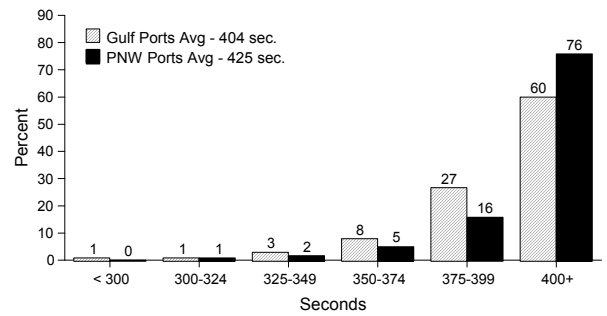
### Protein (12% mb)



### 1000 Kernel Weight



### Falling Number



Note: Charts include Great Plains HRW only.

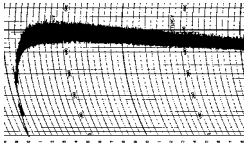


Hard red winter survey results are from eight states.

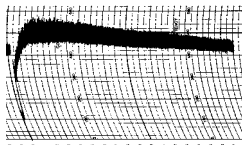
## Composite Average Farinograms and Alveograms

### Farinograms:

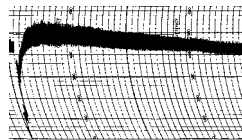
High Protein:



Medium Protein:

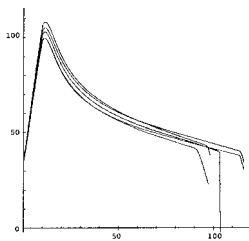


Low Protein:

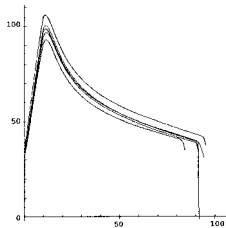


### Alveograms:

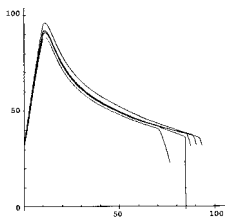
High Protein:



Medium Protein:



Low Protein:



## Hard Red Winter

### Composite Average

	2003 By Protein*				2002 Overall	5-Year Avg
	Low	Med	High	Overall		
<b>Wheat Grade Data:</b>						
Test Weight (lb/bu)	60.9	59.9	60.0	60.4	58.9	59.6
(kg/hl)	80.1	78.9	79.0	79.4	77.5	78.4
Damaged Kernels (%)	0.4	0.4	0.4	0.4	0.2	0.3
Foreign Material (%)	0.1	0.1	0.1	0.1	0.1	0.1
Shrunken & Broken (%)	1.1	1.1	1.0	1.1	1.3	1.3
Total Defects (%)	1.6	1.6	1.5	1.6	1.6	1.7
Grade	1 HRW	2 HRW	1 HRW	1 HRW	2 HRW	2 HRW
<b>Wheat Non-Grade Data:</b>						
Dockage (%)	0.6	0.6	0.7	0.6	0.6	0.7
Moisture (%)	11.8	11.5	11.8	11.7	11.2	11.5
Protein (%) 12%/0% moisture basis	10.7/12.1	11.9/13.5	13.6/15.4	12.0/13.6	13.4/15.2	12.2/13.8
Ash (%) 14%/0% moisture basis	1.52/1.77	1.53/1.78	1.51/1.75	1.52/1.77	1.58/1.84	1.54/1.80
1000 Kernel Weight (g)	30.7	29.5	28.6	29.7	27.5	28.6
Kernel Size (%) lg/md/sm	66/33/1	58/41/1	50/49/1	59/40/1	45/53/2	53/45/2
Single Kernel: Hardness	73.1	73.1	74.9	73.7	75.0	73.7
Weight (mg)	30.7	30.3	29.1	30.1	29.0	29.4
Diameter (mm)	2.33	2.31	2.25	2.30	2.26	2.20
Sedimentation (cc)	30.4	40.0	49.6	39.2	45.6	40.0
Falling Number (sec)	410	408	407	409	425	397
<b>Flour Data:</b>						
Extraction Rate (%)	70.7	70.6	70.5	70.6	70.9	70.3
Color: L*	92.9	92.6	92.3	92.6	92.3	92.3
a*	-3.3	-3.2	-3.4	-3.3	-3.4	-3.3
b*	8.8	8.8	9.1	8.9	8.9	9.5
Protein (%) 14%/0% moisture basis	9.8/11.4	10.7/12.5	12.0/13.9	10.7/12.5	12.1/14.1	10.8/12.6
Ash (%) 14%/0% moisture basis	0.47/0.55	0.46/0.54	0.47/0.55	0.47/0.55	0.51/0.59	0.49/0.57
Wet Gluten (%)	25.4	28.4	32.8	28.6	32.4	28.4
Falling Number (sec)	414	428	438	425	460	415
Amylograph Viscosity 65 g (BU)	660	675	665	665	653	643
Starch Damage (%)	9.3	8.9	8.2	8.9	9.0	8.6
<b>Dough Properties:</b>						
Farinograph:						
Peak Time (min)	5.1	5.7	6.5	5.7	7.0	5.8
Stability (min)	9.3	9.8	11.8	10.2	11.2	10.8
Absorption (%)	59.1	59.7	60.7	59.8	62.0	59.5
Alveograph: P (mm)						
L (mm)	103	99	98	101	108	95
W (10-4 joules)	72	95	105	89	95	90
Extensigraph: Resistance (BU)						
(45/135 min) Extension (cm)	261	315	342	302	345	289
Area (sq cm)						
<b>Baking Evaluation:</b>						
Crumb Grain	6.2	6.3	6.7	6.4	7.0	6.8
Crumb Texture	7.0	7.2	7.5	7.2	8.0	7.1
Loaf Volume (cc)	750	812	882	809	900	838
<b>% of Area Production:</b>	42	25	33	100	100	100

\* Low: Less than 11.5%; Med: 11.5 - 12.5%; High: 12.5% or greater

# Harvest Data

Gulf Exportable Average						PNW Exportable Average					
2003 By Protein*				2002 Overall	5-Year Avg	2003 By Protein*				2002 Overall	5-Year Avg
Low	Med	High	Overall			Low	Med	High	Overall		
60.9	59.7	59.5	60.2	59.0	59.5	61.0	60.8	61.3	61.1	58.8	59.7
80.1	78.5	78.3	79.2	77.6	78.3	80.2	79.9	80.6	80.3	77.4	78.6
0.4	0.4	0.5	0.4	0.2	0.3	0.4	0.4	0.3	0.4	0.2	0.3
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1
1.0	1.1	1.0	1.0	1.3	1.3	1.2	1.3	1.3	1.3	1.7	1.3
1.5	1.6	1.5	1.6	1.6	1.7	1.7	1.8	1.6	1.7	2.0	1.7
1 HRW	2 HRW	2 HRW	1 HRW	2 HRW	2 HRW	1 HRW	1 HRW	1 HRW	1 HRW	2 HRW	2 HRW
0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.9	0.8	0.6	0.7
11.9	11.8	12.3	12.0	11.3	11.8	11.2	10.3	10.3	10.6	10.8	11.4
10.7/12.1	11.9/13.5	13.4/15.2	11.8/13.4	13.2/15.1	12.0/13.7	10.9/12.4	12.0/13.6	14.0/15.9	12.4/14.1	13.8/15.7	12.4/14.1
1.52/1.77	1.53/1.78	1.51/1.75	1.52/1.77	1.59/1.85	1.55/1.81	1.52/1.77	1.52/1.77	1.51/1.75	1.52/1.77	1.56/1.82	1.52/1.77
30.6	29.4	28.6	29.7	27.8	28.6	31.0	30.0	28.5	29.8	26.6	28.5
67/32/1	58/41/1	53/46/1	60/39/1	48/51/1	54/45/1	62/37/1	56/43/1	43/56/1	53/46/1	35/63/2	48/50/2
73.8	73.6	74.5	74.0	75.0	74.1	69.2	71.2	76.0	72.8	74.8	72.5
30.8	30.3	29.1	30.2	29.1	29.2	30.3	30.3	29.1	29.8	28.5	29.4
2.33	2.31	2.27	2.31	2.27	2.20	2.29	2.28	2.22	2.25	2.22	2.24
30.7	40.6	51.4	39.6	45.1	39.8	29.3	38.1	45.1	37.6	47.8	40.8
411	404	393	404	423	394	408	422	442	425	429	407
70.7	70.5	70.3	70.5	71.0	70.2	70.8	71.0	71.2	71.0	70.6	70.5
92.9	92.6	92.3	92.6	92.3	92.2	92.9	92.5	92.3	92.6	92.5	92.5
-3.4	-3.3	-3.5	-3.4	-3.4	-3.3	-3.1	-3.0	-3.0	-3.0	-3.4	-3.4
8.8	8.8	9.0	8.9	8.9	9.4	8.9	9.0	9.3	9.1	8.7	9.5
9.7/11.3	10.8/12.5	11.9/13.8	10.7/12.5	12.0/14.0	10.8/12.6	9.8/11.4	10.7/12.5	12.2/14.2	11.0/12.8	12.4/14.4	11.0/12.8
0.47/0.55	0.46/0.54	0.48/0.56	0.47/0.55	0.51/0.59	0.49/0.57	0.47/0.55	0.46/0.54	0.46/0.54	0.46/0.54	0.50/0.58	0.48/0.56
25.3	28.5	32.5	28.4	32.1	28.1	25.4	27.9	33.7	29.2	33.4	28.6
416	420	424	420	456	411	407	453	475	444	477	438
661	662	645	656	645	643	655	719	718	695	687	637
9.5	9.2	8.1	9.0	9.2	8.7	8.7	8.1	8.5	8.5	8.1	8.3
5.0	5.7	6.2	5.5	7.0	5.7	5.4	5.7	7.1	6.1	6.9	5.8
9.4	10.0	11.7	10.2	11.1	10.7	8.8	9.0	12.3	10.2	11.8	10.3
59.2	59.8	60.6	59.8	62.1	59.3	58.6	59.4	60.9	59.7	61.6	60.5
106	103	103	104	108	95	93	88	87	89	104	95
70	93	97	84	95	90	81	104	125	103	95	89
264	323	344	304	347	290	250	289	338	294	339	288
560/585	570/640	540/600	555/604	526/532	560/585	640/705	580/620	600/620	610/651	523/528	544/579
17.3/16.0	18.9/17.4	19.4/17.2	18.5/16.8	17.4/17.5	18.0/16.4	16.3/13.6	18.0/15.2	19.5/18.2	18.0/15.8	19.5/17.8	17.8/15.8
129/127	140/145	133/134	133/134	117/118	127/124	141/129	135/120	150/143	143/132	131/141	122/122
6.2	6.2	6.4	6.3	7.0	6.8	6.2	6.7	7.4	6.8	7.0	7.2
7.0	7.2	7.3	7.2	8.0	7.1	6.7	7.1	7.9	7.2	7.0	7.1
753	812	883	809	903	837	738	810	879	810	893	856
43	26	31	100	100	100	37	24	39	100	100	100

# California and Export Data

Hard Red Winter	California Harvest Data				Export Cargo Data			
	Medium Protein Average		High Protein Average		Gulf		PNW	
	2003	2002	2003	2002	2003	2002	2003	2002
<b>Wheat Grade Data:</b>								
Test Weight (lb/bu)	61.8	63.3	60.0	62.9	60.7	60.6	62.3	60.9
(kg/hl)	81.3	83.2	78.9	82.7	79.9	79.7	81.9	80.2
Damaged Kernels (%)	0.0	0.0	0.0	0.0	1.4	1.6	0.1	0.3
Foreign Material (%)	0.1	0.1	0.1	0.1	0.2	0.3	0.1	0.1
Shrunken & Broken (%)	0.6	0.6	0.7	0.6	1.5	1.8	1.3	1.9
Total Defects (%)	0.7	0.6	0.8	0.6	3.1	3.7	1.5	2.3
Grade	1 HRW	1 HRW	1 HRW	1 HRW	2 HRW	2 HRW	1 HRW	1 HRW
<b>Wheat Non-Grade Data:</b>								
Dockage (%)	0.6	0.6	0.7	0.6	0.6	0.7	0.3	0.3
Moisture (%)	9.2	8.5	9.2	8.4	11.5	11.4	9.6	10.4
Protein (%) 12%/0% moisture basis	11.8/13.4	11.7/13.3	13.4/15.2	13.4/15.2	11.8/13.4	12.4/14.1	12.7/14.4	13.1/14.9
Ash (%) 14%/0% moisture basis	1.47/1.71	1.47/1.71	1.55/1.80	1.58/1.84	1.51/1.75	1.56/1.81	1.48/1.72	1.53/1.78
1 000 Kernel Weight (g)	39.3	41.5	38.6	42.0	26.9	26.1	27.6	25.7
Kernel Size (%) lg/md/sm					60/39/1	54/44/2	58/41/1	45/53/2
Single Kernel: Hardness					*	70.8	*	71.2
Weight (mg)					*	29.4	*	29.4
Diameter (mm)					*	2.27	*	2.23
Sedimentation (cc)					29.2	29.5	31.4	34.4
Falling Number (sec)					450	525	488	496
<b>Flour Data:</b>								
Extraction Rate (%)	69.4	70.4	69.2	71.8	71.5	70.8	71.9	70.7
Color: L*					92.0	92.4	91.6	92.4
a*					-2.6	-3.0	-2.9	-3.1
b*					8.6	8.3	9.1	8.6
Protein (%) 14%/0% moisture basis	10.1/11.7	10.4/12.1	11.4/13.2	12.1/14.1	10.5/12.2	11.1/12.9	11.3/13.1	11.8/13.7
Ash (%) 14%/0% moisture basis	0.46/0.53	0.49/0.57	0.47/0.55	0.50/0.58	0.48/0.56	0.49/0.57	0.48/0.56	0.48/0.56
Wet Gluten (%)	28.4	28.2	32.1	33.7	27.8	29.4	30.7	32.1
Falling Number (sec)	398	331	412	374	494	552	505	546
Amylograph Viscosity 65 g (BU)					671	704	673	635
Starch Damage (%)								
<b>Dough Properties:</b>								
Farinograph:								
Peak Time (min)	5.1	5.8	6.0	8.0	6.5	7.2	6.3	6.4
Stability (min)	9.1	16.1	10.6	17.2	11.7	14.4	10.7	12.2
Absorption (%)	64.4	63.0	64.8	64.2	58.7	59.9	61.1	61.2
Alveograph: P (mm)								
L (mm)					93	118	99	114
W (10-4 joules)					99	79	100	84
Extensigraph: Resistance (BU)								
(45/135 min) Extension (cm)								
Area (sq cm)								
<b>Baking Evaluation:</b>								
Crumb Grain					7.1	6.8	7.2	6.8
Crumb Texture					7.3	7.3	7.6	7.4
Loaf Volume (cc)	812	888	896	974	801	820	809	847
<b>Number of Samples</b>					109	280	15	88

\* Data not yet available.

## Hard Red Winter Production by Crop Year

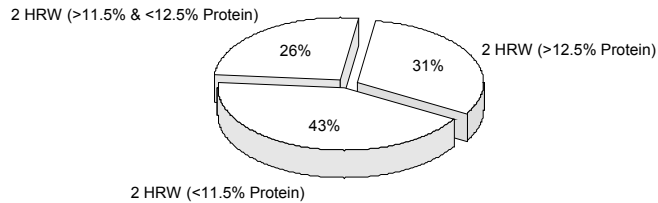
for the major HRW growing region  
(million metric tons)

	2003	2002	2001	2000	1999
Kansas	12.41	7.20	8.84	9.37	11.65
Oklahoma	4.83	2.72	3.29	3.85	4.06
Texas	2.42	1.96	2.72	1.69	3.13
Colorado	1.99	0.99	1.80	1.85	2.81
Nebraska	2.23	1.32	1.61	1.62	2.22
Montana	1.68	0.55	0.51	1.20	0.99
South Dakota	1.62	0.49	0.32	1.46	1.61
California	0.57	0.58	0.69	0.71	0.75
<b>Eight-State Total</b>	<b>27.75</b>	<b>15.82</b>	<b>19.77</b>	<b>21.75</b>	<b>27.22</b>
<b>Total HRW Production</b>	<b>28.93</b>	<b>16.66</b>	<b>20.87</b>	<b>23.03</b>	<b>28.60</b>

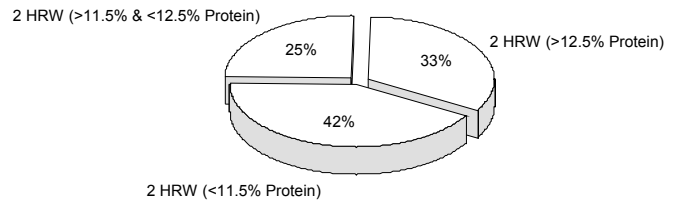
*Based on USDA crop estimates of September 30, 2003.*

## Protein Distribution

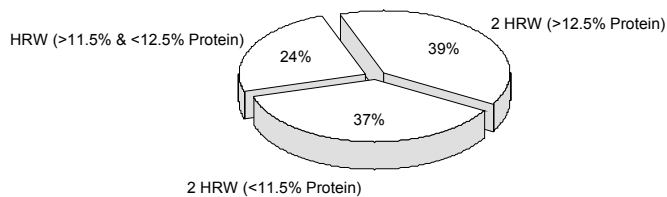
### Gulf Exportable



### Overall



### PNW Exportable



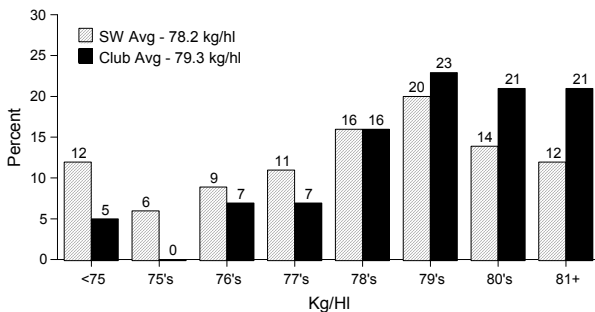
# Pacific Northwest Soft White Wheat

## Harvest Survey

**Weather and Harvest:** The Pacific Northwest experienced a dry fall, but timely rains in early winter to mid-spring helped wheat growth in most dryland farming areas in Oregon, Washington, and Idaho. This weather pattern resulted in higher protein content, lower test weight, lower thousand kernel weight, and smaller kernel size than a normal crop. Mostly dry harvest conditions resulted in very little sprout damage.

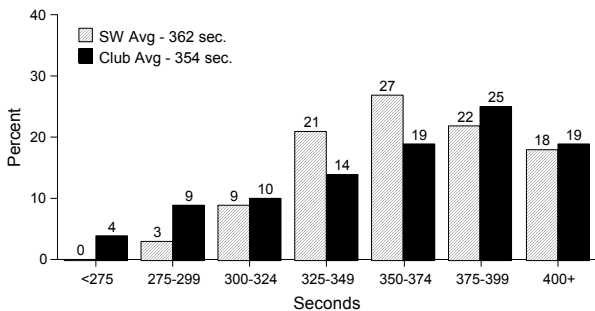
**Wheat and Grade Data:** The average test weight of 59.4 lb/bu (78.2 kg/hl) for the 2003 soft white (SW) crop was slightly below last year and the five-year average. Test weight of white club (WC) was slightly above last year and the same as the five-year average. Other grade data were

### Hectoliter Weight



similar to last year and the five-year average. SW high protein and overall composites were graded No. 2 because test weight was less than 60 lb/bu. Moisture contents for SW and WC were 0.4 and 1.0 percentage points lower than last year, respectively, and lower by a similar amount than the five-year averages. SW protein content of 10.4% was 0.4 percentage points lower than last year and 0.1 higher than five-year average. High protein SW had a relatively high protein content of 12.0%. As a result, sedimentation

### Falling Number



showed a high value of 25.9 cc. Protein content for WC was the same as last year at 9.9%. Wheat ash contents for both SW and WC were similar to last year and the five-year averages. Thousand kernel weights were significantly lower than last year and the five-year averages due to incorporation of a new methodology (see Analysis Methods section). Falling number values were similar to last year and higher than the five-year averages, indicating a sound crop.

**Flour, Dough and Bake Data** (for both SW and WC unless noted): The 2003 Buhler Laboratory Mill flour extractions were significantly lower than last year and the five-year averages with lower flour protein and slightly higher flour ash contents. Flour protein contents were 8.4 and 8.0% for SW and WC, respectively. SW high protein had flour protein content of 9.9%, and resultant wet gluten content had a relatively high value of 28.9%. Flour falling numbers and amylograph peak viscosity values showed sound flour samples. Starch damage values were similar to last year. Solvent Retention Capacity (SRC) data indicated slightly higher glutenin contents than last year. Farinograph water absorptions were about 1% higher and mixing properties were similar compared with last year and the five-year averages. Alveograph maximum overpressure ("P") values were slightly higher, extensibility ("L") values shorter, and overall strengths ("W") similar compared with last year and the five-year averages. Extensigraph data were similar to alveograph results. Dough rheological tests indicated slightly stronger gluten properties than last year and the five-year averages. Sponge cake volumes were slightly smaller than last year, but SW scored slightly higher and WC scored lower than last year and the five-year averages. Cookie spreads were slightly smaller than last year and the five-year averages. Low and medium protein SW, especially, showed excellent quality sponge cakes and cookies.

**Chinese Southern-Type Steamed Bread:** Each flour was made into southern-type steamed bread and compared with a Chinese commercial southern-type steamed bread control flour. Specific volumes were higher than last year, but the total steamed bread score was slightly lower. SW showed potential of making good quality Chinese southern-type steamed breads.

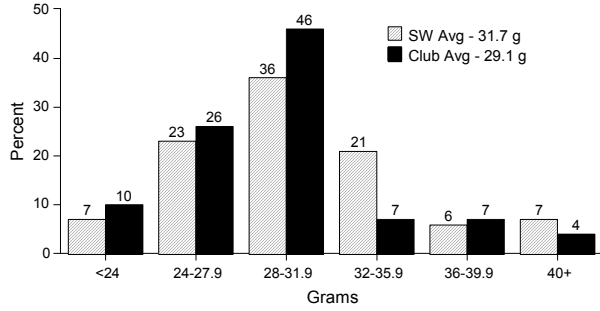
**Survey and Analysis Methods:** Wheat quality testing and data analyses were conducted by the Wheat Marketing Center, Portland, Oregon. Laboratory testing was conducted according to American Association of Cereal Chemists Approved Methods (10<sup>th</sup> Edition). Survey samples were collected from producers under the management of the National Agricultural Statistics Service, USDA, and represent a statistical sampling of the crop. Federal Grain Inspection Service graded the wheat samples. The wheat commissions of Idaho, Oregon, and Washington, U.S. Wheat Associates, Inc., and the U.S. Department of Agriculture supported this program.

## Export Cargo Survey

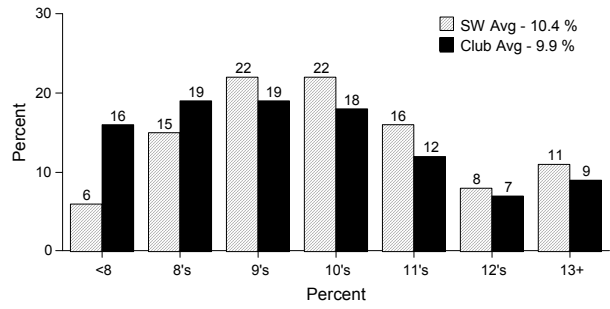
The Pacific Northwest white wheat export cargo data show the results of analyses of individual subplot samples including 91 drawn from the 2001 crop and 61 from the 2002 crop (October 2002 through May 2003). The samples were randomly selected from official Federal Grain Inspection Service samples. Grade data are the actual grades on the individual subplots. Milling and processing analyses were conducted by the Wheat Marketing Center, Portland, Oregon.



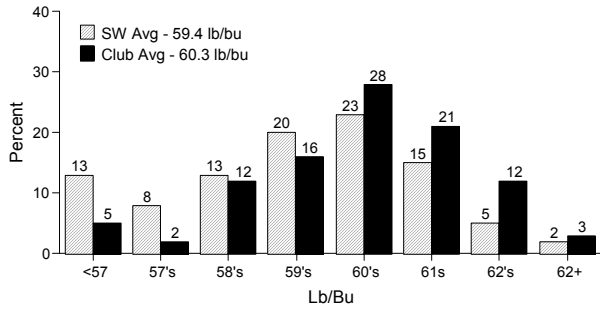
### 1000 Kernel Weight



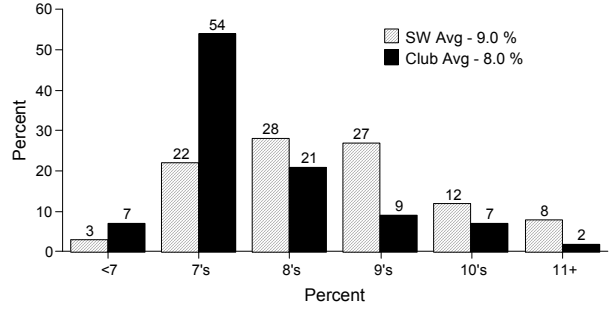
### Protein (12% mb)



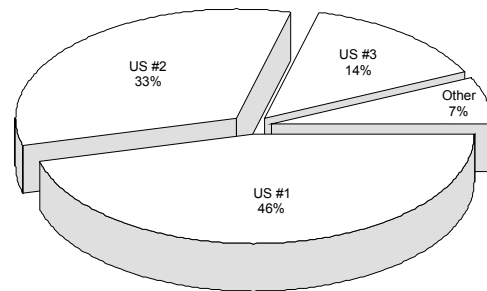
### Test Weight



### Wheat Moisture



### 2003 SW Grade Distribution



## Pacific Northwest Soft White Wheat Production

by crop year in major white wheat producing states  
(million metric tons)

	2003		2002		2001		2000		1999	
	SW	CLUB	SW	CLUB	SW	CLUB	SW	CLUB	SW	CLUB
Washington	3.00	0.31	2.86	0.28	2.91	0.30	3.52	0.41	2.78	0.19
Oregon	1.34	0.04	0.85	0.04	0.81	0.05	1.27	0.11	0.87	0.03
Idaho	1.58	0.04	1.57	0.04	1.49	0.05	2.03	0.08	1.86	0.02
<b>Three-state Total</b>	<b>5.92</b>	<b>0.39</b>	<b>5.28</b>	<b>0.36</b>	<b>5.21</b>	<b>0.40</b>	<b>6.82</b>	<b>0.60</b>	<b>5.51</b>	<b>0.24</b>
<b>Three-state Total Soft White Wheat</b>	6.31		5.64		5.61		7.42		5.75	
<b>Total Soft White Wheat Production</b>	6.99		6.42		6.31		8.25		6.72	

Based on USDA crop estimates of September 30, 2003.

# Pacific Northwest Harvest Data

Soft White

Soft White	2003					2002		5-Year Avg	
	Soft White By Protein*				Club Avg	SW	Club	SW	Club
	Low	Med	High	All					
<b>Wheat Grade Data:</b>									
Test Weight (lb/bu)	60.6	60.6	58.8	59.4	60.3	59.7	59.6	60.1	60.3
(kg/hl)	79.6	79.6	77.4	78.2	79.3	78.5	78.4	79.1	79.4
Heat Damage (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Damaged Kernels (%)	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Foreign Material (%)	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1
Shrunken & Broken (%)	0.8	0.8	1.1	1.0	1.5	0.9	1.9	0.9	1.6
Total Defects (%)	0.8	1.0	1.2	1.1	1.7	1.0	2.0	1.0	1.8
Grade	1 SW	1 SW	2 SW	2 SW	1 WC	2 SW	1 WC	1 SW	1 WC
<b>Wheat Non-Grade Data:</b>									
Dockage (%)	0.5	0.6	1.0	0.7	0.8	0.7	0.9	0.6	0.8
Moisture (%)	9.5	9.3	8.5	9.0	8.0	9.4	9.0	9.4	8.8
Protein (%) 12%/0% moisture basis	8.2/9.3	9.7/11.0	12.0/13.6	10.4/11.8	9.9/11.3	10.8/12.3	9.9/11.3	10.3/11.7	9.6/10.9
Ash (%) 14%/0% moisture basis	1.37/1.59	1.37/1.59	1.45/1.69	1.39/1.62	1.27/1.48	1.41/1.64	1.28/1.49	1.39/1.62	1.27/1.48
1000 Kernel Weight (g)	32.7	32.0	31.0	31.7	29.1	33.4	29.9	34.7	31.1
Kernel Size (%) lg/md/sm	85/14/1	80/19/1	66/33/1	75/24/1	66/33/1	72/27/1	56/42/2		
Single Kernel: Hardness	25.8	28.9	27.8	28.7	38.9	32.4	37.1	33.1	38.2
Weight (mg)	36.2	35.2	32.7	34.3	31.7	35.1	31.6	35.9	32.3
Diameter (mm)	2.45	2.40	2.25	2.40	2.23	2.41	2.22	2.49	2.29
Sedimentation (cc)	12.1	17.1	25.9	19.8	14.0	17.6	14.0	17.7	13.4
Falling Number (sec)	356	376	383	362	354	362	353	345	340
<b>Flour Data:</b>									
Extraction Rate (%)	66.2	65.9	63.7	65.0	67.4	69.1	70.6	67.9	69.8
Color: L*	92.8	92.6	92.5	92.6	92.9	92.6	92.5	92.5	92.5
a*	-2.8	-2.7	-2.5	-2.6	-2.5	-2.6	-2.5	-2.7	-2.5
b*	7.2	7.2	6.8	7.0	6.9	7.3	6.9	7.4	7.0
Protein (%) 14%/0% moisture basis	6.6/7.7	7.8/9.1	9.9/11.5	8.4/9.8	8.0/9.3	9.1/10.6	8.5/9.9	8.6/10.0	8.1/9.4
Ash (%) 14%/0% moisture basis	0.36/0.42	0.34/0.40	0.38/0.44	0.36/0.42	0.40/0.47	0.35/0.41	0.36/0.42	0.36/0.42	0.38/0.44
Wet Gluten (%)	17.1	22.8	28.9	24.1	18.4	23.4	17.2	23.1	16.0
Falling Number (sec)	326	323	333	328	324	373	363	349	347
Amylograph Viscosity 65 g (BU)	560	630	620	608	565	591	590	577	585
Starch Damage (%)	3.1	3.1	3.5	3.3	3.0	3.8	3.0		
<b>Solvent Retention Capacity (%)</b>									
Water/50% Sucrose	53/106	46/108	57/119	53/112	45/105	53/105	47/99		
5% Lactic Acid/5% Sodium Carbonate	109/80	119/79	121/81	118/80	89/76	114/78	88/69		
<b>Dough Properties:</b>									
<b>Farinograph:</b>									
Peak Time (min)	1.1	1.1	2.2	1.6	1.5	1.7	1.2	1.6	1.2
Stability (min)	1.4	3.5	3.0	2.7	1.5	2.7	1.2	2.6	1.2
Absorption (%)	50.1	50.5	50.9	50.6	49.7	49.8	48.6	50.0	48.8
<b>Alveograph: P (mm)</b>									
L (mm)	49	57	51	52	33	40	28	42	29
W (10-4 joules)	54	47	129	86	63	132	74	115	69
W (10-4 joules)	90	90	165	124	53	124	46	117	46
<b>Extensigraph: Resistance (BU)</b>									
(45 min) Extension (cm)	270	305	305	296	133	226	90	239	100
Area (sq cm)	12.7	13.7	15.3	14.1	13.9	17.3	15.4	16.1	14.6
Area (sq cm)	51	60	69	62	31	56	21	56	22
<b>Baking Evaluation:</b>									
<b>Sponge Cake: Volume (cc)</b>									
Score	1182	1163	1100	1139	1132	1146	1175	1128	1160
Score	61	51	50	53	47	50	55	50	52
Cookie Diameter (cm)	8.5	8.4	8.1	8.3	8.4	8.4	8.6	8.4	8.6
<b>Chinese Southern-Type Steamed Bread Evaluation:</b>									
Specific Volume (ml/g)	2.94	2.90	2.95	2.93	3.38	2.62	2.57		
Total Score	68.2	68.6	68.4	68.4	65.3	71.5	65.8		
<b>% of Area Production:</b>									
	25	30	45	100	100	100	100	100	100

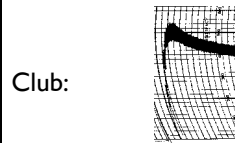
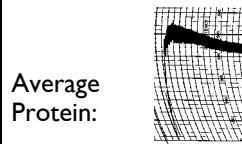
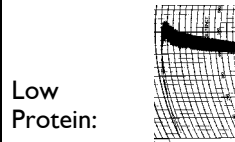
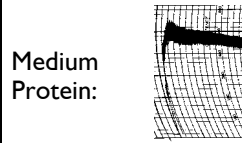
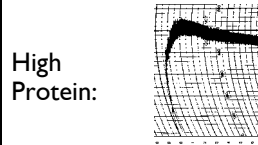
\* Low: Less than 9.0%; Med: 9.0 - 10.5%; High: greater than 10.5%

# Export Cargo Data

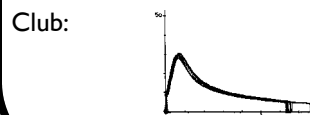
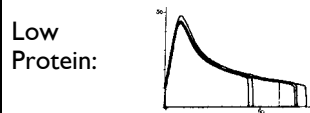
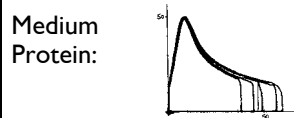
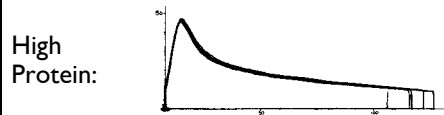
Soft White		
	2002	2001
<b>Wheat Grade Data:</b>		
Test Weight (lb/bu)	61.4	61.7
(kg/hl)	80.7	81.2
Heat Damage (%)	0.0	0.0
Damaged Kernels (%)	0.3	0.1
Foreign Material (%)	0.1	0.1
Shrunken & Broken (%)	1.3	1.0
Total Defects (%)	1.7	1.3
Grade	1 SW	1 SW
<b>Wheat Non-Grade Data:</b>		
Dockage (%)	0.4	0.4
Moisture (%)	9.4	9.0
Protein (%) 12%/0% moisture basis	10.2/11.5	10.4/11.8
Ash (%) 14%/0% moisture basis	1.34/1.56	1.31/1.52
1000 Kernel Weight (g)	35.0	35.6
Kernel Size (%) lg/md/sm	77/22/1	53/22/25
Single Kernel: Hardness	33.7	36.0
Weight (mg)	35.8	36.2
Diameter (mm)	2.41	2.43
Sedimentation (cc)	18.2	17.8
Falling Number (sec)	392	392
<b>Flour Data:</b>		
Extraction Rate (%)	71.8	71.3
Color: L*	92.3	92.4
a*	-2.5	-2.5
b*	7.0	7.1
Protein (%) 14%/0% moisture basis	8.5/9.9	8.7/10.1
Ash (%) 14%/0% moisture basis	0.44/0.51	0.38/0.45
Wet Gluten (%)	22.8	22.4
Falling Number (sec)	408	419
Amylograph Viscosity 65 g (BU)	525	542
Starch Damage (%)		
Solvent Retention Capacity (%)		
Water/50% Sucrose		
5% Lactic Acid/5% Sodium Carbonate		
<b>Dough Properties:</b>		
Farinograph:		
Peak Time (min)	1.7	1.6
Stability (min)	2.5	2.4
Absorption (%)	50.6	50.8
Alveograph: P (mm)		
L (mm)	84	94
W (10-4 joules)	93	97
Extensigraph: Resistance (BU)		
(45 min) Extension (cm)		
Area (sq cm)		
<b>Baking Evaluation:</b>		
Sponge Cake: Volume (cc)	1117	1080
Score	44	43
Cookie Diameter (cm)	8.2	8.2
<b>Chinese Southern-Type Steamed Bread Evaluation:</b>		
Specific Volume (ml/g)		
Total Score		
Sample Count:	61	91

## Composite Average Farinograms and Alveograms

### Farinograms:



### Alveograms:



Soft White

# Hard Red Spring Wheat

## Harvest Survey

**Weather and Harvest:** The 2003 hard red spring wheat (HRS) production season was characterized by early and rapid planting, abundant early season moisture, a dry summer and a dry, swift harvest. These conditions were favorable for minimal disease, excellent harvest quality and average to well-above-average yields over almost the entire region. The crop is about 45% larger than last year's drought-affected crop despite a 12% reduction in planted area, as final harvested area was actually above 2002 and yields nearly 50% larger.

Planting began in early April and was nearly 50% complete by the end of April, far ahead of the five-year average of 30%. Despite rain delays, nearly 90% of the crop was planted by the end of May, equal to the five-year average.

Growing conditions in June were near ideal with favorable moisture and temperature for early-seeded wheat and excellent germination for the later-planted crop. By the end of June and into July, the crop in western areas became stressed by hot temperatures and diminished precipitation. In central and eastern locations, earlier maturity, cooler temperatures, adequate subsoil moisture and sporadic rain in July aided crop development. Overall drier weather almost entirely eliminated disease pressure.

Harvest began in late July and moved swiftly north, as hot, dry conditions hastened crop maturity. Roughly one-quarter of the crop was harvested by August 11, and nearly 95% by the first week in September. The ideal conditions allowed farmers to harvest a high quality, sound crop two to three weeks ahead of normal.

**Samples and Methods:** Sample collection and analysis were conducted by the Department of Cereal and Food Sciences, North Dakota State University, Fargo, North Dakota. The four-state HRS growing region from which samples were collected is depicted in the accompanying map. A total of 849 HRS samples were collected from growers and grain elevators in Minnesota (121), Montana (207), North Dakota (395) and South Dakota (126). Samples were segregated by wheat protein content and assigned and composited to protein levels within each export region as follows: less than 13.5%, 13.5-14.5% and greater than 14.5%. The methods are described in the Analysis Methods section of this booklet.

**Wheat and Grade Data:** The 2003 HRS crop grade averages 1DNS. Eighty-three percent of the crop grades number one and only 9% less than number two. The high grade profile is due to high average test weights and very low damaged kernel levels. Because of a rapid, dry harvest, the crop also boasts high average vitreous kernel (DHV) and high average falling number values. All of these factors are improvements over last year and the five-year average. The average wheat protein content is about one percentage point lower than last year but only slightly lower than the five-year average. Although slightly lower than the five-year average, thousand kernel weights are higher than last year.

**Flour and Baking Data:** The average flour milling extraction, using the Buhler experimental mill, is about the same as last year and the five-year average. Flour ash is the same as the five-year average. The average wet gluten content is similar to last year but slightly higher than the five-year average. The farinograph dough mixing peak time and mixing stability is slightly less than last year but stronger than the five-year average. The overall farinogram classification is stronger than the five-year average. The alveogram W value is a little higher than last year and the five-year average. The average baking data shows markedly higher absorption compared to last year and the five-year average. Loaf volume is higher than the five-year average but slightly lower than last year. Crumb grain and texture is rated the same as last year.

**Summary:** The 2003 HRS crop has good to excellent quality and is a very sound crop that boasts a high grade profile and a protein level that is only slightly lower than the five-year average. The 2003 average test weight is considerably higher than the five-year average and the highest it has been in the past several years. The average falling number values are much higher than the five-year average, and virtually no fusarium head blight (scab) was noticed in this year's crop. However, because of continued drought conditions in the very west portion of the HRS growing region there are some notable differences in test weight, kernel size distribution, wheat protein content and flour extraction between the eastern and western areas.

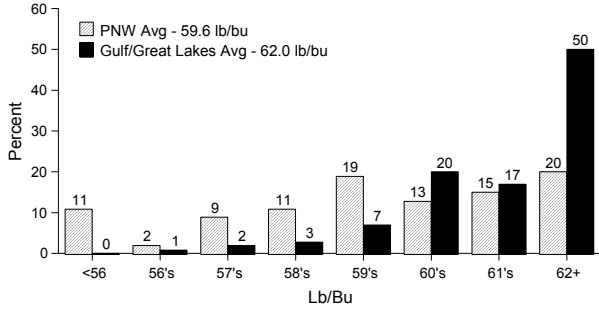
The crop has average flour extraction (Buhler experimental mill) with above-average dough strength, absorption and loaf volume. However, dough mixing characteristics as measured by the farinograph are slightly weaker than last year on average, and variability in dough strength exists within the export regions. The overall bread-baking performance shows higher bake absorption, larger loaf volume, and similar crumb grain and texture compared to the five-year average.

Buyers should be quite pleased with the overall quality of the 2003 HRS crop. The greater than usual difference that exists between the west and east for test weight may require some adjustments in contract specifications. As usual, other quality differences exist between the PNW and Gulf/Great Lakes exportable regions, and buyers are always encouraged to use specifications that best meet their quality needs.

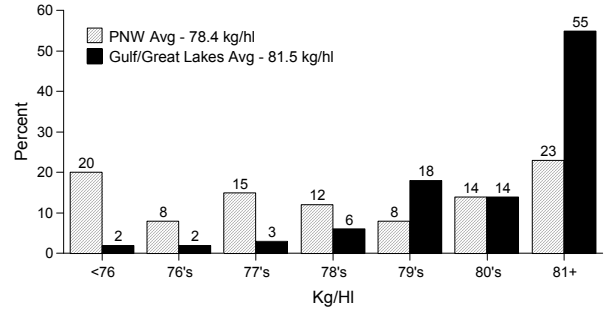
## Export Cargo Survey

The export cargo survey shows the results of analysis of 174 individual subplot samples for crop year 2002 (collected from October through August) and 258 for crop year 2001. Of the 174 2002 samples, 108 were collected from PNW ports, 36 from the Lakes and 30 from Gulf ports. The samples were randomly selected from official Federal Grain Inspection Service samples. Grade data are the official grades on the individual subplots. Milling and baking analyses were conducted by North Dakota State University.

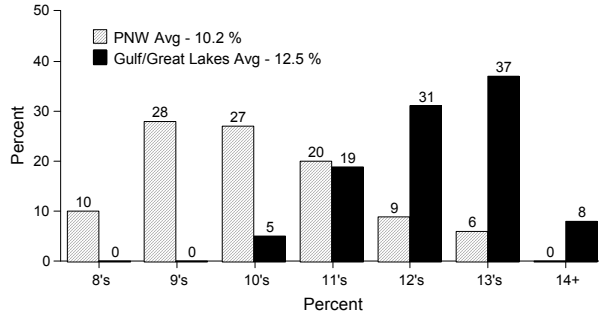
### Test Weight



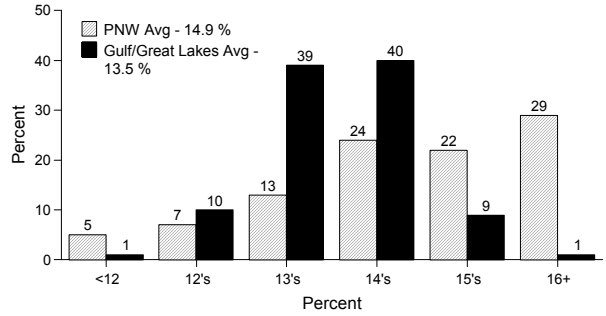
### Hectoliter Weight



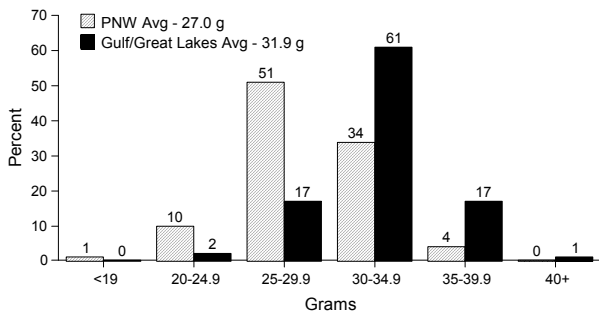
### Wheat Moisture



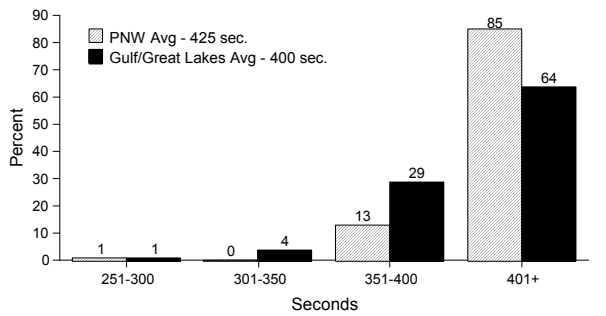
### Protein (12% mb)



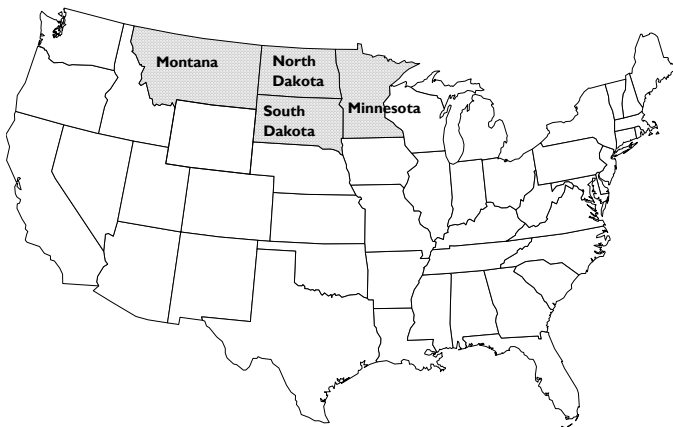
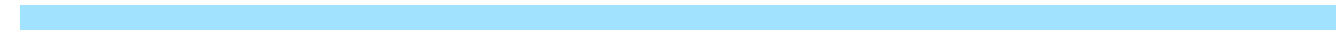
### 1000 Kernel Weight



### Falling Number



Hard Red Spring

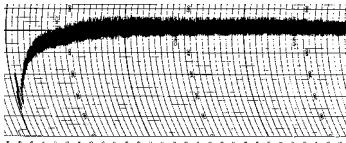


Hard red spring survey results are from four states.

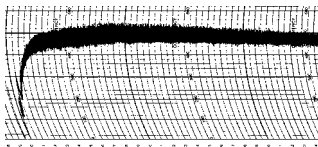
## Composite Average Farinograms and Alveograms

### Farinograms:

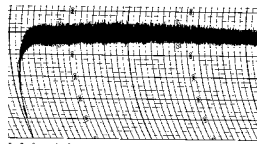
High Protein:



Medium Protein:

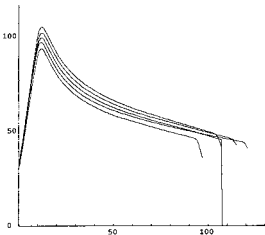


Low Protein:

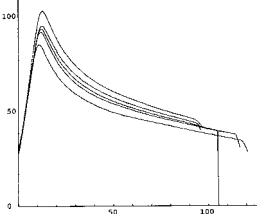


### Alveograms:

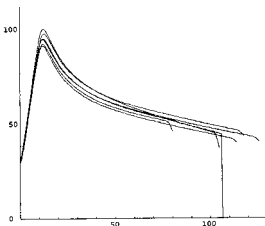
High Protein:



Medium Protein:



Low Protein:



## Hard Red Spring

### Composite Average

	2003 By Protein*			Overall	2002 Overall	5-year Avg
	Low	Med	High			
<b>Wheat Grade Data:</b>						
Test Weight (lb/bu)	62.0	61.7	59.5	60.9	59.3	59.7
(kg/hl)	81.6	81.2	78.2	80.1	78.1	78.6
Damaged Kernels (%)	0.3	0.5	0.3	0.3	0.6	0.6
Foreign Material (%)	0.0	0.1	0.0	0.0	0.0	0.0
Shrunken & Broken (%)	1.1	1.0	1.6	1.2	1.4	1.6
Total Defects (%)	1.4	1.5	1.9	1.6	2.0	2.1
Vitreous Kernels (%)	73.8	77.8	95.2	83.7	72.1	69.6
Grade	1 NS	1 DNS	1 DNS	1 DNS	1 NS	1 NS
<b>Wheat Non-Grade Data:</b>						
Dockage (%)	1.2	1.0	0.9	1.0	1.2	1.3
Moisture (%)	11.9	12.1	10.8	11.5	12.4	11.8
Protein (%) 12%/0% moisture basis	12.4/14.1	13.8/15.7	15.8/17.9	14.2/16.2	15.1/17.2	14.5/16.5
Ash (%) 14%/0% moisture basis	1.62/1.89	1.59/1.85	1.63/1.90	1.62/1.88	1.65/1.91	1.68/1.95
1000 Kernel Weight (g)	32.1	30.9	27.0	29.6	27.9	29.7
Kernel Size (%) lg/md/sm	60/35/6	60/34/6	34/54/13	49/42/9	46/44/10	55/38/7
Single Kernel: Hardness	89.4	90.3	86.2	88.4	84.8	80.2
Weight (mg)	31.7	31.5	29.1	30.6	29.9	30.6
Diameter (mm)	2.32	2.31	2.13	2.24	2.29	2.34
Sedimentation (cc)	42.4	58.0	59.9	54.7	62.0	53.1
Falling Number (sec)	410	400	421	411	321	360
<b>Flour Data:</b>						
Extraction Rate (%)	69.9	69.8	67.4	68.9	68.8	69.1
Color: L*	92.1	91.8	91.5	91.8	90.0	90.2
a*	-1.1	-1.1	-0.9	-1.0	-1.4	-1.4
b*	9.4	9.5	9.4	9.4	9.2	9.4
Protein (%) 14%/0% moisture basis	11.2/13.0	12.6/14.6	14.6/16.9	13.0/15.1	13.9/16.2	13.3/15.5
Ash (%) 14%/0% moisture basis	0.44/0.51	0.44/0.51	0.47/0.55	0.45/0.53	0.43/0.50	0.45/0.52
Wet Gluten (%)	30.3	34.5	41.4	36.2	36.3	35.6
Falling Number (sec)	425	419	468	440	369	390
Amylograph Viscosity: 65g (BU)	830	791	895	843	495	554
100g (BU)	2860	2686	3098	2896	1766	2196
Starch Damage (%)	6.8	6.8	6.3	6.6	6.0	
<b>Dough Properties:</b>						
Farinograph:						
Peak Time (min)	8.0	13.4	21.0	15.0	16.5	11.7
Stability (min)	23.8	25.1	29.1	26.4	28.9	19.8
Absorption (%)	64.2	66.4	68.2	66.6	64.4	64.2
Classification	6.6	7.3	7.7	7.3	7.6	6.5
Alveograph: P (mm)	103	98	104	102	85	94
L (mm)	90	121	110	109	123	112
WV (10-4 joules)	331	407	426	395	380	378
Extensigraph: Resistance (BU)**	532/643	512/590	556/643	535/625	521/559	486
(45/135 min) Extension (cm)	20.2/18.8	22.2/21.8	22.5/22.7	21.8/21.4	24.9/25.8	23.2
Area (sq cm)	134/148	140/162	156/183	145/167	160/182	143
<b>Baking Evaluation:</b>						
Absorption (%)	62.7	64.9	66.7	65.1	62.9	62.7
Crumb Grain and Texture	8.0	8.4	8.5	8.3	8.3	8.3
Loaf Volume (cc)	957	1086	1157	1081	1100	1047
<b>% Area Production:</b>	26	34	40	100	100	100

\* Low: Less than 13.5%; Med: 13.5 - 14.5%; High: 14.5% or greater.

\*\* Result is for 45 minutes on 5-year averages.

# Data

PNW Average						Gulf/Great Lakes Average					
2003 By Protein*				2002	5-year Avg	2003 By Protein*				2002	5-year Avg
Low	Med	High	Overall			Low	Med	High	Overall		
61.6	61.1	58.5	59.6	60.0	60.1	62.2	61.9	61.8	62.0	58.6	59.4
81.0	80.4	77.0	78.4	78.9	79.1	81.8	81.4	81.3	81.5	77.2	78.2
0.1	0.0	0.2	0.1	0.3	0.3	0.4	0.6	0.4	0.5	0.8	0.7
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
1.8	2.0	2.0	2.0	1.5	1.8	0.8	0.6	0.6	0.7	1.3	1.4
1.9	2.0	2.2	2.1	1.9	2.2	1.2	1.3	1.0	1.2	2.1	2.1
85.0	95.0	99.0	95.5	79.7	81.2	69.0	72.0	86.0	73.6	64.1	60.4
I DNS	I DNS	I DNS	I DNS	I DNS	I DNS	I NS	I NS	I DNS	I NS	I NS	I NS
1.1	0.7	0.8	0.8	1.2	1.4	1.2	1.1	1.3	1.2	1.1	1.3
10.0	10.5	10.2	10.2	12.1	11.1	12.7	12.6	12.1	12.5	12.7	12.5
12.2/13.9	13.9/15.8	16.1/18.3	14.9/17.0	15.2/17.3	14.7/16.7	12.5/14.2	13.7/15.6	15.0/17.0	13.5/15.4	15.1/17.1	14.4/16.3
1.54/1.79	1.52/1.77	1.64/1.91	1.60/1.86	1.56/1.81	1.63/1.89	1.66/1.93	1.61/1.87	1.62/1.88	1.63/1.89	1.74/2.03	1.72/2.00
31.1	28.5	25.2	27.0	28.8	29.8	32.5	31.7	31.4	31.9	27.1	29.5
48/45/7	41/49/10	22/62/16	31/56/13	47/45/8	52/40/7	65/30/5	66/29/5	62/33/5	65/30/5	45/43/12	57/36/7
88.0	88.0	85.0	86.2	84.8	80.7	90.0	91.0	89.0	90.3	84.7	79.9
30.8	30.5	27.8	28.9	30.0	30.7	32.1	31.8	32.2	32.0	29.7	30.5
2.25	2.21	2.04	2.11	2.28	2.36	2.35	2.34	2.35	2.35	2.30	2.36
41.0	55.0	59.0	54.8	63.8	55.4	43.0	59.0	62.0	54.1	60.0	51.3
426	429	423	425	371	372	403	390	417	400	268	347
67.5	68.4	66.6	67.1	68.0	68.7	70.9	70.3	69.5	70.4	69.8	69.4
92.0	91.8	91.5	91.6	89.7	90.3	92.2	91.9	91.5	91.9	90.2	90.1
-1.1	-1.0	-0.9	-0.9	-1.3	-1.4	-1.1	-1.1	-1.0	-1.1	-1.5	-1.5
9.0	9.5	9.4	9.3	9.0	9.0	9.6	9.5	9.5	9.5	9.3	9.6
11.1/12.9	12.8/14.9	14.9/17.3	13.8/16.0	14.0/16.3	13.6/15.8	11.2/13.0	12.5/14.5	13.8/16.0	12.3/14.3	13.8/16.0	13.1/15.2
0.44/0.51	0.45/0.52	0.48/0.56	0.47/0.54	0.42/0.49	0.44/0.51	0.44/0.51	0.44/0.51	0.45/0.52	0.44/0.51	0.43/0.50	0.46/0.53
29.7	35.5	42.2	38.5	36.7	36.1	30.5	34.2	39.5	33.9	36.0	35.3
468	440	476	467	402	401	407	412	448	417	334	380
1040	1005	920	960	650	603	740	720	835	749	328	500
3420	3410	3260	3320	2362	2466	2620	2445	2700	2553	1125	1939
7.0	6.9	6.2	6.5	5.7		6.7	6.7	6.4	6.6	6.2	
8.0	17.5	25.5	20.6	21.8	15.9	8.0	12.0	10.0	10.3	10.9	8.2
42.0	30.0	32.0	33.5	34.9	25.6	16.0	23.5	22.0	20.7	22.4	15.2
65.0	66.2	68.3	67.3	65.0	65.4	63.9	66.5	67.9	65.9	63.7	63.3
8.0	8.0	8.0	8.0	7.8	7.3	6.0	7.0	7.0	6.7	7.3	5.9
128	112	105	111	87	105	92	93	103	95	83	86
71	104	107	100	123	106	98	127	119	116	124	117
355	426	423	411	386	405	321	401	432	380	374	358
630/790	565/710	565/650	577/689	509/526	505	490/580	495/550	535/625	501/574	532/594	472
19.7/17.0	20.7/19.5	22.5/22.4	21.6/20.8	26.2/25.5	23.8	20.4/19.6	22.7/22.6	22.4/23.5	21.9/21.8	23.5/26.2	22.6
156/171	145/173	158/181	155/178	166/170	152	125/138	138/158	150/188	136/157	154/196	135
63.5	64.7	66.8	65.8	63.5	63.9	62.4	65.0	66.4	64.4	62.2	61.8
8.0	8.0	8.5	8.3	8.4	8.4	8.0	8.5	8.5	8.3	8.1	8.2
915	1075	1160	1096	1102	1057	975	1090	1150	1062	1100	1041
19	20	61	100	100	100	34	47	19	100	100	100

Hard Red Spring

# Export Cargo Data

Hard Red Spring

Hard Red Spring	PNW Average		Great Lakes Average		Gulf Average	
	2002	2001	2002	2001	2002	2001
<b>Wheat Grade Data:</b>						
Test Weight (lb/bu)	60.8	61.5	60.0	60.2	60.0	60.5
(kg/hl)	79.9	80.9	78.9	79.2	79.0	79.6
Damaged Kernels (%)	0.5	0.5	1.5	1.5	1.3	1.4
Foreign Material (%)	0.1	0.2	0.2	0.1	0.2	0.2
Shrunken & Broken (%)	1.6	1.8	1.4	1.6	1.5	1.5
Total Defects (%)	2.3	2.4	3.0	3.3	3.0	3.1
Vitreous Kernels (%)	74.6	83.2	47.6	53.8	60.3	60.8
Grade	1 NS	1 DNS	2 NS	2 NS	2 NS	2 NS
<b>Wheat Non-Grade Data:</b>						
Dockage (%)	0.3	0.4	0.5	0.5	0.7	0.7
Moisture (%)	11.6	10.7	12.9	12.3	12.7	12.2
Protein (%) 12%/0% moisture basis	14.4/16.3	14.3/16.2	14.6/16.6	14.5/16.5	14.6/16.6	14.2/16.2
Ash (%) 14%/0% moisture basis	1.57/1.83	1.63/1.90	1.70/1.98	1.71/1.99	1.69/1.97	1.69/1.96
1000 Kernel Weight (g)	32.8	30.4	29.5	28.9	30.0	29.3
Kernel Size (%) lg/md/sm	55/37/8	53/39/8	48/41/11	49/42/9	48/42/10	51/41/9
Single Kernel: Hardness	74.6	78.5	76.6	76.5	75.6	75.6
Weight (mg)	32.2	31.2	28.6	29.1	28.6	29.5
Diameter (mm)	2.42	2.40	2.29	2.31	2.27	2.31
Sedimentation (cc)						
Falling Number (sec)	407	403	342	352	345	375
<b>Flour Data:</b>						
Extraction Rate (%)	70.2	70.3	70.3	70.6	70.0	70.7
Color: L*	89.4	90.4	88.6	90.2	89.0	90.4
a*	-1.3	-1.4	-1.3	-1.4	-1.3	-1.4
b*	8.4	8.7	9.2	9.1	9.0	9.0
Protein (%) 14%/0% moisture basis	13.3/15.5	13.2/15.3	13.4/15.6	13.2/15.4	13.5/15.6	13.0/15.1
Ash (%) 14%/0% moisture basis	0.46/0.53	0.48/0.56	0.47/0.55	0.49/0.57	0.47/0.54	0.49/0.57
Wet Gluten (%)	35.6	36.3	35.1	36.2	35.2	35.4
Falling Number (sec)	461	444	380	387	392	413
Amylograph Viscosity: 65g (BU)	627	591	432	455	448	535
100g (BU)						
Starch Damage (%)						
<b>Dough Properties:</b>						
Farinograph:						
Peak Time (min)	11.4	8.7	9.3	7.6	9.5	7.8
Stability (min)	24.2	18.1	16.8	13.1	18.0	14.5
Absorption (%)	66.8	65.1	64.8	63.7	64.5	63.2
Classification	7.3	6.5	6.6	5.6	6.8	5.9
Alveograph: P (mm)	117	103	100	89	100	90
L (mm)	99	105	108	108	109	110
W (10-4 joules)	413	376	388	336	395	344
Extensigraph: Resistance (BU)						
(45/135 min) Extension (cm)						
Area (sq cm)						
<b>Baking Evaluation:</b>						
Absorption (%)	65.3	63.6	63.3	62.2	63.0	61.7
Crumb Grain and Texture	8.2	8.2	8.4	8.1	8.1	8.2
Loaf Volume (cc)	1023	1035	1075	1044	1056	1040
<b>Sample Count:</b>	108	117	36	79	30	62



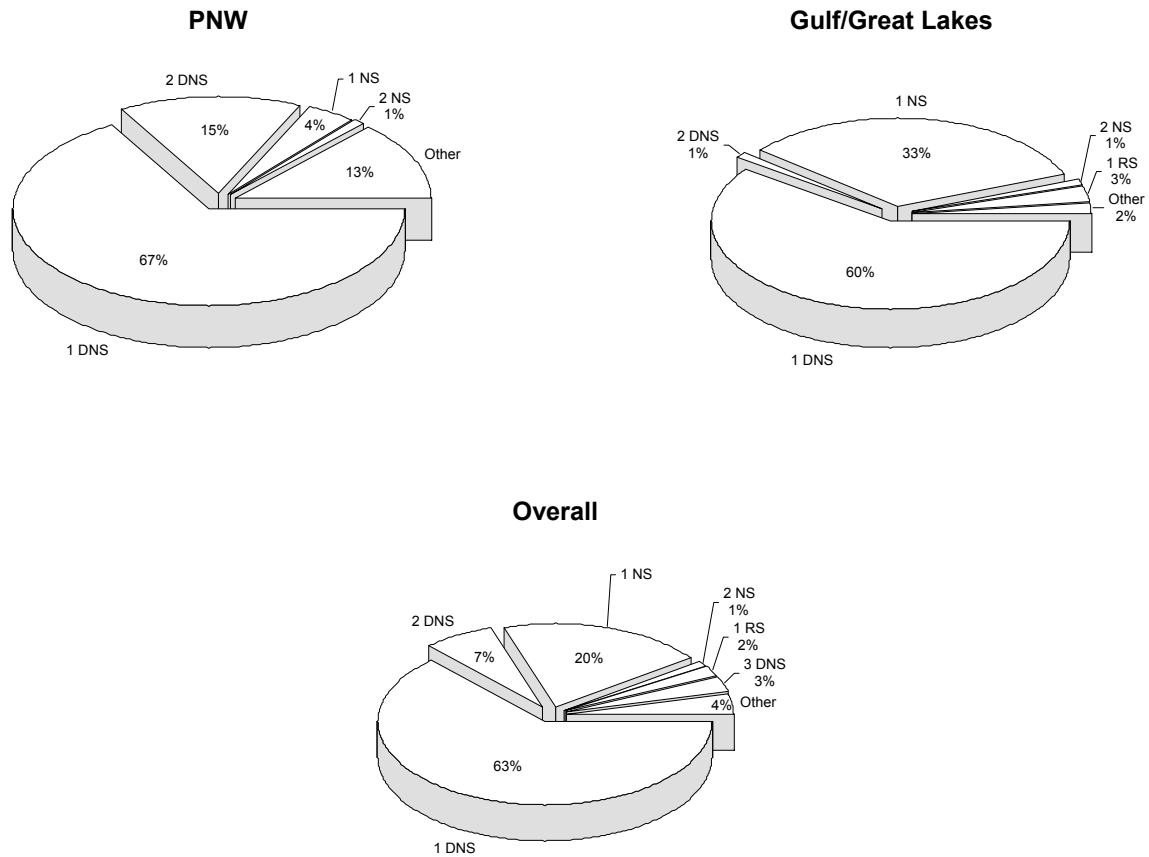
# Hard Red Spring Production by Crop Year

for the major producing states  
(million metric tons)

	2003	2002	2001	2000	1999
Minnesota	2.84	1.67	2.16	2.60	2.12
Montana	1.60	2.05	1.77	2.09	2.91
North Dakota	6.88	4.50	6.38	6.36	4.57
South Dakota	1.53	0.65	1.75	1.63	1.63
<b>Four-State Total</b>	<b>12.85</b>	<b>8.86</b>	<b>12.06</b>	<b>12.68</b>	<b>11.23</b>
<b>Total HRS Production</b>	<b>13.61</b>	<b>9.63</b>	<b>12.94</b>	<b>13.67</b>	<b>12.19</b>

Based on USDA crop estimates of September 30, 2003.

## Grade Distribution



# Soft Red Winter Wheat

## Harvest Survey

Soft red winter wheat (SRW) is grown over a wide area of the eastern United States with diverse weather patterns which result in variations in SRW quality. During the 2002/03 growing season, weather was mostly favorable for wheat growth. Conditions at harvest varied from state to state and also from early to late harvest times. Rainfall extended from May through July in some areas and caused delays in ripening and harvest, higher than desired moisture levels, sprout damage and fusarium (with the resulting mycotoxin DON) in some fields.

Test weight was slightly below last year but remained 0.4 lb/bu (0.5 kg/hl) above the five-year average. Wheat moisture content was 0.5 percentage points above last year but was similar to the five-year average. The overall protein content was 0.6 percentage points less than 2002 and 0.2 points below the five-year average. Although low falling number values were observed in certain areas overall the crop appears to meet most bakers' specifications.

Millers report good flour yields and an easy transition period into the new crop. Baking performance is similar to last year and the five-year average for samples tested. Producers of cakes are pleased with baking performance, although bakers of cakes and biscuit products (cookies) may

find some formulation adjustment necessary to account for changes in the 2003 SRW crop.

**SRW Survey:** For the 2003 SRW survey, 349 samples were collected in nine key production states: Arkansas, Illinois, Indiana, Maryland, Missouri, Ohio, North Carolina, Virginia and Kentucky. Samples were collected in each state at two different times reflecting early and late harvest conditions. Quality analysis was conducted by CII Laboratory Services, Kansas City, Missouri. Data from these samples are reported as "Composite Average" and projected averages that might be expected at "East Coast" and "Gulf Ports." All data are weighted by production based on the USDA "Small Grains Summary" September 30, 2003.

**Summary:** The 2003 SRW crop has moisture, falling number, protein content, and average test weight similar to the five-year average. Grade factors show the crop to be well within the limits for U.S. No. 2 SRW. Overall, the flour from this crop has good functionality.

Wheat buyers should always specify important quality requirements such as protein, moisture content, and falling number. There were areas of extensive rain during harvest resulting in reduced falling numbers. Specifications for falling number and for DON should be considered.

(continued on p. 21)

## Winter Wheat Production

in major soft red winter wheat producing states  
(million metric tons)

	2003	2002	2001	2000	1999
Alabama	0.09	0.07	0.09	0.13	0.12
Arkansas	0.78	1.05	1.37	1.62	1.40
Georgia	0.29	0.22	0.29	0.29	0.26
Illinois	1.40	0.85	1.17	1.40	1.62
Indiana	0.81	0.48	0.68	0.96	0.92
Kentucky	0.53	0.47	0.62	0.63	0.64
Louisiana	0.15	0.23	0.21	0.26	0.13
Maryland	0.15	0.32	0.30	0.34	0.33
Michigan	0.65	0.47	0.55	0.50	0.65
Mississippi	0.17	0.25	0.32	0.35	0.22
Missouri	1.39	0.90	1.08	1.30	1.17
North Carolina	0.40	0.55	0.50	0.75	0.77
Ohio	1.85	1.37	1.64	2.18	1.96
South Carolina	0.20	0.19	0.25	0.26	0.26
Tennessee	0.37	0.38	0.50	0.57	0.52
Virginia	0.20	0.29	0.28	0.35	0.37
<b>16-State Total</b>	<b>9.41</b>	<b>8.09</b>	<b>9.85</b>	<b>11.89</b>	<b>11.34</b>
<b>Total SRW Production</b>	<b>10.32</b>	<b>9.04</b>	<b>10.88</b>	<b>12.83</b>	<b>12.36</b>

Data are based on USDA crop estimates of September 30, 2003.

# Harvest Data

Soft Red Winter	Mennel Data		Composite Average			East Coast*		Gulf Ports*	
	2003	2002	2003	2002	5-Year Avg	2003	2002	2003	2002
<b>Wheat Grade Data:</b>									
Test Weight (lb/bu)	60.0	60.0	58.9	59.2	58.6	56.7	59.5	59.1	59.3
(kg/hl)	79.0	79.0	77.5	77.9	77.2	74.6	78.3	77.8	78.1
Damaged Kernels (%)			2.6	0.9	1.2	4.0	0.6	2.4	1.0
Foreign Material (%)			0.1	0.1	0.1	0.1	0.0	0.1	0.1
Shrunken & Broken (%)			0.6	0.7	0.5	1.1	0.7	0.6	0.7
Total Defects (%)			3.3	1.7	1.8	5.2	1.3	3.1	1.8
Grade			2 SRW	2 SRW	2 SRW	3 SRW	2 SRW	2 SRW	2 SRW
<b>Wheat Non-Grade Data:</b>									
Dockage (%)			0.8	0.8	0.7	1.5	0.7	0.7	0.8
Moisture (%)	13.4	12.7	13.0	12.5	13.2	13.5	12.4	12.9	12.5
Protein (%) 12%/0% moisture basis	9.8/11.1	10.9/12.3	9.9/11.2	10.5/11.9	10.0/11.3	11.0/12.5	10.6/12.0	9.8/11.1	10.4/11.8
Ash (%) 14%/0% moisture basis			1.60/1.87	1.62/1.88	1.54/1.79	1.63/1.90	1.56/1.82	1.60/1.87	1.63/1.90
1000 Kernel Weight (g)			33.0	32.7	32.6	28.8	32.8	33.4	32.6
Kernel Size (%) lg/md/sm			82/17/1	81/18/1	82/17/1	72/27/1	79/20/1	83/16/1	82/17/1
Single Kernel: Hardness			22.4	27.6	22.3	21.9	27.0	22.4	27.8
Weight (mg)			32.4	33.5	32.3	29.8	33.2	32.7	33.6
Diameter (mm)			2.31	2.30	2.31	2.16	2.30	2.32	2.40
Sedimentation (cc)			13.3	16.1	13.3	18.3	17.2	12.8	15.8
Falling Number (sec)	314	342	339	364	336	349	364	338	364
<b>Flour Data:</b>									
Extraction Rate (%)			68.2	68.7	69.6	68.1	68.2	68.3	68.8
Color: L*			93.2	93.1	93.5	92.9	92.8	93.2	93.1
a*			-3.2	-3.4	-3.4	-3.4	-3.4	-3.2	-3.4
b*			7.6	7.9	8.2	7.8	7.6	7.6	8.0
Protein (%) 14%/0% moisture basis	8.2/9.6	9.6/11.1	8.1/9.4	8.8/10.2	8.3/9.7	8.8/10.2	9.1/10.6	8.0/9.3	8.8/10.2
Ash (%) 14%/0% moisture basis	0.47/0.55	0.50/0.58	0.42/0.48	0.46/0.54	0.43/0.50	0.41/0.47	0.48/0.56	0.42/0.48	0.46/0.54
Wet Gluten (%)			20.6	23.1	21.5	22.0	23.3	20.4	23.0
Falling Number (sec)			333	375	393	338	353	332	380
Amylograph Viscosity 65 g (BU)	478	512	419	538	499	437	459	417	558
MacMichael Viscosity			47	50	60	59	58	46	48
Starch Damage (%)			4.8	4.6	4.4	4.4	4.9	4.9	4.5
<b>Solvent Retention Capacity (%)</b>									
Water/50% Sucrose			55/112	57/115		56/119	58/118	56/109	57/113
5% Lactic Acid/5% Sodium Carbonate			110/83	109/82		115/86	112/85	107/82	110/82
<b>Dough Properties:</b>									
<b>Farinograph:</b>									
Peak Time (min)			1.4	1.8	1.7	1.6	2.4	1.4	1.7
Stability (min)			2.8	3.2	3.4	2.8	3.5	2.8	3.1
Absorption (%)			52.5	52.3	52.8	52.8	53.7	52.5	51.9
<b>Alveograph: P (mm)</b>									
L (mm)			34	37	35	35	41	34	36
W (10-4 joules)			90	97	105	105	98	89	97
			78	90	89	90	103	76	87
<b>Baking Evaluation:</b>									
Crumb Grain			5.5	5.7	5.8	5.3	6.1	5.5	5.6
Crumb Texture			5.8	5.9	6.0	6.2	6.0	5.7	5.8
Loaf Volume (cc)			722	751	735	735	768	720	747
Cookie Spread Ratio	8.4	9.0	8.0	8.6	8.4	8.1	8.0	8.0	8.8
<b>% of Area Sampled:</b>			100	100	100	10	20	90	80

\* East Coast - Maryland, Virginia, North Carolina; Gulf Ports - Arkansas, Illinois, Indiana, Kentucky, Missouri and Ohio

Soft Red Winter

# Export Cargo Data

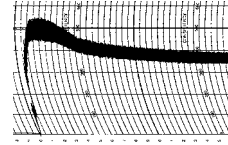
## Soft Red Winter

	2003	2002
<b>Wheat Grade Data:</b>		
Test Weight (lb/bu)	59.3	59.4
(kg/hl)	78.1	78.2
Damaged Kernels (%)	2.7	1.8
Foreign Material (%)	0.1	0.2
Shrunken & Broken (%)	0.8	1.0
Total Defects (%)	3.7	3.1
Grade	2 SRW	2 SRW
<b>Wheat Non-Grade Data:</b>		
Dockage (%)	0.7	0.8
Moisture (%)	12.7	12.3
Protein (%) 12%/0% moisture basis	10.1/11.4	10.5/11.9
Ash (%) 14%/0% moisture basis	1.54/1.79	1.66/1.93
1000 Kernel Weight (g)	30.4	29.1
Kernel Size (%) lg/md/sm	82/18/1	78/21/1
Single Kernel: Hardness	*	22.8
Weight (mg)	*	31.9
Diameter (mm)	*	2.27
Sedimentation (cc)	11.9	14.3
Falling Number (sec)	335	369
<b>Flour Data:</b>		
Extraction Rate (%)	68.8	69.0
Color: L*	92.5	93.1
a*	-3.1	-3.1
b*	8.1	7.4
Protein (%) 14%/0% moisture basis	8.3/9.6	8.6/10.0
Ash (%) 14%/0% moisture basis	0.40/0.47	0.46/0.53
Wet Gluten (%)	20.8	22.5
Falling Number (sec)	348	375
Amylograph Viscosity 65 g (BU)	415	520
MacMichael Viscosity	52	57
Starch Damage (%)		
Solvent Retention Capacity (%)		
Water/50% Sucrose		
5% Lactic Acid/5% Sodium Carbonate		
<b>Dough Properties:</b>		
Farinograph:		
Peak Time (min)	1.3	1.4
Stability (min)	2.5	3.4
Absorption (%)	52.4	52.7
Alveograph: P (mm)		
L (mm)	36	49
W (10-4 joules)	93	86
<b>Baking Evaluation:</b>		
Crumb Grain	5.5	5.9
Crumb Texture	5.9	6.4
Loaf Volume (cc)	717	738
Cookie Spread Ratio	8.0	7.7
<b>Sample Count:</b>	40	80

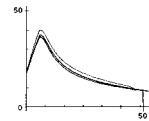
\* Data not yet available.

## 2003 Farinogram and Alveogram

### Farinogram:



### Alveogram:

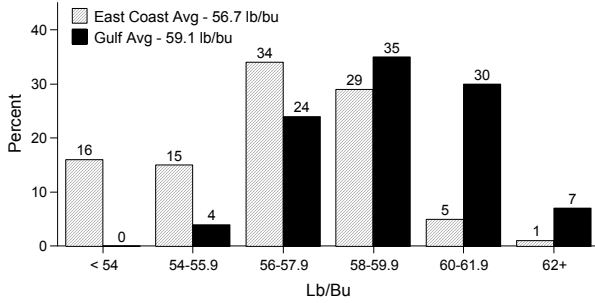


Soft Red Winter

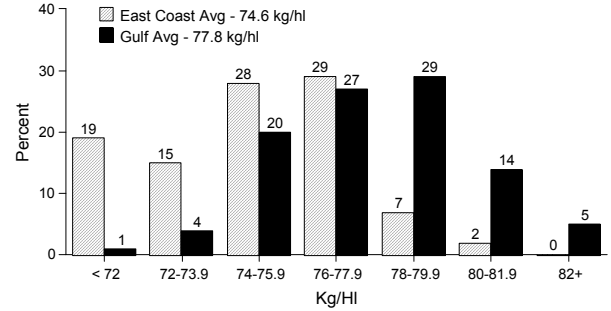
Of the sixteen-state soft red winter wheat growing area, survey samples were collected in nine states.



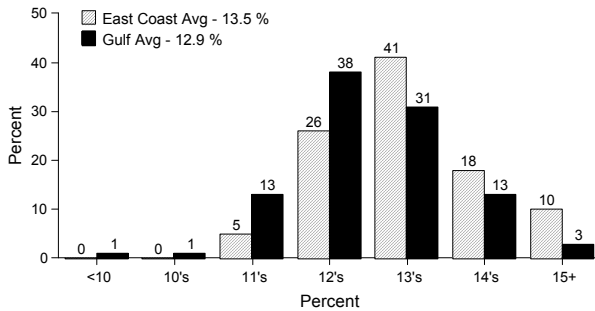
### Test Weight



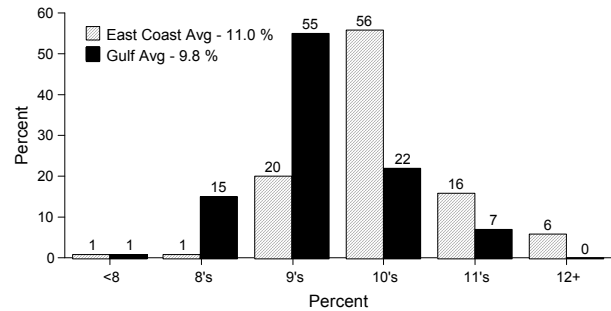
### Hectoliter Weight



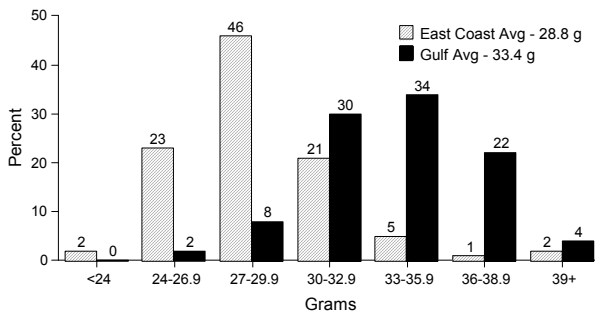
### Wheat Moisture



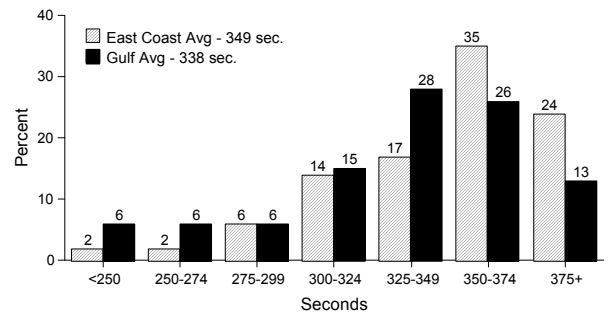
### Protein (12% mb)



### 1000 Kernel Weight



### Falling Number



(continued from p. 18)

The 2003 harvest data was compiled by the International Grains Program (IGP) at Kansas State University, Manhattan, Kansas, with contract support from Stevens Technical Services.

**Mennel Data:** Information about the SRW crop is also provided through a voluntary survey of U.S. mills conducted by Mennel Milling Company. A limited number of SRW samples this year were received from Ohio, Michigan, Missouri, Illinois, Indiana, and Kentucky.

### Export Cargo Survey

The export cargo data show the results of analysis of 120 individual subplot samples for marketing years 2003 and 2002 from Gulf of Mexico and East Coast ports. Samples were randomly selected from official Federal Grain Inspection Service samples. Grade data are the actual official grades on the individual sublots. Milling and baking analyses were conducted by CII Laboratory Services.

# Durum Wheat

## Northern Great Plains

The 2003 durum crop in North Dakota and Montana can be characterized as one of excellent grade and soundness that exhibits good pasta quality with superior color. Abundant early season moisture, an arid growing season and a rapid, dry harvest were beneficial to this year's higher yielding, high quality crop. Production is 18% larger than 2002.

**Weather and Harvest:** The planting season began in late April as a dry winter allowed soil conditions to warm and dry rapidly. Initial progress was quick with 25% of the crop planted by May 4, well ahead of the five-year average of 10%. Planting was then slowed by widespread and soil soaking rains which delayed planting, but more than 90% of the crop was still planted by the first week in June.

Early season growing conditions were excellent as favorable temperatures and frequent precipitation promoted rapid germination, high plant populations and vigorous crop growth. This boosted early season yield potential and alleviated concerns about the reduced subsoil moisture levels over much of the durum production area. Growing conditions remained favorable through early July.

Hot temperatures and little precipitation dominated the second half of the growing season reducing yields in some areas in the south and west. In other areas, the crop benefited from the drier weather as disease was a non-factor and the crop approached maturity in a robust and healthy state.

Harvest began in late July as the hot summer accelerated crop maturity. Weather conditions remained near perfect through August, and progress was rapid. Completion reached 50% by August 25, more than twice the five-year average pace, and the harvest was virtually finished by mid-September, about two weeks ahead of normal. Near perfect conditions produced a low moisture, sound crop with excellent color and a very high grade profile.

**Quality:** The quality summary for the 2003 Northern Plains durum crop is based on analysis of 233 individual samples collected directly from producers at harvest. Between August 4 and September 19, 197 samples were collected in North Dakota and 36 in Montana.

The crop averages #1 hard amber durum (HAD) with nearly 60% grading #1 HAD and only 6% falling below a number 3 grade. Key grade factors are at their best average in more than five years. The average test weight is 61 pounds per bushel (79.4 kg/hl), up by more than a pound (1.4 kg) from 2002. Total damage averages only 0.3%, significantly less than the 2.1% reported in 2002 and 2.4% for the five-year average. The crop is bright in color and has a high vitreous kernel count, averaging 92% compared to 82 for a five-year average.

Non-grade factors, such as protein content and moisture also show improvement. Average protein content is 14.5% (12% basis), compared to 14.1% for a five-year average.

Moisture averages 10.5%, a full point and a half less than last year. The average falling number is 391 seconds, up sharply from the five-year average of 296 seconds, indicating a sound, sprout-free crop. Thousand kernel weights, averaging 33.8 grams, are lower than last year and the five-year average. This is primarily due to the acute heat and drought in parts of Montana and southwest North Dakota.

Milling extractions (Buhler lab mill) are down from last year and the five-year average but the milled product is of higher quality with lower ash levels and speck counts. Semolina strength is equal to last year and the five-year average, recording a mixogram classification of 6 on a scale of 1-8.

Pasta cooked quality is rated similar to last year with a significant enhancement in the color of the finished product. The average color score is a 9.4 on a scale of 1 to 12, compared to 8.7 last year. Average cooking loss and cooked firmness are similar to last year. Cooked weight is down slightly from 2002.

Buyers should be pleased with the 2003 crop and its overall grade and processing quality. There are some notable differences in kernel size and weight between some growing regions due to acute mid-summer heat and drought, but in most areas the physical characteristics are excellent. Appropriate contract specifications are the best method for buyers to ensure they get the quality of durum they need at the best value

## Pacific Southwest

Desert Durum ®, a trademark of the Arizona Grain Research and Promotion Council and the California Wheat Commission, applies only to durum wheat produced in the states of Arizona and California.

Desert Durum is usually delivered "identity preserved" to US domestic and export markets. The identity preservation system allows buyers to purchase grain of varieties having intrinsic quality parameters specific to their needs. Annual production requirements can be contracted ahead with experienced growers using certified seed and then "identity" stored for season-long shipment at the buyer's schedule.

During marketing year 2002/03 Desert Durum was purchased for export to Algeria, Italy, Costa Rica, Guatemala, Netherlands, Nigeria, and Venezuela. Desert Durum varieties have consistent kernel size, low moisture (6%-8%), strong gluten properties and very good color.

## Export Cargo Survey

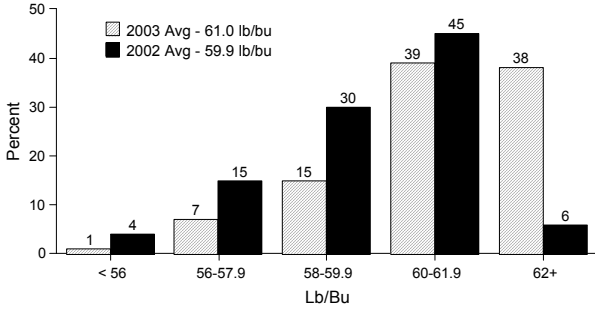
The durum export cargo survey shows the results of analysis of 28 individual subplot samples for crop year 2002 (collected from October 2002 through June 2003) and 43 samples for 2001. The samples were randomly selected from official Federal Grain Inspection Service samples. Grade data are the actual official grades on the individual sublots. Processing analysis was conducted by North Dakota State University.

# Harvest and Export Data

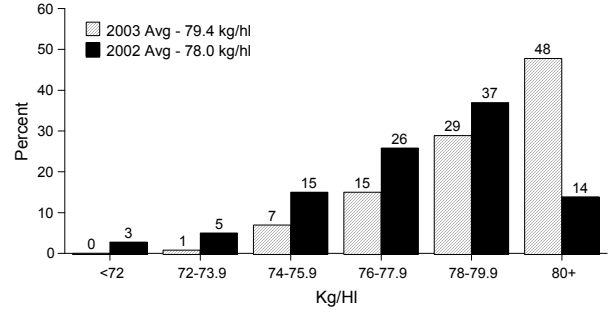
Durum	Harvest Data					Export Cargo Data			
	Great Plains		5-Year	Pacific Southwest		Great Plains		Pacific Southwest	
	2003	2002	Avg.	2003	2002	2002	2001	2002	2001
<b>Wheat Grade Data:</b>									
Test Weight (lb/bu)	61.0	59.9	59.5	62.7	62.4	60.0	60.1	62.8	62.6
(kg/hl)	79.4	78.0	77.5	81.6	81.3	78.1	78.3	81.8	81.6
Damaged Kernels (%)	0.3	2.1	2.4	0.1	0.1	5.6	5.5	0.8	0.8
Foreign Material (%)	0.0	0.0	0.1	0.2	0.1	0.4	0.3	0.1	0.2
Shrunken and Broken (%)	1.3	1.2	1.9	0.4	0.5	1.7	1.9	0.6	0.7
Total Defects (%)	1.6	3.3	4.4	0.7	0.7	7.7	7.8	1.5	1.7
Contrasting Classes (%)	0.2	0.2	0.3	0.0	0.0	0.8	1.1	0.0	0.2
Vitreous Kernels (%)	92.0	85.0	81.6	96.0	95.0	73.1	77.0	95.1	96.1
Grade	1 HAD	2 HAD	2 HAD	1 HAD	1 HAD	3 AD	3 HAD	1 HAD	1 HAD
<b>Wheat Non-Grade Data:</b>									
Dockage (%)	0.7	1.7	1.8	0.3	0.5	0.9	0.7	0.4	0.5
Moisture (%)	10.5	12.0	11.6	6.8	6.5	11.9	11.7	6.6	6.9
Protein (%) 12%/0% moisture basis	14.5/16.4	14.0/16.0	14.1/16.1	13.6/15.5	13.0/14.8	13.7/15.6	13.8/15.7	13.0/14.8	13.4/15.2
Ash (%) 14%/0% moisture basis	1.53/1.78	1.56/1.81	1.67/1.94	1.74/2.02	1.73/2.01	1.68/1.96	1.75/2.04	1.67/1.94	1.65/1.92
1000 Kernel Weight (g)	33.8	36.9	36.8	52.5	47.4	37.4	36.7	48.5	47.8
Kernel Size (%) lg/md/sm	42/50/8	56/39/6	54/39/7	94/6/0	91/9/0	52/40/8	49/42/9	86/12/2	83/14/3
Single Kernel: Hardness	97.4	99.8	89.9						
Weight (mg)	40.5	38.4	37.5						
Diameter (mm)	2.45	2.50	2.54						
Falling Number (sec)	391	292	296			365	309	950	1195
Sedimentation (cc)	51	46	42						
<b>Semolina Data:</b>									
Total Extraction (%)	68.8	69.7	70.4	73.9	76.7	68.8	70.1	71.1	72.0
Semolina Extraction (%)	62.9	63.3	63.6	62.9	62.9	61.8	62.7	64.0	65.1
Ash (%) 14%/0% moisture basis	0.66/0.77	0.67/0.78	0.68/0.80	0.69/0.80	0.77/0.89	0.71/0.82	0.72/0.83	0.67/0.78	0.69/0.80
Specks (no/10 sq in)	12	26	24	8	17	25	27	14	13
Protein (%) 14%/0% moisture basis	13.5/15.6	13.0/15.1	13.1/15.3	11.3/13.1	10.8/12.6	12.7/14.8	12.9/15.0	11.7/13.5	12.3/14.3
Wet Gluten (%)	37.2	36.5	37.6	33.7	32.1				
Mixograph Classification	6.0	6.0	5.6			5.3	5.4	7.1	7.4
Alveograph: P (mm)	38	36	33						
L (mm)	99	96	110						
W (10-4 joules)	92	78	79	178	156				
Color: L*	84.7	84.2	84.5			84.1	84.6	85.0	84.9
a*	-2.8	-2.7	-2.8			-2.4	-2.6	-2.9	-2.5
b*	28.4	25.9	27.5	26.5	26.1	25.2	26.3	26.8	25.8
<b>Spaghetti Processing Data:</b>									
Color Score	9.4	8.7	9.1	9.0	9.0	8.2	8.7	9.6	9.0
Cooked Weight (gm)	30.9	31.4	31.4	30.3	29.6	30.4	30.4	30.9	30.6
Cooking Loss (%)	5.6	5.5	5.8	7.8	7.1	6.1	6.0	6.0	6.2
Cooked Firmness (g cm)	6.0	6.0	6.1	7.1	7.6	5.4	6.1	5.5	5.9
<b>Sample Count:</b>						11	36	17	7

Durum

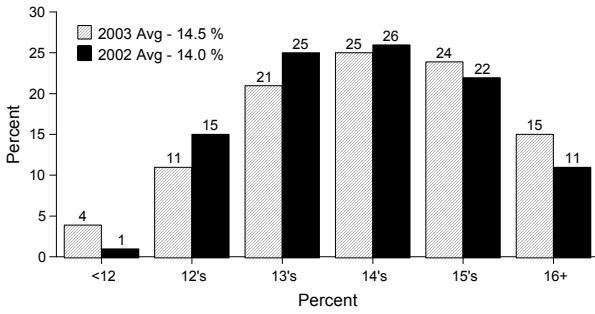
### Test Weight



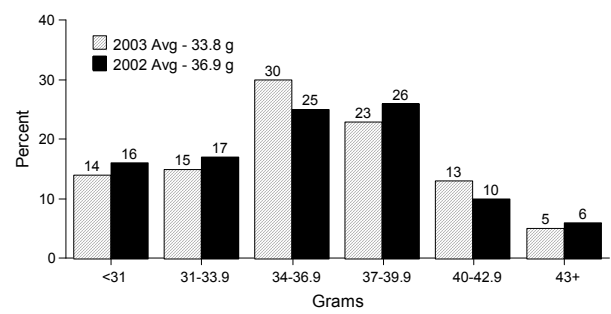
### Hectoliter Weight



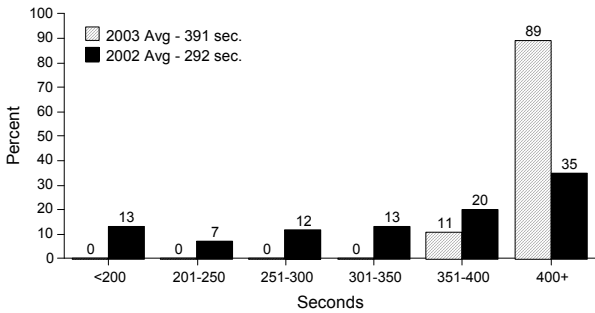
### Protein (12% mb)



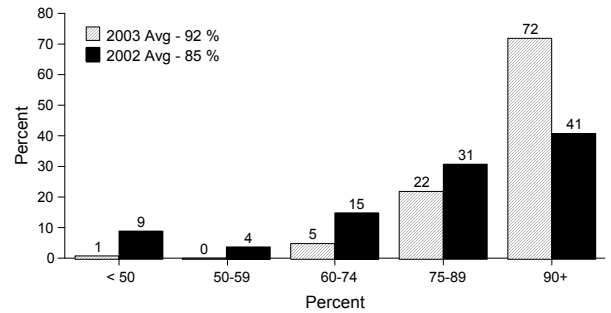
### 1000 Kernel Weight



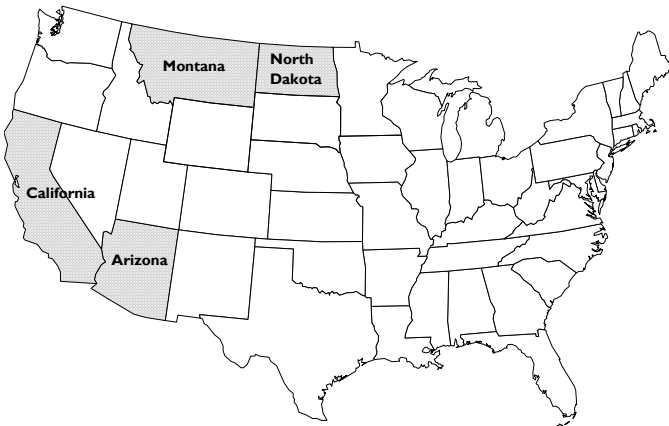
### Falling Number



### Vitreous Kernels



Note: Charts include Great Plains durum only.



Durum survey results are from four states.



## Durum Production by Crop Year

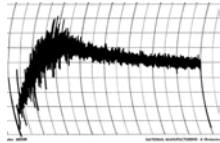
for the major producing states  
(million metric tons)

	2003	2002	2001	2000	1999
Arizona	0.31	0.23	0.22	0.20	0.41
California	0.31	0.24	0.23	0.24	0.43
Montana	0.39	0.35	0.32	0.26	0.33
North Dakota	1.59	1.33	1.49	1.96	2.57
<b>Total U.S.</b>	<b>2.63</b>	<b>2.16</b>	<b>2.27</b>	<b>2.70</b>	<b>3.76</b>

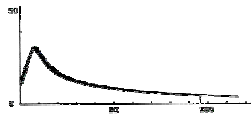
Based on USDA crop estimates of September 30, 2003.

### 2003 Great Plains Durum Mixogram and Alveogram

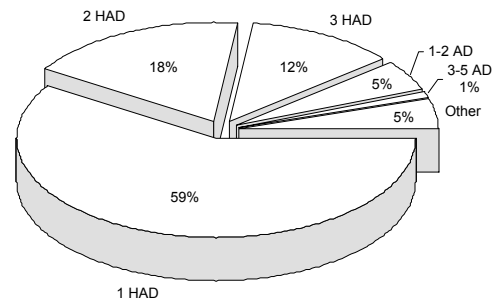
**Regional Average Mixogram:**  
(score = 6)



**Alveogram:**



### Great Plains Durum Grade Distribution



# Hard White Wheat

## Hard White Harvest Survey

Hard white wheat (HW) samples were made into nine composites based on regions (Northern Plains or NP, Southern Plains or SP, and Western) and protein (low, less than 11.5%; medium, 11.5–12.5%; high, 12.6–13.5%; and very high, greater than 13.5%).

**Survey Methods:** Samples were collected by CII Laboratory Services, Kansas City, Missouri, and by grain trading companies. All tests were conducted by the Wheat Marketing Center (WMC) Portland, Oregon. Wheat and flour tests were done according to the American Association of Cereal Chemists Methods (10<sup>th</sup> Edition). Chinese raw and wet noodle and Chinese northern-type and Taiwan-type steamed bread evaluations were conducted according to protocols established by Chinese noodle and steamed bread makers and flour millers at the WMC during U.S. Wheat Associates' Asian Products Collaborative Program.

**Wheat and Grade Data:** All nine samples graded U.S. No. 1 with test weights from 60.1 to 64.0 lb/bu (79.1 to 84.1 kg/hl). In general, NP showed lower wheat ash than SP and Western. Western composites had larger and heavier kernels than SP, and NP showed the smallest and lightest kernels. Falling number values ranged from 345 to 496 seconds, indicating sound kernels.

**Flour, Dough, and Baking Data:** Buhler straight grade flour extractions ranged from 67.1 to 70.3% and flour ash from 0.32 to 0.41%, similar to the regional wheat ash pattern. All but SP low and Western low and medium had amylograph peak viscosities higher than 700 BU. Starch

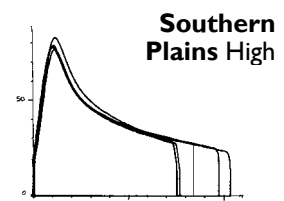
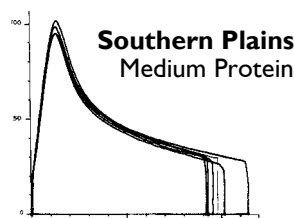
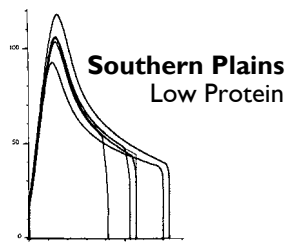
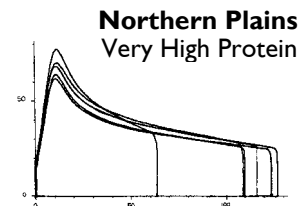
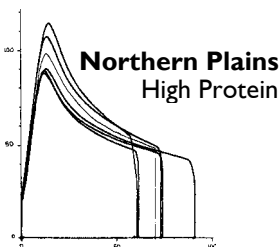
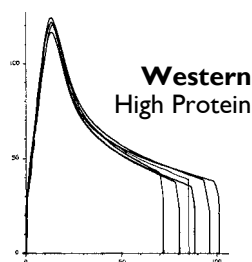
damage and farinograph results showed a wide range of variation among the samples. NP very high and SP high had low alveograph maximum overpressure ("P") values for U.S. hard wheat of similar protein contents, while three Western samples showed higher "P" values than expected. Lower protein content samples from all regions had short extensibility ("L") values for similar hard wheat protein contents. Extensigraph peak resistance at 135 minutes all exceeded 650 BU with extensibility from 8.3 to 14.3 cm. Bake absorptions were in the range of 53.3 to 62.3%, relatively low. NP very high, SP medium, and Western medium and high had loaf volumes and scores comparable to a commercial bread control flour.

**Noodle Evaluation:** Both Chinese raw noodles (white salted) and Chinese wet noodles (yellow alkaline) were made from each of the HW flours. A control flour was included in each noodle type for evaluation comparison. Chinese raw noodle color was acceptable for most samples except SP high, which was slightly dark after 24 hours. The boiled noodle texture was acceptable for samples from NP, but was slightly soft for wheat from other regions. Similar to the Chinese raw noodles, Chinese wet noodle color was acceptable for most samples except SP high, which was dark. The texture of boiled Chinese wet noodles was acceptable for all samples except Western high.

**Chinese Steamed Bread:** Two types of Chinese steamed breads were evaluated: Chinese northern-type and Taiwan-type. A control steamed bread flour was included in each type for comparison. Results indicated that a majority of samples produced steamed breads that were similar to or

(continued on page 29)

## Composite Average Alveograms



# Harvest Data

Hard White	Northern Plains			Southern Plains			Western		
	Low*	High	Very High	Low	Med	High	Low	Med	High
<b>Wheat Grade Data:</b>									
Test Weight (lb/bu)	62.3	60.4	60.1	62.5	61.4	60.8	64.0	63.9	62.4
(kg/hl)	81.9	79.5	79.1	82.2	80.7	80.0	84.1	84.0	82.0
Heat Damage (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Damaged Kernels Total (%)	0.0	0.0	0.0	0.2	0.3	0.2	0.0	0.0	0.0
Foreign Material (%)	0.1	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Shrunken & Broken (%)	1.6	2.3	1.6	0.7	0.3	0.8	0.8	0.4	0.9
Total Defects (%)	1.7	2.7	1.6	0.9	0.6	1.1	0.8	0.4	0.9
Grade	1 HW	1 HW	1 HW	1 HW	1 HW	1 HW	1 HW	1 HW	1 HW
<b>Wheat Non-Grade Data:</b>									
Dockage (%)	0.8	0.9	0.2	0.4	0.7	0.6	0.2	0.1	0.2
Moisture (%)	11.7	12.1	10.3	11.5	11.9	11.3	9.0	8.7	9.3
Protein (%) 12%/0% moisture basis	11.0/12.5	13.2/15.0	13.9/15.8	10.8/12.3	12.0/13.6	13.2/15.0	10.4/11.8	11.9/13.5	12.8/14.5
Ash (%) 14%/0% moisture basis	1.15/1.34	1.25/1.45	1.36/1.58	1.41/1.64	1.58/1.84	1.57/1.83	1.46/1.70	1.42/1.65	1.45/1.69
1000 Kernel Weight (g)	27.9	23.5	25.6	31.7	34.2	29.7	30.9	38.0	38.6
Kernel Size (%) lg/md/sm	55/44/1	41/57/2	34/65/1	63/36/1	81/19/0	55/44/1	66/33/1	83/16/1	86/13/1
Single Kernel: Hardness	76.8	77.2	76.6	62.8	58.6	65.8	74.2	70.0	56.3
Weight (mg)	28.4	26.9	27.5	31.9	36.0	31.3	33.1	39.3	40.4
Diameter (mm)	2.08	1.99	2.09	2.37	2.55	2.31	2.47	2.75	2.70
Sedimentation (cc)	31.5	40.0	34.5	14.0	11.9	17.5	14.3	17.6	22.5
Falling Number (sec)	403	416	496	345	418	412	411	416	353
<b>Flour Data:</b>									
Extraction Rate (%)	70.1	68.9	69.3	69.1	69.9	68.0	68.9	70.3	67.1
Color: L*	91.8	91.6	91.6	92.2	92.1	91.6	92.0	91.8	92.3
a*	-2.6	-2.6	-2.6	-2.4	-2.4	-2.3	-2.5	-2.5	-2.1
b*	8.6	9.3	9.0	7.3	7.1	7.3	8.1	8.0	6.0
Protein (%) 14%/0% moisture basis	9.5/11.0	11.5/13.4	11.4/13.3	9.2/10.7	10.4/12.1	11.4/13.3	8.9/10.3	10.4/12.1	11.4/13.3
Ash (%) 14%/0% moisture basis	0.32/0.37	0.34/0.40	0.34/0.40	0.35/0.41	0.40/0.47	0.39/0.45	0.41/0.48	0.38/0.44	0.36/0.42
Wet Gluten (%)	23.8	29.2	34.6	25.9	28.6	33.1	24.5	30.7	33.5
Falling Number (sec)	435	471	454	366	402	435	458	443	415
Amylograph Viscosity 65 g (BU)	840	930	830	520	870	730	670	600	770
Starch Damage (%)	4.4	4.0	3.7	5.1	4.9	4.3	6.2	6.7	5.1
<b>Dough Properties:</b>									
Farinograph:									
Peak Time (min)	1.7	16.3	6.6	1.1	7.0	6.3	1.6	6.6	7.5
Stability (min)	39.5	35.6	35.0	39.4	42.5	24.2	33.9	22.5	16.0
Absorption (%)	55.2	57.2	57.3	55.8	57.1	57.1	56.9	62.3	62.6
Alveograph: P (mm)	99	106	75	116	107	87	125	>144	133
L (mm)	59	70	115	56	97	84	46	56	85
W (10-4 joules)	230	300	300	245	315	240	215	>300	365
Extensigraph: Resistance (BU)	635/700	730/850	545/980	550/740	480/830	470/710	485/820	495/720	445/675
(45/135 min) Extension (cm)	11.1/8.3	9.7/8.3	13.2/9.3	12.5/9.1	15.7/9.4	18.4/14.3	8.7/6.4	14.9/9.3	19.5/10.8
Area (sq cm)	83/67	80/73	93/96	91/84	98/100	111/132	51/56	80/82	111/94
<b>Baking Evaluation:</b>									
Bake Absorption (%)	62.3	54.6	59.3	53.3	56.6	56.0	55.9	56.7	58.1
Crumb Grain and Texture	6.5	6.0	6.5	5.0	8.0	7.5	5.5	6.5	7.5
Loaf Volume (cc)	675	725	750	675	763	718	675	750	850

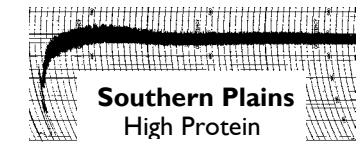
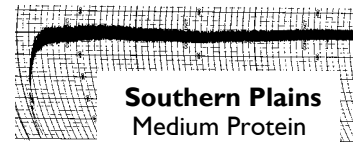
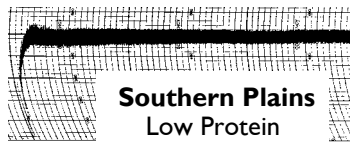
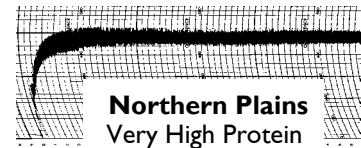
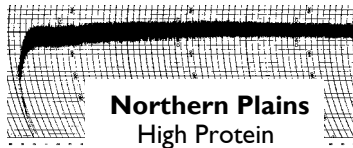
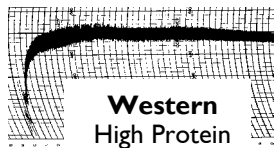
\* Low: Less than 11.5%; Med: 11.5 - 12.5%; High: 12.6 - 13.5%; Very High: greater than 13.5%

# Harvest Data

Hard White	Northern Plains			Southern Plains			Western		
	Low*	High	Very High	Low	Med	High	Low	Med	High
<b>Chinese Raw Noodle-Making Quality:</b>									
Color at 0/24 hour: L*	84.9/75.1	82.1/74.2	81.9/72.6	83.5/74.6	82.8/73.1	80.9/70.4	85.8/76.8	85.1/76.8	84.1/73.2
a*	-1.0/0.0	-0.8/0.2	-0.8/0.1	-0.9/-0.6	-1.0/-0.7	-0.4/0.2	-1.2/-1.2	-1.0/-0.8	-0.4/0.0
b*	18.8/23.9	23.3/27.7	23.3/26.8	19.5/25.0	20.1/25.9	19.1/24.0	18.5/23.3	19.6/25.0	17.2/22.0
Change in L* (0-24 hr)	9.8	8.0	9.3	8.9	9.7	10.5	8.9	8.3	10.8
Cooking Yield (%)	118	117	108	119	119	117	122	117	119
Sensory Color Stability Score	8.0	7.5	6.7	7.3	6.8	6.2	7.3	7.3	6.7
Instrumental Texture:									
Firmness (g)	1074	1217	1279	1065	1035	1067	1054	1006	950
Springiness (%)	95.0	95.7	96.4	96.8	96.3	96.7	96.8	97.3	97.3
Cohesiveness	0.63	0.62	0.62	0.64	0.66	0.67	0.67	0.65	0.66
Chewiness (g)	647	726	765	664	657	688	683	637	613
<b>Chinese Wet Noodle-Making Quality:</b>									
Uncooked Color at 0/24 hour: L*	82.1/75.7	81.5/75.1	79.7/72.5	82.3/73.3	81.1/71.0	78.7/69.3	81.7/70.7	82.2/72.1	80.3/67.7
a*	-2.2/-2.0	-2.0/-1.7	-1.9/-1.6	-2.1/-1.6	-2.1/-1.5	-1.8/-0.9	-2.7/-1.5	-2.2/-1.7	-2.1/-1.5
b*	24.5/28.1	25.6/29.6	26.7/28.2	20.6/24.8	20.5/24.0	21.3/23.5	21.5/23.1	21.0/24.2	19.1/20.3
Change in L* (0-24 hr)	6.4	6.4	7.2	9.0	10.1	9.4	11.0	10.1	12.6
Parboiled Color at 0/24 hour: L*	78.7/80.6	79.1/80.6	77.8/79.4	79.6/80.4	77.4/77.6	76.8/76.7	77.4/78.4	78.1/78.5	76.9/77.1
a*	-3.7/-3.9	-3.8/-4.0	-3.1/-3.7	-4.1/-4.0	-3.7/-3.6	-2.7/-3.0	-3.7/-3.9	-3.4/-3.6	-2.8/-3.1
b*	30.3/29.1	30.5/30.2	29.9/29.4	28.9/27.6	28.2/27.1	27.1/25.8	29.7/28.9	29.3/28.6	25.8/24.7
Cooking Yield (1.5 min, %)	71	67	67	73	70	67	71	66	66
Uncooked Color Stability Score	9.0	8.7	7.8	7.5	6.7	6.0	6.7	7.0	5.7
Parboiled Color Stability Score	9.0	8.5	8.3	8.3	8.5	6.5	8.0	7.5	7.3
Instrumental Texture:									
Firmness (g)	863	904	950	757	717	746	743	762	691
Springiness (%)	96.2	95.4	95.3	97.2	98.3	97.9	96.0	97.4	95.6
Cohesiveness	0.63	0.62	0.63	0.66	0.65	0.65	0.63	0.64	0.66
Chewiness (g)	523	531	566	488	456	477	448	474	436
<b>Chinese Northern-Type Steamed Bread Evaluation:</b>									
Specific Volume (ml/g)	2.21	2.15	2.30	2.01	1.85	2.31	2.32	2.32	2.54
Total Score	69.8	70.5	72.8	66.8	66.5	70.8	69.8	72.3	76.3
<b>Taiwan-Type Steamed Bread Evaluation:</b>									
Specific Volume (ml/g)	2.83	3.08	3.11	2.76	3.04	2.99	2.54	2.56	2.80
Total Score	70.5	69.8	69.8	67.0	70.1	71.3	59.3	62.3	65.8

\* Low: Less than 11.5%; Med: 11.5 - 12.5%; High: 12.6 - 13.5%; Very High: greater than 13.5%

## Composite Average Farinograms



## U.S. Production by Class

Crop Year (Beginning June 1)  
(million metric tons)

	2003	2002	2001	2000	1999
Hard Red Winter	28.93	16.66	20.87	23.03	28.60
Soft Red Winter	10.32	9.04	10.88	12.83	12.36
Hard Red Spring	13.61	9.63	12.94	13.67	12.19
Soft White	6.99	6.42	6.31	8.25	6.72
Hard White	0.27	0.33	0.26	n/a	n/a
Durum	2.63	2.16	2.27	2.70	3.76
<b>Total</b>	<b>63.59</b>	<b>44.06</b>	<b>53.26</b>	<b>62.57</b>	<b>69.33</b>

*Estimates are based on USDA crop estimates of September 30, 2003. The soft white and hard white estimates are made by US Wheat Associates; hard white includes some production which USDA has included in red wheats.*

## U.S. Supply and Demand

Estimated for 2003/2004 (year beginning June 1)  
(million metric tons)

	HRW	HRS	SRW	White	Durum	TOTAL
Supply:						
Beginning Stocks	5.1	3.9	1.5	2.0	0.8	13.4
Production	28.9	13.6	10.3	8.1	2.6	63.6
<b>Total Supply</b>	<b>34.4</b>	<b>18.1</b>	<b>11.8</b>	<b>10.5</b>	<b>4.2</b>	<b>79.0</b>
Demand:						
Domestic Use	13.2	6.9	7.6	3.2	2.3	33.2
Exports	12.5	6.9	3.0	5.0	1.1	28.6
<b>Total Demand</b>	<b>25.7</b>	<b>13.8</b>	<b>10.6</b>	<b>8.2</b>	<b>3.4</b>	<b>61.8</b>
<b>Ending Stocks</b>	<b>8.7</b>	<b>4.3</b>	<b>1.2</b>	<b>2.3</b>	<b>0.8</b>	<b>17.2</b>

*Based on USDA Supply/Demand estimates of October 11, 2003.*

(continued from p. 26)

better than the control flours for both. However, SP medium produced northern-type of poor quality, and samples from the Western region produced Taiwan-type of poor quality. The major problem was shrinkage, which was corrected by blending with some SW flour in a separate test.

**Summary:** This year for the first time U.S. HW production exceeded 1 MMT. The quality of this year's larger crop may be more representative of what can be expected from U.S. HW than previous smaller crops. As might be expected wheat grown in various regions showed

quality differences in milling, dough rheology, and end-product performance in baking, Chinese noodles and steamed breads. Baking quality was acceptable for wheat of more than 11.5% protein. Most samples produced noodles of good color and texture, although wheat of more than 13% protein often gave a slightly dark noodle color and reduced color stability. HW showed good potential for making Chinese steamed breads, but excessively strong gluten in some samples caused shrinkage problems. Blending some SW with HW is recommended to improve steamed bread appearance.

## Analysis Methods

With the exception of the Mennel soft red winter survey, both the harvest samples and cargo samples for each class were evaluated in the same methods as described below. All flour, semolina and end-use tests utilize flour or semolina produced as documented below under the methods labeled "Extraction." The Mennel data were volunteered by individual participating mills which may have used other methods.

### Wheat and Grade Data

**Grade:** Official U.S. Standards for Grain.

**Dockage:** Official USDA procedure using the Carter Dockage Tester.

**Moisture:** HRS, Durum, SW, HW - Motomco Moisture Meter and AACC 44-15A. HRW, SRW - AACC 44-15A.

**Test Weight:** AACC 55-10; test weight is mathematically converted to hectoliter weight: for durum - kg/hl = lb/bu x 1.292 + 0.630, for other wheats - kg/hl = lb/bu x 1.292 + 1.419.

**Protein:** AACC 46-30 (Combustion Nitrogen Analysis technique).

**Single Kernel Characterization:** Perten method using Perten SKCS 4100.

**Sedimentation:** HRS, HRW (Plains), SRW, SW, HW - AACC 56-61A; Durum - AACC 56-70.

**1000 Kernel Weight:** HRS, Durum, HRW, SRW - based on a 10-gram sample of clean wheat counted by an electronic counter. SW, HW - based on three 100-kernel sample weight.

**Ash:** AACC 08-01 expressed on a 14% moisture basis.

**Falling Number:** AACC 56-81B. An average value is a simple mean of sample results.

**Vitreous Kernels:** HRS & durum only - Percentage by weight of vitreous kernels hand-picked from a 50-gram sample of clean wheat.

**Kernel Size Distribution:** *Cereal Foods World (Cereal Science Today)* 5:(3), 71 (1960). Wheat is sifted with a RoTap sifter using a Tyler No. 7 screen (2.82 mm) and a Tyler No. 9 screen (2.00 mm). Kernels retained on the No. 7 screen are classified as "Large." Kernels passing through the No. 7 screen and retained on the No. 9 screen are "Medium." Kernels passing through the No. 9 screen are "Small."

### Flour Data

**Extraction:** Samples were cleaned and tempered according to AACC Method 26-10A. All samples within each class other than California HRW were milled with identical mill settings on a Buhler laboratory mill as described in the following procedures: SW - AACC 26-31; HW - AACC 26-31A; HRW (Midwestern), SRW, and HRS - AACC 26-21A. California HRW was milled on a Brabender Quadrumat Senior mill using the Brabender procedure. All extraction rates were calculated against total products on an "as is" moisture basis.

**Ash:** AACC 08-01, reported on a 14% moisture basis.

**Color:** HRW and SRW - Minolta Method using Minolta Chroma Meter CR-110 (for HRW and SRW) or CR-310 (for HRS, SW, and HW) with Granular-Materials

Attachment CR-A50. CIE 1976 L\*a\*b\* color system: L\* indicates white-black, a\* - red-green, and b\* - yellow-blue.

**Protein:** AACC 46-30 (Combustion Nitrogen Analysis technique).

**Wet Gluten:** HRS, SRW, HW, HRW (Plains) - AACC 38-12; SW - AACC 38-12 (water reduced from 4.8 to 4.2ml); HRW (CA) - Glutomatic Method (ICC 137).

**Falling Number:** AACC 56-81B. An average value is a simple mean of sample results.

**MacMichael Test:** AACC Method 56-79 without conversion to cps.

**Farinograph:** AACC 54-21 with 50-gram bowl. Absorption except HRW (CA) is reported on 14% moisture basis. HRW (CA) reports "as is" absorption. Classification (HRS only) incorporates peak time, mixing tolerance, and general curve characteristics to assign rating based on a scale of 1-8. Higher numbers indicate stronger protein flours.

**Alveograph:** Durum - AACC 54-30A modified. Other classes - AACC 54-30A.

**Amylograph:** HRS (100g) - AACC 22-10. HRS (65g), SRW, SW, HRW, HW - AACC 22-10 modified to use 65g flour (14% moisture basis) and 450ml distilled water with paddle (HRS) or pins (other classes).

**Extensigraph:** AACC 54-10, modified 45 min. and 135 min. stretch, HRS, HRW, HW.

**Starch Damage:** AACC Method 76-31.

**Solvent Retention Capacity (SRC):** AACC Method 56-11.

### Semolina Data (Durum only)

**Extraction:** Great Plains samples were milled using a modified Buhler laboratory mill with identical settings and equipped with Miag laboratory purifiers, as described by Vasiljevic and Banasik 1980: *Quality Testing Methods for Durum Wheat and its Products*, pp. 64-72, Dept. of Cereal Chemistry and Technology, NDSU, Fargo, ND. Roll gaps have been modified to (in mm): B1-0.762; B2-0.305; B3-0.254; R1-0.102; B4-0.076; B5-0.038. Extraction rates were calculated against total products on an "as is" moisture basis. Procedure is derived from AACC 26-41 based on research showing improved correlation between laboratory and commercially milled semolina quality. Pacific Southwest samples were milled on a Modified Chopin CD2 mill.

**Ash:** AACC 08-01 on 14.0% moisture basis.

**Color:** Minolta Method using Minolta Chroma Meter CR-310

**Protein:** AACC 46-30 (Combustion Nitrogen Analysis technique).

**Wet Gluten:** AACC 38-12 Glutomatic procedure.

**Specks:** Sample is pressed under 3x4 inch glass plate, and number of specks within one-inch square marked on plate are counted. Average of three determinations is expressed as specks per 10 square inches.

**Mixogram:** Ten grams of semolina are mixed in a 10-gram mixograph bowl with 5.8 ml of distilled water to give maximum dough consistency. An overall empirical classification incorporating peak height and general curve characteristics is assigned based on comparison with eight reference mixograms. The higher the number, the stronger the curve type.

## Baking, Noodle, Steamed Bread and Spaghetti Data

**HRW & SRW:** AACC Method 10-10B producing two loaves per batch using wet compressed yeast and ascorbic acid. After mixing, dough is divided into two equal portions, fermented for 160 min., proofed and baked in “pup loaf” pans. Loaf volume is measured immediately after baking by rapeseed displacement. California HRW only - AACC Method 10-10B producing two loaves per batch using wet compressed yeast, malt flour, 45 ppm ascorbic acid, and 120 min. fermentation. Loaf volume measured immediately after baking. SRW cookie spread ratio - AACC Method 10-50D.

**HRS:** AACC Method 10-09, modified: fungal amylase (15 SKB units/100 g flour) replacing malt dry powder; instant dry yeast (1%); 10 ppm bromate, where added oxidants are required; 2% added shortening. Doughs are mechanically punched, moulded, and baked in “Shogren-type” pans. Scoring based on a scale of 1-10. Higher numbers indicate preferred quality attributes.

**SW:** Cookie diameter - AACC Method 10-52. Sponge cake volume and score - Japanese standard method described by Nagao in *Cereal Chemistry* 53:977-988, 1976.

**Durum:** Pasta is made using the laboratory procedure described by Walsh, Ebeling, and Dick, *Cereal Foods World*: 16:(11) 385 (1971). Water (32.0% based on semolina weight) is added to semolina and mixed in a Hobart mixing bowl 3.5 min. Semolina-water mixture is extruded using a DeMaco laboratory pasta extruder. Spaghetti is dried using modified Buhler high-temperature drying cycle as described by Debbouz, Pitz, Moore, and D'Appolonia, *Cereal Chemistry*: 72 (1):128-131. Color scores are determined by the procedure described by Walsh, *Macaroni Journal* 52:(4) 20 (1970), using a Minolta Color Difference Meter (Model: CR 310). Higher values (scale 1-12) are preferred. Cooked weight, cooking loss and firmness are determined by AACC Method 16-50.

**HW Baking:** AACC Method 10-10B. 180 min fermentation time is used. Loaf volume is measured by rapeseed displacement immediately after baking.

**HW Noodle:** Two types of Chinese noodles were prepared from each of the HW flours: Chinese raw noodles and Chinese wet noodles. The Chinese raw noodle formula was: flour, 1000 g; salt, 12 g; and distilled water, 280 g. The Chinese wet noodle formula was: flour, 1000 g; salt, 20 g; K<sub>2</sub>CO<sub>3</sub>, 4.5 g; Na<sub>2</sub>CO<sub>3</sub>, 4.5 g; and water, 320 g. Noodle sheet color is measured by stacking three dough sheets and taking two readings from each side of two dough sheets (a

total of eight readings) using a Minolta CR-310 Chroma Meter; the mean value is reported. For Chinese wet noodles, noodle sheet color was measured on both uncooked and parboiled (boiling for 1.5 min) sheets. Cooking Yield is % of weight gain after cooking for 5 min for Chinese raw noodles and for 1.5 min for Chinese wet noodles, rinsing in 27°C water and draining. Sensory Noodle Color Stability Score is a total score of noodle color rated at 2 hr and 24 hr against a control sample (an assigned score of 7) and is reported based on a scale of 1-10; higher scores indicate better color stability. The Instrumental Texture is determined on five strands of cooked noodles (2.5 x 1.2 mm, W x T) using a TA.XT2 Texture Analyzer. *Firmness* indicates noodle bite; *springiness* indicates the degree of recovery after first bite; *cohesiveness* is a measure of the extent to which noodle structure is disrupted during first bite; and *chewiness* is a product of firmness, cohesiveness and springiness (firmness x cohesiveness x springiness) and thus is a single parameter that incorporates the three textural parameters. Higher values of these textural parameters are generally more desirable for Chinese-style noodles.

**Chinese Steamed Bread:** Three types of Chinese steamed breads were prepared: Chinese southern-type from each of the SW and club wheat flours, and Chinese northern-type and Taiwan-type from each of the HW flours. The Chinese southern-type formula was: flour 500g, sugar 75g, shortening 20g, baking powder 6g, yeast 4g, water 195-215g, and nonfat dry milk powder 15g. The Chinese northern-type formula was: flour 400g, yeast 4g, and water 180-208g. The Taiwan-type formula was: flour 400g, yeast 4g, sugar 16g, shortening 16g, and water 170-180g. Yeast was dissolved in water before use. All steamed breads were prepared using straight dough methods (WMC protocol). The Total Score is the sum of process score (15% of the total) and product score (85%). Process score includes mixing, sheeting, rolling, cutting and fermentation scores. Product score comprises volume, external characteristics, internal characteristics, eating quality and flavor. Each property was rated compared with a control sample. The control flour was scored 70. The Specific Volume is the volume per unit weight product (volume divided by weight).

## Wheat Grades and Grade Requirements Table

Grading Factors	Grades U.S. Nos.				
	1	2	3	4	5
<b>Minimum limits:</b>					
<b>Test Weight (lbs/bu)</b>					
Hard Red Spring 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
<b>Test Weight (kg/hl)</b>					
Hard Red Spring 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
<b>Maximum percent limits:</b>					
<b>Defects</b>					
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
<b>Wheat of Other Classes 2/</b>					
Contrasting classes	1.0	2.0	3.0	10.0	10.0
Total 3/	3.0	5.0	10.0	10.0	10.0
<b>Stones</b>	0.1	0.1	0.1	0.1	0.1
<b>Maximum count limits:</b>					
<b>Other material (1000 gram sample)</b>					
Animal filth	1	1	1	1	1
Castor beans	1	1	1	1	1
Crotalaria seeds	2	2	2	2	2
Glass	0	0	0	0	0
Stones	3	3	3	3	3
Unknown foreign substance	3	3	3	3	3
Total 4/	4	4	4	4	4
<b>Insect-damaged kernels in 100 grams</b>	31	31	31	31	31
<b>U.S. Sample grade:</b>					
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); or					
(c) Is heating or of distinctly low quality.					
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.					
<b>Conversion Factors</b>					
<b>Wheat Equivalents:</b>			<b>Metric Equivalents:</b>		
1 bushel =	60 pounds (27.2 kg)	1 pound =	0.4536 kg		
36.74 bushels =	1 metric ton	1 metric ton (MT) =	2204.6 lbs		
37.33 bushels =	1 long ton	1 short ton (2000 lbs) =	0.9072 MT, or 907.2 kg		
33.33 bushels =	1 short ton	1 long ton (2240 lbs) =	1.0160 MT, or 1016.0 kg		
3.67 bushels =	1 quintal	1 metric ton =	10 quintals		
tons/ha =	0.06725 bu/acre	1 hectare =	2.47 acres		
durum kg/hl =	lbs/bu x 1.292 + 0.630	1 acre =	0.40 hectare		
other wheat kg/hl =	lbs/bu x 1.292 + 1.419	1 hundredweight =	100 pounds or 45.36 kg		