Quality of Western Canadian Wheat Exports

Cargo Shipments • August 1, 1997, to January 31, 1998

Introduction

This bulletin reports quality data for cargoes of all classes of western Canadian wheat exported by ship from August 1, 1997, to January 31, 1998. Three types of information are presented:

- Distribution tables for moisture content, test weight and other grade determining factors assessed during grading of individual cargoes by Industry Services, Canadian Grain Commission, at time of vessel loading.
- Quality data (wheat and flour characteristics, milling, end-use quality) for weighted composite samples that represent all cargoes of a given grade (and protein segregate where appropriate) exported during the six-month period. For Canada Western Red Spring wheat, composites representing Atlantic and Pacific shipments are prepared and tested. For the other wheat classes, only one series of composites represents all cargoes (Atlantic and Pacific) exported from Canada during the period.
- Pilot milling and baking data for No. 1 Canada Western Red Spring wheat—13.5% protein content segregate. Composites for each quarter are tested. Each of the two composites is a weighted representation of all cargoes (Atlantic and Pacific) exported during that quarter of the crop year.

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K.H. Tipples, Director

Grain Research Laboratory
Canadian Grain Commission
1404-303 Main Street
Winnipeg MB R3C 3G8

Canada Western Red Spring wheat

Canada Western Red Spring (CWRS) wheat is well known for its excellent milling and baking quality. Three milling grades are available, the top two of which are further segregated according to protein content. Guaranteed minimum protein content is reported on a 13.5% moisture basis.

Higher protein CWRS wheat is highly suitable for blending and for the production of high volume pan breads. It is also commonly used alone or in blends with softer wheats for the production of hearth breads, steamed breads, noodles, flat breads and common wheat pasta.

To qualify for the milling grades in this class, wheat must be a registered variety—a variety equal in quality to the statutory standard, Neepawa. Varietal standards and registration ensure that a high degree of uniformity in quality is maintained in export shipments.

Table 1 • Moisture content, test weight and other grade determining factors*
Atlantic export cargoes of Canada Western Red Spring wheat
First and second quarters 1997–98

	No. 1 CWRS						
	Guaranteed minimum protein content						
	14.5	14.0	13.5	13.0	12.5	12.0	11.5
Number of cargoes	27	6	24	5	12	7	6
Thousands of tonnes	205	57	241	102	192	157	64
Moisture content, %							
Weighted mean	13.5	13.7	13.7	13.6	13.8	13.9	13.2
Standard deviation	0.35	0.31	0.42	0.26	0.43	0.20	0.54
Minimum	12.8	13.3	12.8	13.3	12.9	13.5	12.5
Maximum	14.2	14.1	14.2	13.9	14.2	14.1	14.0
Test weight, kg/hl							
Weighted mean	80.9	81.7	81.4	82.3	82.5	83.0	83.0
Standard deviation	0.88	0.56	0.74	0.31	0.50	0.16	0.42
Minimum	79.5	80.5	80.2	81.8	81.3	82.8	82.4
Maximum	82.2	82.0	82.4	82.6	82.9	83.2	83.5
Wheats of other classes, %							
Weighted mean	0.23	0.24	0.31	0.34	0.45	0.32	0.36
Cereal grains other than wheat, %							
Weighted mean	0.14	0.20	0.18	0.18	0.16	0.15	0.13

	No. 2 CWRS							No. 3 CWRS
	Guaranteed minimum protein content							
	15.0	14.5	14.0	13.5	13.0	12.0	11.5	
Number of cargoes	3	2	7	7	3	2	3	29
Thousands of tonnes	15	38	138	86	64	47	20	566
Moisture content, %								
Weighted mean	13.6	13.8	13.7	13.9	14.1	14.1	14.0	14.2
Standard deviation	0.06	0.14	0.32	0.24	0.46	0.07	0.25	0.22
Minimum	13.5	13.6	13.3	13.6	13.6	14.1	13.8	13.5
Maximum	13.6	13.8	14.2	14.2	14.5	14.2	14.3	14.5
Test weight, kg/hl								
Weighted mean	78.3	80.2	80.7	81.1	81.1	82.1	82.0	79.7
Standard deviation	0.25	0.21	0.68	0.93	0.72	0.28	0.75	0.34
Minimum	77.9	79.9	79.3	79.0	80.1	81.9	81.1	78.5
Maximum	78.4	80.2	81.3	81.9	81.4	82.3	82.6	80.7
Wheats of other classes, %								
Weighted mean	0.59	0.31	0.46	0.47	0.41	0.40	0.65	1.14
Cereal grains other than wheat, %								
Weighted mean	0.30	0.33	0.33	0.31	0.25	0.18	0.25	0.53

* Canadian Grain Commission Industry Services data for official loading samples tested at time of loading

Table 2 • No. 1 Canada Western Red Spring wheat
Atlantic export cargo composites
First and second quarters 1997–98

	No. 1 CWRS						
	Guaranteed minimum protein content						
Quality parameter*	14.5	14.0	13.5	13.0	12.5	12.0	11.5
Wheat							
Weight per 1000 kernels, g	31.5	31.7	31.3	32.0	32.1	32.2	31.8
Protein content, %	14.9	14.2	13.9	13.1	12.7	12.2	11.9
Protein content, % (dry matter basis)	17.2	16.4	16.1	15.1	14.7	14.1	13.8
Ash content, %	1.63	1.63	1.60	1.56	1.51	1.53	1.52
α-amylase activity, units/g	9.5	7.5	10.0	10.0	9.0	11.0	7.5
Falling number, s	395	400	380	395	390	375	400
PSI	55	54	54	53	52	52	51
Milling							
Flour yield							
Clean wheat basis, %	76.2	76.0	76.2	75.6	76.4	76.7	76.1
0.50% ash basis, %	75.2	74.5	75.2	74.6	75.4	74.7	75.6
Flour							
Protein content, %	14.2	13.7	13.2	12.7	12.0	11.6	11.2
Wet gluten content, %	39.2	37.2	35.7	33.3	31.4	30.4	29.4
Ash content, %	0.52	0.53	0.52	0.52	0.52	0.54	0.51
Grade colour	0.8	-1.0	-1.2	-1.5	-1.5	-1.5	-1.9
AGTRON colour, %	66	68	69	69	69	69	73
Starch damage, %	6.3	6.4	6.8	6.9	7.4	7.9	7.6
α-amylase activity, units/g	2.0	2.0	2.5	2.0	2.5	2.0	2.0
Amylograph peak viscosity, BU	615	600	575	580	535	545	560
Maltose value, g/100 g	2.1	2.1	2.2	2.3	2.5	2.6	2.5
Zeleny sedimentation, ml	70	70	69	67	64	63	61
Farinogram							
Absorption, %	65.7	65.4	65.4	65.7	65.3	65.8	64.7
Development time, min	5.75	5.75	5.5	4.75	4.5	4.5	4.25
Mixing tolerance index, BU	30	25	20	20	25	20	25
Stability, min	10.5	10.5	10.5	9.5	9.5	9.5	8.5
Extensogram							
Length, cm	22	21	22	20	19	18	19
Height at 5 cm, BU	285	300	305	295	320	320	320
Maximum height, BU	490	500	515	490	515	515	515
Area, cm^2	145	145	155	135	135	125	130
Alveogram							
Length, mm	140	130	123	110	89	75	70
P (height x 1.1), mm	90	94	102	106	123	128	128
W, x 10^{-4} joules	406	407	409	403	392	353	334
Baking (Canadian Short Process Baking Test)							
Absorption, %	70	69	69	70	69	70	69
Mixing energy, W–h/kg	13.6	13.6	12.2	10.2	11.1	11.3	9.4
Mixing time, min	9.3	9.4	8.9	8.4	10.0	10.5	9.4
Loaf volume, cm^3/100 g flour	1135	1110	1080	1060	1010	1015	1030

* Unless otherwise specified, data are reported on a 13.5% moisture basis for wheat and a 14.0% moisture basis for flour.

Table 3 • No. 2 Canada Western Red Spring wheat
Atlantic export cargo composites
First and second quarters 1997–98

	No. 2 CWRS						
	Guaranteed minimum protein content						
Quality parameter*	15.0	14.5	14.0	13.5	13.0	12.0	11.5
Wheat							
Weight per 1000 kernels, g	28.8	30.0	31.1	31.6	32.4	32.4	32.5
Protein content, %	15.3	14.8	14.5	13.7	13.4	12.5	12.3
Protein content, % (dry matter basis)	17.7	17.1	16.8	15.8	15.5	14.5	14.2
Ash content, %	1.82	1.75	1.72	1.63	1.63	1.55	1.53
α-amylase activity, units/g	8.0	10.5	9.0	8.5	9.0	11.0	27.0
Falling number, s	400	390	370	360	395	350	330
PSI	55	54	54	54	54	52	53
Milling							
Flour yield							
Clean wheat basis, %	75.7	75.8	76.0	76.1	76.2	76.6	76.1
0.50% ash basis, %	73.7	73.8	74.5	74.6	75.2	75.6	76.1
Flour							
Protein content, %	14.6	14.1	13.8	13.1	12.6	11.7	11.4
Wet gluten content, %	39.8	37.7	37.2	35.2	33.2	29.8	29.1
Ash content, %	0.54	0.54	0.53	0.53	0.52	0.52	0.50
Grade colour	0.3	0.5	-0.3	-0.6	-0.9	-1.5	-1.8
AGTRON colour, %	57	58	60	64	66	69	70
Starch damage, %	6.4	6.6	6.7	6.8	7.0	7.3	7.1
α-amylase activity, units/g	2.5	4.5	3.5	3.0	4.0	5.5	4.5
Amylograph peak viscosity, BU	675	530	535	535	410	360	380
Maltose value, g/100 g	2.2	2.3	2.3	2.3	2.5	2.7	2.5
Zeleny sedimentation, ml	68	68	68	66	66	63	62
Farinogram							
Absorption, %	65.8	65.7	65.6	65.3	65.3	64.6	64.2
Development time, min	5.5	6.0	5.75	5.75	5.25	4.25	4.25
Mixing tolerance index, BU	40	35	35	20	30	25	30
Stability, min	7.5	7.5	7.5	9.0	9.0	9.0	8.5
Extensogram							
Length, cm	24	23	22	22	21	19	20
Height at 5 cm, BU	225	235	240	290	280	350	330
Maximum height, BU	380	385	425	475	460	530	525
Area, cm^2	125	125	130	140	135	140	140
Alveogram							
Length, mm	160	140	123	126	104	89	79
P (height x 1.1), mm	79	86	92	96	103	117	117
W, x 10^{-4} joules	379	390	373	386	360	383	342
Baking (Canadian Short Process Baking Test)							
Absorption, %	70	70	70	69	69	69	68
Mixing energy, W–h/kg	14.3	12.2	11.7	11.7	11.1	11.4	12.5
Mixing time, min	9.9	9.2	8.5	8.4	8.3	10.4	10.5
Loaf volume, cm^3/100 g flour	1095	1070	1070	1035	1060	1030	1040

* Unless otherwise specified, data are reported on a 13.5% moisture basis for wheat and a 14.0% moisture basis for flour.

Table 4 • No. 3 Canada Western Red Spring wheat
Atlantic export cargo composite
First and second quarters 1997–98

Quality parameter*	No. 3 CWRS Not segregated by protein content
Wheat	
Weight per 1000 kernels, g	32.6
Protein content, %	12.4
Protein content, % (dry matter basis)	14.3
Ash content, %	1.55
α-amylase activity, units/g	65.0
Falling number, s	245
PSI	54
Milling	
Flour yield	
Clean wheat basis, %	75.3
0.50% ash basis, %	75.3
Flour	
Protein content, %	11.4
Wet gluten content, %	28.4
Ash content, %	0.50
Grade colour	-1.2
AGTRON colour, %	68
Starch damage, %	6.8
α-amylase activity, units/g	24.0
Amylograph peak viscosity, BU	100
Maltose value, g/100 g	3.1
Zeleny sedimentation, ml	63
Farinogram	
Absorption, %	63.4
Development time, min	2.75
Mixing tolerance index, BU	30
Stability, min	6.5
Extensogram	
Length, cm	20
Height at 5 cm, BU	315
Maximum height, BU	490
Area, cm^2	135
Alveogram	
Length, mm	78
P (height x 1.1), mm	110
W, x 10^{-4} joules	320
Baking (Canadian Short Process Baking Test)	
Absorption, %	67
Mixing energy, W–h/kg	10.7
Mixing time, min	9.1
Loaf volume, cm^3/100 g flour	1010

* Unless otherwise specified, data are reported on a 13.5% moisture basis for wheat and a 14.0% moisture basis for flour.

Table 5 • Moisture content, test weight and other grade determining factors*
Pacific export cargoes of Canada Western Red Spring wheat
First and second quarters 1997–98

	No. 1 CWRS					
	Guaranteed minimum protein content					
	14.5	14.0	13.5	13.0	12.5	12.0
Number of cargoes	1	6	8	42	26	4
Thousands of tonnes	8	42	146	687	501	64
Moisture content, %						
Weighted mean	12.9	12.4	13.2	12.9	13.2	13.1
Standard deviation	0.00	0.45	0.56	0.43	0.38	0.45
Minimum	12.9	12.0	12.5	12.1	12.4	12.4
Maximum	12.9	13.2	14.1	13.8	14.0	13.4
Test weight, kg/hl						
Weighted mean	79.5	80.8	81.7	81.6	82.0	82.4
Standard deviation	0.00	0.76	0.46	0.52	0.50	0.26
Minimum	79.5	80.3	81.2	80.6	81.1	82.1
Maximum	79.5	82.3	82.5	82.7	82.8	82.7
Wheats of other classes, %						
Weighted mean	0.24	0.67	0.23	0.29	0.28	0.28
Cereal grains other than wheat, %						
Weighted mean	0.17	0.17	0.19	0.18	0.20	0.17

	No. 2 CWRS							No. 3 CWRS
	Guaranteed minimum protein content							
	14.5	14.0	13.5	13.0	12.5	12.0	11.5	
Number of cargoes	5	12	27	14	26	10	5	19
Thousands of tonnes	43	226	293	287	559	133	59	475
Moisture content, %								
Weighted mean	13.2	13.4	13.5	13.4	13.5	13.5	13.5	13.8
Standard deviation	0.34	0.38	0.38	0.32	0.39	0.59	0.46	0.23
Minimum	12.7	12.9	12.8	13.0	12.6	12.6	13.1	13.4
Maximum	13.5	14.0	14.3	14.2	14.2	14.3	14.2	14.3
Test weight, kg/hl								
Weighted mean	80.0	80.2	80.8	80.9	81.5	81.6	81.6	79.5
Standard deviation	0.26	0.57	0.54	0.47	0.46	0.35	0.49	0.61
Minimum	79.6	79.3	79.5	80.1	80.5	81.2	81.2	78.5
Maximum	80.2	81.0	82.0	81.7	82.1	82.3	82.3	81.1
Wheats of other classes, %								
Weighted mean	0.38	0.46	0.49	0.36	0.43	0.34	0.24	0.91
Cereal grains other than wheat, %								
Weighted mean	0.22	0.29	0.31	0.28	0.31	0.26	0.30	0.55

* Canadian Grain Commission Industry Services data for official loading samples tested at time of loading

Table 6 • No. 1 Canada Western Red Spring wheat
Pacific export cargo composites
First and second quarters 1997–98

	No. 1 CWRS					
	Guaranteed minimum protein content					
Quality parameter*	14.5	14.0	13.5	13.0	12.5	12.0
Wheat						
Weight per 1000 kernels, g	29.0	29.9	31.4	32.1	32.0	32.8
Protein content, %	14.8	14.2	13.6	13.2	12.6	12.1
Protein content, % (dry matter basis)	17.1	16.4	15.7	15.3	14.6	14.0
Ash content, %	1.62	1.54	1.52	1.52	1.53	1.52
α-amylase activity, units/g	6.0	5.5	7.5	7.5	9.0	9.5
Falling number, s	390	400	380	395	380	380
PSI	56	55	54	54	52	51
Milling						
Flour yield						
Clean wheat basis, %	75.3	74.9	75.9	75.5	75.7	75.8
0.50% ash basis, %	77.3	75.9	75.9	77.0	76.2	75.8
Flour						
Protein content, %	14.0	13.7	13.0	12.8	12.0	11.5
Wet gluten content, %	37.9	36.8	34.4	33.3	31.2	29.5
Ash content, %	0.46	0.48	0.50	0.47	0.49	0.50
Grade colour	-1.2	-1.2	-1.2	-1.6	-1.5	-1.7
AGTRON colour, %	69	69	68	71	69	71
Starch damage, %	5.6	5.9	6.6	6.8	7.1	7.1
α-amylase activity, units/g	2.5	2.0	3.5	3.0	3.0	2.5
Amylograph peak viscosity, BU	660	640	530	570	560	550
Maltose value, g/100 g	1.9	2.0	2.2	2.3	2.4	2.6
Zeleny sedimentation, ml	71	71	69	69	67	62
Farinogram						
Absorption, %	65.2	65.0	65.1	65.2	65.0	65.2
Development time, min	6.0	5.75	5.0	5.25	4.50	4.25
Mixing tolerance index, BU	25	25	25	25	25	30
Stability, min	9.5	10.0	9.0	10.5	9.0	8.5
Extensogram						
Length, cm	22	21	21	19	20	20
Height at 5 cm, BU	295	330	305	295	300	300
Maximum height, BU	535	545	505	490	490	500
Area, cm^2	160	160	145	125	145	135
Alveogram						
Length, mm	132	131	107	95	98	80
P (height x 1.1), mm	85	92	99	105	107	116
W, x 10^{-4} joules	370	405	362	353	368	345
Baking (Canadian Short Process Baking Test)						
Absorption, %	70	69	69	69	69	69
Mixing energy, W–h/kg	14.1	11.7	11.5	11.5	11.3	11.0
Mixing time, min	10.2	8.7	8.8	8.8	9.0	8.8
Loaf volume, cm^3/100 g flour	1125	1110	1050	1050	1025	1050

* Unless otherwise specified, data are reported on a 13.5% moisture basis for wheat and a 14.0% moisture basis for flour.

Table 7 • No. 2 Canada Western Red Spring wheat
Pacific export cargo composites
First and second quarters 1997–98

	No. 2 CWRS						
	Guaranteed minimum protein content						
Quality parameter*	14.5	14.0	13.5	13.0	12.5	12.0	11.5
Wheat							
Weight per 1000 kernels, g	30.6	31.0	32.4	32.0	32.8	32.9	32.3
Protein content, %	14.8	14.2	13.6	13.1	12.6	12.2	12.2
Protein content, % (dry matter basis)	17.1	16.4	15.7	15.1	14.6	14.1	14.1
Ash content, %	1.62	1.66	1.60	1.57	1.52	1.56	1.52
α-amylase activity, units/g	12.0	10.5	12.0	11.5	12.5	11.0	9.0
Falling number, s	375	380	375	370	375	365	375
PSI	56	56	55	54	54	52	53
Milling							
Flour yield							
Clean wheat basis, %	75.5	75.5	75.5	75.5	75.6	75.6	75.5
0.50% ash basis, %	76.5	76.0	75.5	76.0	76.6	76.6	76.5
Flour							
Protein content, %	14.1	13.5	12.9	12.3	11.9	11.5	11.3
Wet gluten content, %	37.8	36.0	34.0	32.2	31.0	29.3	29.0
Ash content, %	0.48	0.49	0.50	0.49	0.48	0.48	0.48
Grade colour	-0.8	-1.2	-1.2	-1.5	-1.7	-1.8	-1.7
AGTRON colour, %	66	68	68	70	71	72	71
Starch damage, %	6.3	6.6	6.8	6.9	7.4	7.4	7.1
α-amylase activity, units/g	3.0	3.5	4.5	4.0	4.5	5.0	3.5
Amylograph peak viscosity, BU	550	530	425	490	425	430	450
Maltose value, g/100 g	2.0	2.0	2.2	2.3	2.5	2.5	2.6
Zeleny sedimentation, ml	71	71	70	69	68	62	60
Farinogram							
Absorption, %	65.5	65.5	65.2	64.8	65.1	64.7	65.1
Development time, min	5.75	5.5	5.5	5.0	4.5	4.5	4.0
Mixing tolerance index, BU	25	25	25	25	20	25	25
Stability, min	10.5	9.5	10.0	10.0	10.0	9.0	8.5
Extensogram							
Length, cm	22	22	20	21	19	18	20
Height at 5 cm, BU	280	300	310	305	315	330	295
Maximum height, BU	485	500	505	510	520	525	505
Area, cm^2	150	150	140	145	135	125	135
Alveogram							
Length, mm	142	125	116	110	91	90	71
P (height x 1.1), mm	85	86	99	100	119	127	127
W, x 10^{-4} joules	386	366	377	372	383	396	334
Baking (Canadian Short Process Baking Test)							
Absorption, %	70	70	69	69	69	69	69
Mixing energy, W–h/kg	13.0	11.7	11.3	10.3	10.4	10.7	10.4
Mixing time, min	9.5	8.7	8.2	8.4	9.2	9.3	10.3
Loaf volume, cm^3/100 g flour	1070	1080	1030	1050	1010	1050	1065

* Unless otherwise specified, data are reported on a 13.5% moisture basis for wheat and a 14.0% moisture basis for flour.

Table 8 • No. 3 Canada Western Red Spring wheat
Pacific export cargo composite
First and second quarters 1997–98

Quality parameter*	No. 3 CWRS Not segregated by protein content
Wheat	
Weight per 1000 kernels, g	33.4
Protein content, %	12.2
Protein content, % (dry matter basis)	14.1
Ash content, %	1.54
α-amylase activity, units/g	30.5
Falling number, s	290
PSI	55
Milling	
Flour yield	
Clean wheat basis, %	74.8
0.50% ash basis, %	74.8
Flour	
Protein content, %	11.4
Wet gluten content, %	28.9
Ash content, %	0.50
Grade colour	-1.1
AGTRON colour, %	68
Starch damage, %	7.2
α-amylase activity, units/g	14.0
Amylograph peak viscosity, BU	160
Maltose value, g/100 g	2.7
Zeleny sedimentation, ml	67
Farinogram	
Absorption, %	64.7
Development time, min	3.0
Mixing tolerance index, BU	30
Stability, min	7.0
Extensogram	
Length, cm	18
Height at 5 cm, BU	320
Maximum height, BU	480
Area, cm^2	125
Alveogram	
Length, mm	68
P (height x 1.1), mm	123
W, x 10^{-4} joules	317
Baking (Canadian Short Process Baking Test)	
Absorption, %	69
Mixing energy, W–h/kg	11.2
Mixing time, min	10.9
Loaf volume, cm^3/100 g flour	1025

* Unless otherwise specified, data are reported on a 13.5% moisture basis for wheat and a 14.0% moisture basis for flour.

Milling and baking quality GRL pilot mill

Composites were prepared from all official loading samples (Atlantic and Pacific) of No. 1 CWRS 13.5 wheat cargoes shipped during the first and second quarters of the 1997–98 crop year. These composites were milled consecutively with the GRL pilot mill to complement laboratory-scale test results.

Figure 1 shows cumulative ash curves computed from the ash content and flour yield of individual millstreams from each milling. A straight-grade flour and a high quality patent flour (prime quality reduction streams representing 60% of total flour) were prepared to allow comparison of wheat milling properties in a commercially relevant fashion as shown in Table 9. The pilot mill flours were also used to evaluate baking quality by a 4.5-hour Sponge-and-Dough Baking Test and the Canadian Short Process Baking Test—a short, mechanical dough development procedure. Results are shown in Table 10.

Figure 1 • Cumulative ash curves for pilot mill flour

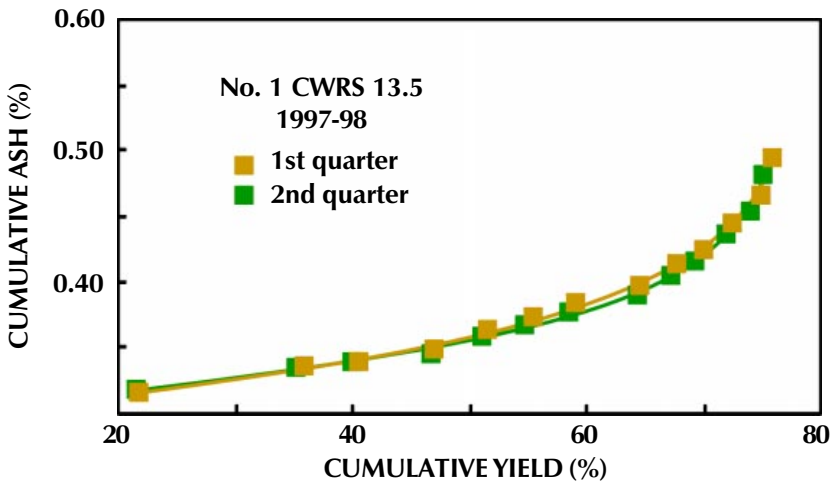

Table 9 • No. 1 Canada Western Red Spring 13.5 wheat
Export cargo composites
Pilot mill flour data • First and second quarters 1997–98

	Straight-grade		Patent	
Quality parameter*	First quarter	Second quarter	First quarter	Second quarter
Flour				
Yield, %	75.9	75.1	45.0	45.0
Protein content, %	12.9	12.8	11.7	11.6
Ash content, %	0.51	0.48	0.35	0.35
Grade colour	-0.5	-0.5	-3.7	-3.9
AGTRON colour, %	62	64	88	90
Starch damage, %	6.1	6.0	6.4	6.2
Amylograph peak viscosity, BU	530	525	670	665
Farinogram				
Absorption, %	62.8	62.5	61.6	61.5
Development time, min	4.75	4.75	5.25	4.75
Mixing tolerance index, BU	30	35	10	15
Stability, min	9.0	8.5	22.5	28.5

* Data are reported on a 14.0% moisture basis.

Table 10 • No. 1 Canada Western Red Spring 13.5 wheat
Export cargo composites
Pilot mill flour baking data • First and second quarters 1997–98

	Straight-grade		Patent	
Quality parameter	First quarter	Second quarter	First quarter	Second quarter
Sponge-and-Dough Baking Test	**(40 ppm ascorbic acid)**		**(20 ppm ascorbic acid)**	
Absorption, %	65	65	64	64
Mixing* : energy, W–h/kg	6.0	7.1	7.6	8.9
Mixing* : time, min	5.9	6.5	8.0	8.9
Loaf volume, cm^3/100 g flour	1140	1110	1080	1065
Appearance	7.7	7.5	7.8	7.7
Crumb structure	6.0	6.2	6.2	6.2
Crumb colour	8.0	8.0	8.5	8.4
Canadian Short Process Baking Test	**(150 ppm ascorbic acid)**		**(150 ppm ascorbic acid)**	
Absorption, %	67	67	66	66
Mixing: energy, W–h/kg	10.0	10.9	9.8	10.9
Mixing: time, min	7.9	8.6	7.7	9.1
Loaf volume, cm^3/100 g flour	1060	1050	1040	1045
Appearance	7.7	7.5	7.5	7.5
Crumb structure	6.3	6.2	6.2	6.3
Crumb colour	7.8	7.9	8.1	8.1

* dough stage

Canada Western Amber Durum wheat

Canada has an international reputation as a reliable supplier of high quality durum wheat, furnishing about two thirds of the world's exports in recent years. The attributes of Canadian durum that attract demand are reliability of supply, cleanliness, uniformity and consistency within and between shipments, and excellent end-product quality.

Canada has a strong commitment to quality throughout its grain system. This extends to strict varietal control to protect the inherent quality of all grades of amber durum wheat and to strict adherence to wheat grade standards. The requirement that only durum varieties of high intrinsic quality are registered is a cornerstone of the Canadian grading system.

Currently, the predominant variety of Canada Western Amber Durum wheat is Kyle.

Table 11 • Moisture content, test weight and other grade determining factors*
Export cargoes of Canada Western Amber Durum wheat
First and second quarters 1997–98

	No. 1 CWAD	No. 2 CWAD	No. 3 CWAD	No. 4 CWAD
Number of cargoes	43	54	43	5
Thousands of tonnes	448	690	599	45
Moisture content, %				
Weighted mean	12.4	12.9	13.8	13.8
Standard deviation	0.46	0.64	0.38	0.19
Minimum	10.7	11.5	12.5	13.6
Maximum	13.1	13.8	14.2	14.1
Test weight, kg/hl				
Weighted mean	82.7	82.0	80.6	79.5
Standard deviation	0.53	0.48	0.62	0.85
Minimum	81.1	80.1	79.3	78.3
Maximum	83.7	83.2	82.2	80.4
Hard vitreous kernels, %				
Weighted mean	83	72	50	N/A
Wheats of other classes, %				
Weighted mean	0.99	1.27	1.77	3.90
Cereal grains other than wheat, %				
Weighted mean	0.17	0.27	0.32	0.37

* Canadian Grain Commission Industry Services data for official loading samples tested at time of loading

Table 12 • Canada Western Amber Durum wheat
Export cargo composites
First and second quarters 1997–98

Quality parameter*	No. 1 CWAD	No. 2 CWAD	No. 3 CWAD	No. 4 CWAD
Wheat				
Weight per 1000 kernels, g	42.5	42.0	44.5	44.7
Protein content, %	12.1	12.2	11.4	11.3
Protein content, % (dry matter basis)	14.0	14.1	13.2	13.1
SDS sedimentation, ml	35	35	33	34
Ash content, %	1.48	1.54	1.55	1.55
Yellow pigment content, ppm	7.7	7.7	7.2	6.8
Falling number, s	400	350	245	220
α-amylase activity, units/g	5.5	16.0	66.0	83.0
Milling yield, %	73.3	73.1	72.6	72.8
Semolina yield, %	64.7	64.3	62.3	61.9
PSI	36.6	37.8	39.1	41.4
Semolina				
Protein content, %	11.2	11.2	10.6	10.6
Wet gluten content, %	28.7	28.8	26.7	26.5
Dry gluten content, %	10.2	10.8	9.6	9.1
Ash content, %	0.63	0.64	0.65	0.66
Yellow pigment content, ppm	7.0	6.8	6.5	6.2
AGTRON colour, %	80	79	80	73
Minolta colour:				
L* (L)	88.6 86.2	88.7 85.8	88.5 86.3	88.8 85.9
a* (a)	-3.5 -3.5	-3.5 -3.4	-3.3 -3.2	-3.2 -3.0
b* (b)	32.9 22.8	32.3 22.2	29.9 21.0	29.3 20.4
Speck count per 50 cm^2	19	31	42	51
Falling number, s	525	450	335	300
α-amylase activity, units/g	2.0	5.0	25.0	35.0
Spaghetti				
Dried at 70°C				
Minolta colour:				
L* (L)	79.4 74.7	79.0 74.5	78.7 73.9	77.4 72.4
a* (a)	-0.5 -0.4	-0.4 -0.3	0.0 0.1	1.3 1.3
b* (b)	64.4 33.8	63.3 33.4	60.9 32.5	58.1 31.4
Cooking quality, CQP	24	24	20	14

* Unless otherwise specified, data are reported on a 13.5% moisture basis for wheat and a 14.0% moisture basis for semolina.

Canada Western Extra Strong wheat

Canada Western Extra Strong (CWES) wheat is a red spring wheat. The most widely grown cultivar is Glenlea.

Flour milled from this wheat is characterized by very strong gluten. Dough made from CWES wheat flour cannot be properly developed at the normal farinograph speed of 63 rpm and must be tested at the higher speed of 90 rpm to obtain a true mixing peak.

The strong physical dough properties of CWES wheat make it ideal for blending and for specialty products in which very high gluten strength is needed.

Two milling grades have been established for this class.

Table 13 • Moisture content, test weight and other grade determining factors*
Export cargoes of Canada Western Extra Strong wheat
First and second quarters 1997–98

	No. 1 CWES	No. 2 CWES
Number of cargoes	11	7
Thousands of tonnes	39	50
Moisture content, %		
Weighted mean	13.9	13.4
Standard deviation	0.29	0.53
Minimum	13.2	12.9
Maximum	14.2	14.3
Test weight, kg/hl		
Weighted mean	80.1	80.3
Standard deviation	0.93	0.92
Minimum	77.8	78.3
Maximum	81.1	81.3
Wheats of other classes, %		
Weighted mean	1.15	1.35
Cereal grains other than wheat, %		
Weighted mean	0.32	0.43

* Canadian Grain Commission Industry Services data for official loading samples tested at time of loading

Table 14 • Canada Western Extra Strong wheat
Export cargo composites
First and second quarters 1997–98

Quality parameter*	No. 1 CWES	No. 2 CWES
Wheat		
Weight per 1000 kernels, g	41.6	42.7
Protein content, %	12.0	12.0
Protein content, % (dry matter basis)	13.9	13.9
Ash content, %	1.57	1.52
α-amylase activity, units/g	14.0	17.5
Falling number, s	330	310
Flour yield, %	75.9	76.0
PSI	50	48
Flour		
Protein content, %	11.4	11.0
Wet gluten content, %	25.5	25.8
Ash content, %	0.55	0.54
Grade colour	-0.6	-0.6
AGTRON colour, %	63	64
Starch damage, %	8.0	8.2
α-amylase activity, units/g	5.0	5.5
Amylograph peak viscosity, BU	300	320
Maltose value, g/100 g	3.0	3.0
Zeleny sedimentation, ml	61	61
Farinogram		
Absorption, %	62.4	63.0
Development time (90 rpm), min	9.5	9.0
Extensogram		
Length, cm	22	23
Height at 5 cm, BU	370	340
Maximum height, BU	650	635
Area, cm^2	200	200
Alveogram		
Length, mm	64	81
P (height x 1.1), mm	128	139
W, x 10^{-4} joules	353	458
Baking (Remix-to-Peak Baking Test)		
Absorption, %	64	64
Remix time, min	4.6	4.8
Loaf volume, cm^3/100 g flour	935	895

* Unless otherwise specified, data are reported on a 13.5% moisture basis for wheat and a 14.0% moisture basis for flour.

Canada Prairie Spring Red wheat

Canada Prairie Spring Red (CPSR) wheat, used alone or in blends, has quality characteristics suitable for the production of various types of hearth breads, flat breads, noodles and related products. The most commonly grown varieties eligible for milling grades of CPSR are AC Taber and Biggar.

Table 15 • Moisture content, test weight and other grade determining factors*
Export cargoes of Canada Prairie Spring Red and White wheat
First and second quarters 1997–98

	No. 1 CPSR	No. 2 CPSR
Number of cargoes	1	15
Thousands of tonnes	5	206
Moisture content, %		
Weighted mean	14.0	13.8
Standard deviation	0.00	0.51
Minimum	14.0	12.9
Maximum	14.0	14.3
Test weight, kg/hl		
Weighted mean	81.7	80.5
Standard deviation	0.00	0.55
Minimum	81.7	79.4
Maximum	81.7	81.3
Wheats of other classes, %		
Weighted mean	1.50	2.48
Cereal grains other than wheat, %		
Weighted mean	0.16	0.56

* Canadian Grain Commission Industry Services data for official loading samples tested at time of loading

Table 16 • Canada Prairie Spring Red and White wheat
Export cargo composites
First and second quarters 1997–98

Quality parameter*	No. 1 CPSR	No. 2 CPSR
Wheat		
Weight per 1000 kernels, g	41.1	40.7
Protein content, %	11.6	11.0
Protein content, % (dry matter basis)	13.4	12.7
Ash content, %	1.53	1.47
α-amylase activity, units/g	6.5	31.0
Falling number, s	375	240
Flour yield, %	76.2	75.1
PSI	60	58
Flour		
Protein content, %	10.8	10.0
Wet gluten content, %	28.0	24.5
Ash content, %	0.49	0.45
Grade colour	-1.1	-1.2
AGTRON colour, %	66	67
Starch damage, %	5.4	5.9
α-amylase activity, units/g	2.5	8.5
Amylograph peak viscosity, BU	555	180
Maltose value, g/100 g	1.8	2.3
Zeleny sedimentation, ml	51	47
Farinogram		
Absorption, %	58.6	59.1
Development time, min	5.0	4.75
Mixing tolerance index, BU	40	40
Stability, min	8.0	8.0
Extensogram		
Length, cm	21	18
Height at 5 cm, BU	290	325
Maximum height, BU	505	520
Area, cm^2	140	130
Alveogram		
Length, mm	141	104
P (height x 1.1), mm	63	79
W, x 10^{-4} joules	268	274
Baking (Remix-to-Peak Baking Test)		
Absorption, %	58	59
Remix time, min	2.3	2.4
Loaf volume, cm^3/100 g flour	785	705

* Unless otherwise specified, data are reported on a 13.5% moisture basis for wheat and a 14.0% moisture basis for flour.

Canada Western Red Winter wheat

Canada Western Red Winter (CWRW) wheat is a hard wheat exhibiting excellent milling quality. It is available in two milling grades. Flour produced from high grade CWRW wheat performs well in the production of hearth breads (such as French-style bread) and certain types of noodles, and is also suitable for the production of various types of flat bread, steamed bread and related products.

Production of CWRW wheat is concentrated in the southern region of the province of Alberta where milder winters reduce the incidence of winter kill.

Current varieties eligible for the milling grades of CWRW are Norstar, AC Readymade and CDC Kestral.

Table 17 • Moisture content, test weight and other grade determining factors*
Export cargoes of Canada Western Red Winter wheat
First and second quarters 1997–98

	No. 2 CWRW
Number of cargoes	3
Thousands of tonnes	21
Moisture content, %	
Weighted mean	12.6
Standard deviation	0.35
Minimum	12.2
Maximum	12.8
Test weight, kg/hl	
Weighted mean	82.4
Standard deviation	0.40
Minimum	82.1
Maximum	82.9
Wheats of other classes, %	
Weighted mean	2.21
Cereal grains other than wheat, %	
Weighted mean	0.25

* Canadian Grain Commission Industry Services data for official loading samples tested at time of loading

Table 18 • Canada Western Red Winter wheat
Export cargo composite
First and second quarters 1997–98

Quality parameter*	No. 2 CWRW
Wheat	
Weight per 1000 kernels, g	32.0
Protein content, %	10.9
Protein content, % (dry matter basis)	12.6
Ash content, %	1.45
α-amylase activity, units/g	11.0
Falling number, s	335
Flour yield, %	75.9
PSI	58
Flour	
Protein content, %	10.2
Wet gluten content, %	27.2
Ash content, %	0.43
Grade colour	-2.2
AGTRON colour, %	73
Starch damage, %	6.1
α-amylase activity, units/g	4.5
Amylograph peak viscosity, BU	330
Maltose value, g/100 g	2.3
Zeleny sedimentation, ml	50
Farinogram	
Absorption, %	58.6
Development time, min	5.0
Mixing tolerance index, BU	40
Stability, min	7.0
Extensogram	
Length, cm	19
Height at 5 cm, BU	290
Maximum height, BU	480
Area, cm^2	125
Alveogram	
Length, mm	129
P (height x 1.1), mm	72
W, x 10^{-4} joules	285
Baking (Remix-to-Peak Baking Test)	
Absorption, %	59
Remix time, min	2.5
Loaf volume, cm^3/100 g flour	790

* Unless otherwise specified, data are reported on a 13.5% moisture basis for wheat and a 14.0% moisture basis for flour.

Canada Prairie Spring White wheat

Canada Prairie Spring White (CPSW) wheat, used alone or in blends, has the quality characteristics suitable for the production of various types of flat breads, noodles, chapatis, crackers and similar products. The most commonly grown varieties eligible for milling grades of CPSW are AC Karma and Genesis.

Table 19 • Moisture content, test weight and other grade determining factors*
Export cargoes of Canada Prairie Spring Red and White wheat
First and second quarters 1997–98

	No. 1 CPSW	No. 2 CPSW
Number of cargoes	2	17
Thousands of tonnes	11	340
Moisture content, %		
Weighted mean	13.6	13.5
Standard deviation	0.57	0.36
Minimum	13.2	13.1
Maximum	14.0	14.1
Test weight, kg/hl		
Weighted mean	81.8	82.0
Standard deviation	0.71	0.53
Minimum	81.3	80.9
Maximum	82.3	82.8
Wheats of other classes, %		
Weighted mean	1.04	1.82
Cereal grains other than wheat, %		
Weighted mean	0.21	0.29

* Canadian Grain Commission Industry Services data for official loading samples tested at time of loading

Table 20 • Canada Prairie Spring Red and White wheat
Export cargo composites
First and second quarters 1997–98

Quality parameter*	No. 1 CPSW	No. 2 CPSW
Wheat		
Weight per 1000 kernels, g	39.2	37.2
Protein content, %	11.0	10.9
Protein content, % (dry matter basis)	12.7	12.6
Ash content, %	1.46	1.42
α-amylase activity, units/g	12.0	17.5
Falling number, s	345	305
Flour yield, %	75.9	75.3
PSI	60	60
Flour		
Protein content, %	10.1	9.9
Wet gluten content, %	27.5	26.6
Ash content, %	0.49	0.46
Grade colour	-2.1	-1.6
AGTRON colour, %	75	72
Starch damage, %	5.5	5.2
α-amylase activity, units/g	3.5	5.5
Amylograph peak viscosity, BU	525	360
Maltose value, g/100 g	1.9	2.0
Zeleny sedimentation, ml	38	38
Farinogram		
Absorption, %	60.0	59.2
Development time, min	3.25	3.5
Mixing tolerance index, BU	60	60
Stability, min	4.0	5.0
Extensogram		
Length, cm	22	19
Height at 5 cm, BU	210	255
Maximum height, BU	270	345
Area, cm^2	75	90
Alveogram		
Length, mm	111	125
P (height x 1.1), mm	63	65
W, x 10^{-4} joules	188	229
Baking (Remix-to-Peak Baking Test)		
Absorption, %	58	59
Remix time, min	1.4	1.8
Loaf volume, cm^3/100 g flour	640	655

* Unless otherwise specified, data are reported on a 13.5% moisture basis for wheat and a 14.0% moisture basis for flour.

Canada Western Soft White Spring wheat

Canada Western Soft White Spring (CWSWS) wheat is a lower protein, soft wheat with weak dough properties. Flour milled from this wheat is suitable for producing cookies, cakes, biscuits and related products. Alone or in blends with stronger wheat, CWSWS wheat can also be used to produce crackers, flat breads, steamed breads and certain types of noodles.

Most CWSWS wheat is grown under irrigation to maximize yield and minimize protein content.

Table 21 • Moisture content, test weight and other grade determining factors*
Export cargoes of Canada Western Soft White Spring wheat
First and second quarters 1997–98

	No. 2 CWSWS
Number of cargoes	13
Thousands of tonnes	120
Moisture content, %	
Weighted mean	11.9
Standard deviation	0.30
Minimum	11.3
Maximum	12.4
Test weight, kg/hl	
Weighted mean	82.2
Standard deviation	0.34
Minimum	81.5
Maximum	82.7
Wheats of other classes, %	
Weighted mean	0.81
Cereal grains other than wheat, %	
Weighted mean	0.18

* Canadian Grain Commission Industry Services data for official loading samples tested at time of loading

Table 22 • Canada Western Soft White Spring wheat
Export cargo composite
First and second quarters 1997–98

Quality parameter*	No. 2 CWSWS
Wheat	
Weight per 1000 kernels, g	39.0
Protein content, %	10.6
Protein content, % (dry matter basis)	12.3
Ash content, %	1.50
α-amylase activity, units/g	33.5
Falling number, s	230
Flour yield, %	77.0
PSI	68
Flour	
Protein content, %	9.6
Wet gluten content, %	24.8
Ash content, %	0.51
Grade colour	-0.2
AGTRON colour, %	63
Starch damage, %	3.4
α-amylase activity, units/g	10.0
Amylograph peak viscosity, BU	95
Maltose value, g/100 g	1.6
Zeleny sedimentation, ml	22
AWRC, %	61.3
Farinogram	
Absorption, %	54.7
Development time, min	1.25
Mixing tolerance index, BU	170
Stability, min	1.0
Alveogram	
Length, mm	105
P (height x 1.1), mm	23
W, x 10^{-4} joules	48
Cookie Test	
Spread, mm	81.5
Ratio (spread/thickness)	8.2

* Unless otherwise specified, data are reported on a 13.5% moisture basis for wheat and a 14.0% moisture basis for flour.

Methods and definitions

At the Grain Research Laboratory (GRL), unless otherwise specified,

- Analytical results for wheat are reported at 13.5% moisture content.
- Analytical results for flour and semolina are reported at 14.0% moisture content.
- AACC methods cited are from *The American Association of Cereal Chemists (AACC): Approved Methods of the Association*, Ninth Edition, 1995.
- ICC methods cited are those of the International Association for Cereal Science And Technology.

AGTRON colour

The AGTRON colour of flour and durum wheat semolina is determined using AACC Method 14-30. An AGTRON direct reading reflectance spectrophotometer is used.

Alveogram

ICC Standard Method No. 121 is followed, using the constant pressure Chopin Alveograph Model MA82.

α-Amylase activity

The α-amylase activity of wheat and flour is determined by the method of Kruger and Tipples (1981), *Cereal Chemistry* 58:271–274.

Amylograph peak viscosity

Sixty-five grams of flour and 450 ml of distilled water are used with the Brabender Amylograph and the pin stirrer. Other details are as in AACC Method 22-10. Peak viscosity is reported in Brabender units.

Ash content

To determine wheat and flour ash content, AACC Method 8-01 is used.

AWRC (Alkaline Water Retention Capacity)

AWRC (Alkaline Water Retention Capacity) is determined using AACC Method 56-10.

Canadian Short Process Baking Test

The Canadian Short Process Baking Test is carried out as described by Preston et al. (1982), *Canadian Institute of Food Science and Technology Journal* 15:29–36. For this test and for the Sponge-and-Dough Baking Test, loaves are produced from 200 g of flour in baking pans with cross-sectional dimensions similar to those of Canadian commercial baking pans. Loaf volume is reported for each 100 g of flour.

Cereal grains other than wheat

Cereal grains other than wheat in wheat are rye, barley, oats, triticale, oat groats and wild oat groats. The percentage of other cereal grains present is determined by handpicking from a subsample of at least 250 g from each incremental sample. After a cargo has been loaded, the weighted average of the results is calculated. The amount of other cereal grains found is reported as a percentage by weight without reference to moisture content.

Cookie Test

The Cookie Test is performed according to AACC Method 10-50 D.

Crop year

The Canadian crop year begins on August 1 and ends July 31 the following year.

- First quarter, August 1 to October 31
- Second quarter, November 1 to January 31
- Third quarter, February 1 to April 30
- Fourth quarter, May 1 to July 31

Dockage

Dockage is material that can be removed by approved cleaning equipment. Canadian cargoes must be free of dockage, unless the buyer agrees in writing to accept grain containing dockage.

Dry gluten content

Dry gluten content is determined according to the Glutomatic System Operation manual.

Extensogram

Doughs are made from 300 g flour, 6 g salt, and distilled water equal to Farinograph absorption less 2.0% (for example, 65.0% reduced to 63.0%). The adjustment in Farinograph absorption is to compensate both for the salt and for the substitution of the large stainless steel Farinograph bowl. Doughs are mixed for one minute and rested for five minutes. Mixing continues until the curve is centred about the 500 Brabender Unit line. Curves are drawn for duplicate doughs at 45 and at 135 minutes, although doughs are rounded and shaped at 90 minutes. Average curves for 45 and 135 minutes are reproduced, but measurements are reported only for the 135-minute curve. Length is in centimetres, height is in Brabender units, and area is in square centimetres. The extensigraph is set so that 100 Brabender units equal a 100-g load.

Falling number

The falling number is determined on a 7-g sample of ground wheat or semolina by AACC Method 56-81B. A 300-g sample of wheat is ground in a Falling Number Laboratory Mill 3100 according to ICC Standard Method No. 107.

Farinogram

Fifty grams of flour are mixed in a small stainless steel farinograph bowl at 63 rpm for 15 minutes with enough distilled water to give a maximum dough consistency centred about the 500 Brabender Unit line.

- Farinograph absorption is the amount of water that must be added to flour to give the required consistency. It is reported as a percent.
- Dough development time is the time required for the curve to reach its maximum height.
- Mixing tolerance index (MTI) is the difference, in Brabender units, between the top of the curve at the peak and the top of the curve measured 5 min after the peak is reached.
- Stability is defined as the difference in time, to the nearest half minute, between the point at which the top of the curve first intercepts the 500-BU line (arrival time) and the point at which the top of the curve leaves the 500-BU line (departure time).

For CWES, Farinograph absorption is determined at 63 rpm and dough development time is measured at 90 rpm. For additional details, see the *Farinograph Handbook*, AACC, 1960.

Flour yield

Wheat is cleaned, scoured and tempered overnight to optimum moisture as described by Dexter and Tipples (1987), *Milling* 180(7):16, 18–20. All millings at the GRL are performed in rooms with environmental control maintained at 21°C and at 60% relative humidity.

- Common wheat is milled on an Allis-Chalmers laboratory mill using the GRL sifter flow as described by Black et al. (1980), *Cereal Foods World* 25:757–760. Flour yield is expressed as a percentage of cleaned wheat on a constant moisture basis. For CWRS wheat, flour yield also is expressed at a constant ash content of 0.50%, as described by Dexter and Tipples (1989), *Milling* 182(8):9–11. The procedure for pilot milling is described by Fajardo et al. (1995), *Cereal Chemistry* 72:291–298.
- Durum wheat is milled on a four stand Allis-Chalmers mill in conjunction with a laboratory purifier as described by Black (1966), *Cereal Science Today* 11:533–534, 542. The mill flow is described by Dexter et al. (1990), *Cereal Chemistry* 67:405–412. Semolina is defined as having less than 1% pass through a 149-micron sieve. Semolina yield and milling yield (which includes semolina and flour combined) are reported as a percentage of the cleaned wheat on a constant moisture basis.

Grade colour

A colour index is obtained by the procedure of Kent-Jones, et al. (1956), *Chemistry & Industry (London)* 1490–1493. The procedure uses the automated Satake Series IV Colour Grader, which gives the relative reflectance of a flour-water slurry. Results are standardized to the Satake International Units—the lower the number, the brighter the colour.

Hard vitreous kernels (HVK)

Determination of hard vitreous kernels (HVK) is made according to Memorandum No. 95-5 of Industry Services, Canadian Grain Commission. A sieved 25-g sample is examined externally for the natural translucency associated with hardness. Bleached kernels may be cut transversely to determine vitreousness.

Incremental sample

As vessels are loaded at terminal and transfer elevators, a series of samples is taken at specific intervals by a mechanical grain sampler. These are called incremental samples.

Maltose value

Maltose value is determined according to AACC Method 22-16.

Moisture content (flour)

To determine the moisture content of flour, a 10-g sample is heated for one hour in a semi-automatic Brabender oven at 130°C.

Moisture content (wheat)

Industry Services determines the moisture content of wheat on individual cargoes, and the Grain Research Laboratory determines the moisture content of wheat on grade composites using the Model 919 moisture meter calibrated against the AACC method 44-15A subsection 2-stage (130°C air-oven).

Protein content (N x 5.7)

Protein content of the composite samples is determined by Combustion Nitrogen Analysis (CNA). Protein content (total nitrogen) is determined on a LECO Model FP-428 Dumas CNA analyzer calibrated with EDTA. Samples are ground on a UDY Cyclone Sample Mill fitted with a 1.0-mm screen. A 250-mg sample is analyzed as received (it is not dried before analysis). Moisture is determined by the AACC Method No. 44-15A (Single stage air oven).

The CGC previously used the Kjeldahl method, but switched to CNA on August 1, 1996, after evaluating the method for two years.The CNA method is becoming the world standard for protein determination. The method is

- More environmentally acceptable because it uses no corrosive or potentially toxic chemicals
- Safer because it does not use hot liquids
- More economical to install and to use because it requires no drainage or fume exhaust
- More precise than the Kjeldahl method
- Suitable for sample sizes of up to 300 mg, which can be used with today's instruments, and which create less sampling error than the samples of only a few milligrams used with older instruments

The Dumas test extracts about 2% more nitrogen than the Kjeldahl test.Consequently, the results for any given wheat sample may be higher by 0.2–0.3 percentage units. The difference between CNA and Kjeldahl results increases with increasing protein content.

PSI (particle size index)

PSI is a measure of the hardness of a wheat kernel. AACC Method No. 55-30 is modified by using a UDY Cyclone Sample Mill fitted with a feed rate regulator and a 1.0-mm screen. A 10-g sample from 22 g of ground, blended wheat is sieved in a US Standard 200-mesh sieve for 10 minutes in a Ro-tap sieve shaker. The weight of throughs X 10 is recorded as the PSI.

Remix-to-Peak Baking Test

The Remix-to-Peak Baking Test is a modification of the Remix Baking Test of Irvine and McMullan (1960), *Cereal Chemistry* 37:603–613, as described in detail by Kilborn and Tipples (1981), *Cereal Foods World* 26:624–628. Dough is mixed to peak consistency at the second mixing stage.

Sampling cargoes

As vessels are loaded at terminal and transfer elevators, a series of samples is taken at specific intervals by a mechanical grain sampler. Canadian grain is cleaned to export specification at terminal elevators before it is shipped. Canadian cargoes must be free of dockage, unless the buyer agrees in writing to accept grain containing dockage.

1. Each sample, referred to as an incremental sample, represents the grain loaded during the interval. Incremental samples are analyzed for commercial cleanliness, visual quality, total foreign material, and non-visual criteria such as test weight, moisture and protein content.
2. An official loading record for the cargo is generated from the data for all incremental samples taken.
3. Representative samples are taken for each grain and grade loaded to a vessel. These representative samples are combined to achieve a weighted average composite sample.
   - One subsample is kept by Industry Services as the official loading sample for the shipment.
   - A second subsample is sent to the GRL for compositing of weighted grade average samples on which milling, baking and analytical tests are performed.
4. Vessel shipments of No. 1 and No. 2 CWRS wheat are further segregated by guaranteed level of protein content. Each individual sample representing the grain and protein level loaded into a vessel during a prescribed time interval is thoroughly mixed and tested for protein content at the port using near-infrared spectroscopy. The protein result is verified by the CNA procedure. These samples are used by the GRL to prepare the weighted composite samples used for the publication of quality data.

SDS sedimentation values

SDS sedimentation values are determined by the method of Axford and Redman (1979), *Cereal Chemistry* 56:582, using 3% SDS.

Semolina colour

A small metal container is filled with durum wheat semolina and covered with a low reflectance glass plate. Lightness (L*), redness (a*) and yellowness (b*), and Hunter lab L a b data are determined using the tristimulus method, with a Minolta CM 525i spectrophotometer (CIE 2° Standard Observer D65).

Spaghetti

Spaghetti is processed from semolina on a Demaco laboratory-scale continuous extrusion press as described by Matsuo et al. (1978), *Cereal Chemistry* 55:744-753, and dried at 70°C as described by Dexter et al. (1981), *Journal of Food Science* 46:1741-1746.

Spaghetti colour

Whole strands of spaghetti are mounted on white cardboard for colour measurements. Lightness (L*), redness (a*) and yellowness (b*), and Hunter lab L, a, b data are determined using the tristimulus method, with a Minolta CM 525i spectrophotometer

Spaghetti cooking quality

Spaghetti cooking quality is determined as described by Dexter and Matsuo (1977), *Canadian Journal of Plant Science* 57:717–727.

Speck count

Speck count is determined as described by Dexter and Matsuo (1982), *Cereal Chemistry* 59:63-69.

Sponge-and-Dough Baking Test

The Sponge-and-Dough Baking Test is based on a 4.5-hour 70% sponge system as described by Kilborn and Preston (1981), *Cereal Chemistry* 58:198–201.

Starch damage, %

Starch damage is determined using AACC Method 76-31 Damaged Starch: Spectrophotometric Method. Starch damage is expressed as as a percentage of flour weight. The method is also referred to as the MegaZyme method. Conversion factors for alternate methods are

AACC 76-30A = 1.5662 * MegaZyme - 0.338

Farrand = 6.6092 * MegaZyme - 11.972

Test weight

Test weight is determined using the Schopper Chondrometer equipped with the one litre container. The weight in grams of the measured litre of wheat is divided by 10. The result is reported without reference to the moisture content.

Weight per 1000 kernels

Broken kernels and foreign material are handpicked from a sample to create a cleaned sample. The number of kernels in a 10-g subsample of the cleaned sample is then counted using an electronic seed counter.

Wet gluten content

ICC Standard Method No. 137 is followed using the Glutomatic System Type 2200 with metal sieves.

Note: When the GRL changed from the Theby Gluten washer, which was no longer available, to the Glutomatic in 1988, the buffer composition (salt, phosphate, pH 6.7) was maintained and dough mixing time was set at 30 seconds when testing common wheat flours. Under these conditions results were comparable to those obtained previously over many years using the Theby machine.

Effective August 1, 1996, we decided to change to exactly the conditions specified in ICC Standard Method No. 137 (20 seconds dough mixing time; salt-phosphate buffer pH 5.95) for common wheat flours. Results obtained using this changed procedure are significantly lower; for example, by up to 5 percentage units for CWRS.

No changes have been made to the wet gluten procedure used for durum wheat semolina.

Wheats of other classes

Wheats of other classes refers to all classes or types of wheat other than the predominant class. The percentage of wheat of other classes present is determined by hand-picking from a subsample of at least 25 g of each increment sample. After a cargo has been loaded, the weighted average of the results is calculated. without reference to moisture content.

W-h/kg

Watt-hours per kilogram. This is a measure of mixing energy used in the Canadian Short Process Baking Test.

Yellow pigment content

Yellow pigment content of durum wheat and semolina is determined using AACC Method 14-50.

Zeleny sedimentation

Zeleny sedimentation is determined according to AACC Method 56-60 for flour. Results are reported in millilitres.