Canadian Grain Commission
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Quality of western Canadian wheat 2002

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Canada

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Summary

Cool dry conditions over much of the prairies delayed seeding and slowed initial growth. Very warm temperatures during late June and July and continued drought across the northern regions increased crop stress and reduced yield potential. Frequent rains during late August and into September delayed harvesting and resulted in extensive downgrading. The predominant degrading factors in red spring wheat include mildew, green kernels, low % vitreous kernels and fusarium damage. In durum wheat, predominant grading factors include mildew, low % vitreous kernels, sprouting, green kernels and smudge. Spring wheat production is estimated at 9.9 million tones, the lowest amount since 1970. Durum wheat production is estimated at 3.6 million tonnes, an increase of 14% over 2001.

High grade Canada Western Red Spring wheat quality shows somewhat higher protein content, lower test weight, poorer flour colour, higher absorption and stronger dough properties compared to last year. High grade Canada Western Amber Durum wheat quality showed a slight decrease in milling quality, a decrease in yellow color but an improvement in cooking quality.

Low production and extensive downgrading in other western Canadian wheat classes severely limited the number of samples available for testing. Therefore, quality data for these classes have not been published in this bulletin.

Figure 1 • Map of Canada showing major wheat producing areas in the prairies

Seven classes of Canadian wheat

This report presents information on the quality of the three milling grades of Canada Western Red Spring wheat and the four grades of Canada Western Amber Durum wheat for the 2002 crop. Further information for other classes of western Canadian wheat, if available, can be obtained by contacting the Canadian Grain Commission at the address given on the first page of this report.

Canada Western Red Spring (CWRS) wheat is a hard wheat with superior milling and baking quality. It is offered at various guaranteed protein levels. There are three milling grades in the CWRS class.

Canada Western Amber Durum (CWAD) wheat is a durum wheat producing a high yield of semolina with excellent pasta-making quality. There are four milling grades in the CWAD class.

Canada Western Extra Strong (CWES) wheat is a hard red spring wheat with extra-strong gluten suitable for blending purposes and for special breads. There are two milling grades in the CWES class.

Canada Prairie Spring Red (CPSR) wheat is a medium-strength wheat suitable for the production of certain types of hearth breads, flat breads, steamed breads, noodles and related products. There are two milling grades in the CPSR class.

Canada Western Red Winter (CWRW) wheat is a hard wheat with very good milling quality suitable for the production of a wide variety of products including French breads, flat breads, steamed breads, noodles and related products. There are two milling grades in the CWRW class.

Canada Prairie Spring White (CPSW) wheat is a medium-strength wheat suitable for the production of various types of flat breads, noodles, chapatis and related products. There are two milling grades in the CPSW class.

Canada Western Soft White Spring (CWSWS) wheat is a soft wheat of low protein content for production of cookies, cakes and pastry as well as various types of flat breads, noodles, steamed breads and chapatis. There are three milling grades in the CWSWS class.

Introduction

What data in this report represent

Data presented in this report were generated from quality tests carried out on composites representing approximately 6000 individual samples submitted by producers and primary elevator managers from the three prairie provinces. Figure 1 highlights the wheat producing regions in the provinces of, from east to west, Manitoba, Saskatchewan and Alberta. These data are not quality specifications for Canadian wheat. Rather, they represent our best estimate of quality. How closely they represent the exact quality characteristics of wheat of any given grade exported during the coming year depends on

- The amounts and relative quality of carryover stocks of each grade
- The degree to which the harvest survey composites are representative of 2002 production

Background for the 2002 crop

Background information for the 2002 crop was provided by the Canadian Wheat Board.

Seeding conditions

A dry fall and winter in late 2001 and early 2002 led to extremely poor moisture conditions for the planting of the 2002 crop over most of the prairie region. Soil moisture conditions were better in eastern and central Manitoba, but even these regions reported very dry topsoil. The extremely dry conditions, combined with cooler than normal weather in April and May, delayed most seeding until later in May. Planting was further delayed in the southern areas of Saskatchewan and Alberta due to heavy rains during the first week of June.

Growing conditions

Cool weather during May and early June slowed crop growth and development across the Prairies. Heavy rains in the southern Prairies did improve soil moisture conditions, especially in Alberta and Saskatchewan. The heavy rains caused some flooding in all three provinces, which resulted in some reseeding, especially in southern Alberta. Warmer than normal temperatures during the second half of June increased crop stress, especially in the parched regions of northern Alberta and Saskatchewan.

The warmer than normal weather continued through July, causing further severe stress and reduced yield potential. The rainfall pattern of the spring continued into July, with the heaviest rainfall reported in the southern Prairies. Northern regions reported only minimal amounts during the month, with only isolated areas reporting enough rainfall to improve crop prospects. The warm temperatures did accelerate crop development, especially in eastern areas of the Prairies.

A cool, wet weather pattern settled over the Prairies during the first week in August, bringing significantly above normal amounts of rain to the dry areas in Saskatchewan. A frost during the first week of August caused damage to crop quality in northern and central areas of Saskatchewan and Alberta. The rains also brought a flush of secondary growth in the drought regions and delayed maturity in southern areas.

Harvest conditions

The harvest started in southern Manitoba and southeastern Saskatchewan in the third week of August. Frequent rains during the last week of August and the first two weeks of September slowed harvesting and resulted in downgrading of the mature crops in the eastern Prairies. Severe frost was reported by the middle of September in Saskatchewan and Alberta, which brought an end to the growing season in most areas. Harvest during the last half of September continued to be plagued by frequent showers. In eastern growing areas, significant progress was made during the last two weeks of September, while western areas continued to struggle with poor drying conditions. The uneven growth of crops in Alberta and Saskatchewan continued to slow harvest activity into October. Frequent precipitation combined with cooler than normal temperatures to delay further progress. Snow during the last two weeks of October essentially brought an end to harvest activity. Approximately 10 per cent of the crop will be left out during the winter and will have to be harvested in the spring.

Production and grade information

Production estimates from the Statistics Canada *Field Crop Reporting Series No. 7*, October, 2002 are the poorest in close to thirty years due to the severe drought conditions in most of Saskatchewan and Alberta. Total wheat production for Western Canada is estimated at 13.9 million tonnes, the smallest crop since 1974. Spring wheat production, currently estimated at 9.9 million tonnes, is the smallest output since 1970. Durum production has increased from last year to an estimated 3.6 million tonnes due to the improved moisture situation in the southern Prairies. Spring wheat yield is expected to reach only 1.6 tonnes per hectare, the lowest since 1988. Durum wheat yield is estimated at 1.6 tonnes per hectare, a 14 per cent increase from 2001.

Much of the crop has been downgraded due to the cool, wet conditions experienced during harvest. Major downgrading factors in Canada Western Red Spring wheat include weathering related mildew damage, green kernels associated with secondary growth, low % of vitreous kernels and fusarium damage in some parts of eastern Saskatchewan and Manitoba. Sprout damage and frost are also present. In Canada Western Amber Durum wheat, major degrading factors include mildew, sprouting, low % of vitreous kernels, green kernels and smudge. Tight grading tolerances for these factors ensure that the high inherent quality of the top milling grades of Canada Western Red Spring and Canada Western Amber Durum wheat are protected.

Protein

Table 1 compares available mean protein values for each of the seven classes of western Canadian wheat surveyed in 2002 to corresponding values obtained in the 2001 and 2000 harvest survey as of November 28. Canada Western Red Spring (CWRS) wheat shows a similar protein value to last year while Canada Western Amber Durum (CWAD) shows a decrease of 0.8% relative to 2001. A large increase in protein content over last year is evident for the Canada Western Prairie Spring Red wheat class while a small increase is evident for the Canada Western Red Winter wheat class. For other classes, insufficient samples are available to accurately assess protein content.

Table 1 • Mean protein content of milling grades of western Canadian wheat classes, 2002, 2001, 2000

	Protein content , %[1]		
Class	2002	2001	2000
CWRS	14.6	14.7	13.6
CWAD	13.3	14.1	12.5
CWES	N/A	13.4	12.3
CPSR	14.5	13.1	11.2
CWRW	11.5	11.1	10.3
CPSW	N/A	13.0	11.4
CWSWS	N/A	11.0	10.9

[1] Mean value, N x 5.7; 13.5% moisture content basis
N/A Data not available

Canada Western Red Spring wheat

Protein and variety survey

Table 2 lists mean protein values for Canada Western Red Spring (CWRS) wheat by grade and province for 2002. Comparative values for western Canada by grade are shown for 2001 and for the previous 10 years (1992-2001). Figure 2 shows the fluctuations in annual mean protein content since 1927.

The average protein content of the 2002 CWRS wheat crop is 14.6%, similar to 2001 and 1.3% higher than the ten year mean. A decrease in protein content is evident with decreasing grade, ranging from 15.0% for the No. 1 grade to 14.4% for the No. 3 grade. All three provinces show high protein content due, in large part, to drought conditions. Alberta shows the highest protein content at 15.0% while Saskatchewan shows the lowest value at 14.4%.

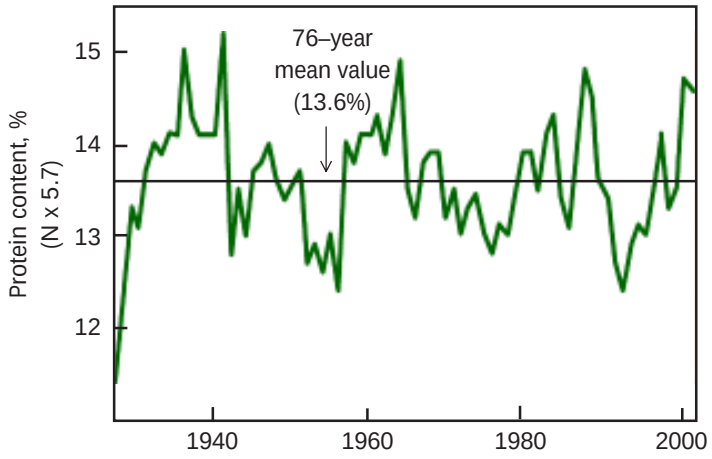
Preliminary results from the Canadian Wheat Board 2002 Variety Survey show that AC Barrie is the predominant variety in the CWRS class with 36% of the seeded acreage, down from 38% in 2001. Five varieties, including AC Cadillac, AC Intrepid, AC Splendor, CDC Teal, McKenzie and Prodigy, each account for 5-8% of the acreage.

Table 2 • Mean protein content of 2002 Canada Western Red Spring wheat, by grade, year and province

	Protein content, %[1]					
	Western Canada			2002		
Grade	2002	2001	1992–2001	Manitoba	Saskatchewan	Alberta
No. 1 CWRS	15.0	14.4	13.3	15.1	14.3	15.3
No. 2 CWRS	14.9	14.9	13.4	14.9	14.6	15.3
No. 3 CWRS	14.4	15.2	13.1	14.6	14.2	14.8
All milling grades	**14.6**	**14.7**	**13.3**	**14.7**	**14.4**	**15.0**

[1] N x 5.7; 13.5% moisture content basis

Figure 2 • Mean protein content of harvest survey Canada Western Red Spring wheat–1927 to 2002



Milling and baking quality Allis-Chalmers laboratory mill

To assess the quality of the 2002 CWRS wheat crop, composites were prepared from harvest survey samples representing the three milling grades. The No. 1 and No. 2 CWRS samples were segregated into composites having minimum protein levels of 14.5% and 13.5%. Results for the 12.5% composite are not reported due to the very small amount of wheat segregating into this protein level. The No. 3 grade was included this year since it represents the largest volume for the class. However, less stringent grading tolerances and greater regional variability in major degrading factors result in greater variability between shipments compared to the top two grades. Therefore, the data presented for the No. 3 grade should only be viewed as a very general indication of quality.

No. 1 Canada Western Red Spring wheat

Table 3 summarizes quality data for the No. 1 CWRS composites. Corresponding data are provided at the 13.5% minimum protein level for both last year's composite and the ten-year average, 1992-2001.

Test weight weights of the 2002 No. 1 grade protein segregates are lower than last year but similar to the long term average. Seed size is lower than last year and the long term average. Wheat ash is lower compared to last year and to the long term average. Wheat falling number and flour amylograph peak viscosity values are lower than last year but still show a high degree of soundness as expected for this grade.

Wheat particle size index and flour starch damage values indicate that kernel texture is harder relative to last year. Flour yield, when corrected for ash content, is higher than last year. Flour grade colour is similar while Agtron colour is higher compared to 2001. Compared to long term averages, this year's No. 1 grade composites show lower flour yield but a higher degree of flour refinement in terms of ash and colour.

Farinograph absorption is about 1% higher than last year and 2% higher than the long term average. The higher starch damage this year is probably the major contributor to this increased absorption. Farinograph, extensograph and alveograph results indicate stronger dough properties relative to last year and the long term averages. Canadian short process baking absorption is higher than last year and the long term average. Loaf volumes are lower compared to 2001 values. During processing, dough shows longer mixing requirements while maintaining the superior handling properties characteristic of this wheat class.

No. 2 Canada Western Red Spring wheat

Table 4 shows quality data for the 2002 No. 2 CWRS composites and comparative data for the 13.5% minimum protein level for last year's composite and the ten-year average, 1992-2001.

Test weight is lower than 2001 but higher than the long term average. Kernel weight is lower than last year and the long term average. The No. 2 grade composites show a high degree of soundness, evident from the high wheat falling number and flour amylograph peak viscosity values. Wheat particle size index and flour starch damage values indicate that kernel texture is somewhat harder relative to last year and considerably harder than the long term average. Milling yield and the degree of flour refinement (ash and colour) are similar to last year and the long term average.

Rheological tests demonstrate dough strength properties stronger than last year. Farinograph absorption is higher than last year and the long term average. Good baking quality is evident with the Canadian short process baking procedure. Baking absorption is similar and mixing time is longer compared to last year.

No. 3 Canada Western Red Spring wheat

Table 5 shows quality data for the 2002 No. 3 CWRS composite and comparative data for last year's composite and the ten-year average, 1992-2001.

Protein content of this year's No. 3 grade, which is not segregated by this factor, is lower than last year but higher than the long term mean. Both test weight and kernel weight are lower than 2001 values. The Falling Number value is lower than 2001. Milling yield is similar to last year while flour ash content is lower.

Farinograph absorption is slightly higher than last year in spite of lower protein content. This increase is probably associated with the higher starch damage value. Rheological tests demonstrate increased dough strength properties compared to 2001 and the long term average. Baking quality is similar to last year.

Table 3 • No. 1 Canada Western Red Spring wheat
Quality data for 2002 harvest survey grade composite samples

Quality parameter[1]	Minimum protein content		No. 1 CWRS 13.5	
	14.5	13.5	2001	1992–01 mean
Wheat				
Test weight, kg/hl	81.1	81.2	83.1	81.4
Weight per 1000 kernels, g	32.3	30.8	33.0	32.1
Protein content, %	14.7	13.8	13.8	13.7
Protein content, % (dry matter basis)	17.0	15.9	15.9	15.8
Ash content, %	1.52	1.54	1.57	1.56
α-amylase activity, units/g	4.0	8.5	2.0	4.7
Falling number, s	365	345	425	395
PSI, %	53	51	53	53
Milling				
Flour yield				
Clean wheat basis, %	74.8	74.9	75.8	75.7
0.50% ash basis, %	77.3	77.4	76.3	76.7
Flour				
Protein content, %	14.2	13.2	13.2	13.1
Wet gluten content, %	39.0	35.4	36.1	37.3[2]
Ash content, %	0.45	0.45	0.49	0.48
Grade colour	-1.7	-1.9	-2.0	-1.6
AGTRON colour, %	73	76	73	72[3]
Starch damage, %	8.2	8.5	8.1	7.2[4]
α-amylase activity, units/g	1.0	3.0	0.5	1.2
Amylograph peak viscosity, BU	580	520	670	690
Maltose value, g/100 g	2.6	2.7	2.6	2.2
Farinogram				
Absorption, %	68.5	67.5	66.7	65.5
Development time, min	6.75	6.0	5.0	5.25
Mixing tolerance index, BU	25	30	30	25
Stability, min	10.5	9.5	8.5	9.5
Extensogram				
Length, cm	21	21	21	22
Height at 5 cm, BU	355	370	310	295
Maximum height, BU	665	670	550	525
Area, cm^2	190	185	150	155
Alveogram				
Length, mm	117	121	105	120
P (height x 1.1), mm	131	130	120	108
W, x 10^{-4} joules	526	519	458	429
Baking (Canadian short process baking test)				
Absorption, %	72	72	71	70
Mixing energy, W–h/kg	14.4	13.8	12.0	10.0
Mixing time, min	9.7	9.8	9.0	8.1
Loaf volume, cm^3/100 g flour	1075	1045	1110	1100

[1] Unless otherwise specified, data are reported on a 13.5% moisture basis for wheat and a 14.0% moisture basis for flour.
[2] Mean of data generated starting in 1996
[3] Mean of data generated starting in 1993
[4] Mean of data generated starting in 1997

Table 4 • No. 2 Canada Western Red Spring wheat
Quality data for 2002 harvest survey grade composite samples

Quality parameter[1]	Minimum protein content		No. 2 CWRS 13.5	
	14.5	13.5	2001	1992–01 mean
Wheat				
Test weight, kg/hl	80.2	80.7	81.5	80.0
Weight per 1000 kernels, g	32.4	31.7	32.3	32.1
Protein content, %	14.7	13.8	13.7	13.7
Protein content, % (dry matter basis)	17.0	15.9	15.9	15.9
Ash content, %	1.65	1.62	1.70	1.63
α-amylase activity, units/g	6.5	6.0	4.0	8.9
Falling number, s	375	370	385	375
PSI, %	55	52	53	54
Milling				
Flour yield				
Clean wheat basis, %	75.0	75.6	75.6	75.4
0.50% ash basis, %	76.0	75.6	75.1	75.4
Flour				
Protein content, %	14.2	13.2	13.1	13.1
Wet gluten content, %	38.1	35.3	35.2	36.1[2]
Ash content, %	0.48	0.50	0.51	0.50
Grade colour	-1.2	-1.5	-1.8	-1.3
AGTRON colour, %	69	71	73	70[3]
Starch damage, %	8.6	8.5	8.0	6.8[4]
α-amylase activity, units/g	2.0	1.5	0.5	2.7
Amylograph peak viscosity, BU	430	480	675	555
Maltose value, g/100 g	2.6	2.8	2.6	2.2
Farinogram				
Absorption, %	68.3	67.3	66.1	65.3
Development time, min	6.25	6.25	5.0	5.0
Mixing tolerance index, BU	25	35	30	30
Stability, min	9.5	8.0	7.5	8.5
Extensogram				
Length, cm	24	21	21	22
Height at 5 cm, BU	325	335	300	285
Maximum height, BU	620	605	545	495
Area, cm^2	195	170	155	150
Alveogram				
Length, mm	122	109	114	124
P (height x 1.1), mm	120	133	119	103
W, x 10^{-4} joules	504	510	461	417
Baking (Canadian short process baking test)				
Absorption, %	72	71	71	70
Mixing energy, W–h/kg	15.8	15.0	13.8	10.7
Mixing time, min	10.3	10.2	9.4	8.4
Loaf volume, cm^3/100 g flour	1065	1050	1085	1085

1 Unless otherwise specified, data are reported on a 13.5% moisture basis for wheat and a 14.0% moisture basis for flour.
2 Mean of data generated starting in 1996
3 Mean of data generated starting in 1993
4 Mean of data generated starting in 1997

Table 5 • No. 3 Canada Western Red Spring wheat
Quality data for 2002 harvest survey grade composite samples

Quality parameter[1]	No. 3 CWRS		
	2002	2001	1992–01 mean
Wheat			
Test weight, kg/hl	78.1	79.8	79.0
Weight per 1000 kernels, g	31.8	32.4	32.1
Protein content, %	14.4	15.1	13.1
Protein content, % (dry matter basis)	16.6	17.6	15.2
Ash content, %	1.60	1.76	1.61
α-amylase activity, units/g	10.5	5.0	19.8
Falling number, s	340	390	333
PSI, %	54	54	54[4]
Milling			
Flour yield			
Clean wheat basis, %	74.7	74.8	75.0
0.50% ash basis, %	76.7	73.8	75.0
Flour			
Protein content, %	13.7	14.4	12.5
Wet gluten content, %	37.8	39.4	34.7[2]
Ash content, %	0.46	0.52	0.50
Grade colour	-0.7	-0.6	-1.0
AGTRON colour, %	67	64	69[3]
Starch damage, %	7.8	7.2	6.7[4]
α-amylase activity, units/g	5.5	2.0	8.3
Amylograph peak viscosity, BU	340	660	350
Maltose value, g/100 g	2.7	2.4	2.5
Farinogram			
Absorption, %	66.5	66.1	64.9
Development time, min	6.50	5.25	4.25
Mixing tolerance index, BU	30	40	35
Stability, min	8.5	7.5	8.0
Extensogram			
Length, cm	22	22	22
Height at 5 cm, BU	360	295	280
Maximum height, BU	610	535	470
Area, cm^2	190	165	140
Alveogram			
Length, mm	142	144	114
P (height x 1.1), mm	111	106	109
W, x 10^{-4} joules	517	448	398
Baking (Canadian short process baking test)			
Absorption, %	71	70	69
Mixing energy, W–h/kg	15.4	17.3	11.5
Mixing time, min	10.3	10.7	8.9
Loaf volume, cm^3/100 g flour	1115	1110	1065

1 Unless otherwise specified, data are reported on a 13.5% moisture basis for wheat and a 14.0% moisture basis for flour.
2 Mean of data generated starting in 1996
3 Mean of data generated starting in 1993
4 Mean of data generated starting in 1997

Comparative Buhler laboratory mill flour data

Samples of 2002 and stored 2001 harvest survey No. 1 and No. 2 CWRS wheat composites representing this year's expected major protein segregate (14.5%) were milled consecutively on the same day on the tandem Buhler laboratory mill into straight grade and 45% extraction patent flour. Data are shown in Tables 6 and 7.

No. 1 Canada Western Red Spring 14.5 composite

The 2002 No. 1 CWRS-14.5 composite (Table 6) shows somewhat inferior milling properties relative to last year. The straight grade flour from the 2002 composite shows lower flour yield, identical ash content and somewhat inferior flour colour values compared to 2001. The patent flour shows slightly higher ash and colour relative to last year. Starch damage values for the straight grade and patent flour are slightly higher compared to last year.

Farinograph data show higher absorption and stronger dough properties in both straight grade and patent flour. Good baking quality using both sponge and dough and Canadian short process procedures is evident for both straight grade and patent flour. Baking absorption is higher than last year while dough mixing requirements are somewhat shorter with the sponge and dough process and longer with the Canadian short process compared to last year.

No. 2 Canada Western Red Spring 14.5 composite

For straight grade milling, the 2002 No. 2 CWRS-14.5 composite (Table 7) shows similar milling yield, lower flour ash and somewhat inferior flour colour compared to the 2001 composite. Milling properties for 2002 and 2001 patent flours are very similar. Flour starch damage values for both flour types are slightly higher than last year.

Farinograph results show higher absorption and stronger dough properties for this year's composite. Canadian short process and sponge and dough baking properties for both flour types are generally similar to last year except for an increase in mixing requirements.

Table 6 • No. 1 Canada Western Red Spring wheat • 14.5% protein segregate
Comparative Buhler mill flour data • 2002 and 2001 harvest survey composites[1]

Quality parameter[2]	Straight grade		45% patent	
	2002	2001	2002	2001
Flour				
Yield, %	75.0	75.6	45.0	45.0
Protein content, %	14.2	14.1	13.0	13.1
Wet gluten content, %	39.4	39.0	36.1	36.2
Ash content, %	0.44	0.44	0.36	0.35
Grade colour	-1.8	-2.2	-3.7	-3.9
AGTRON colour, %	76	79	92	96
Amylograph peak viscosity, BU	635	765	740	N/A
Starch damage, %	6.2	6.0	6.6	6.4
Farinogram				
Absorption, %	64.8	63.2	64.4	62.9
Development time, min	6.25	5.50	8.25	6.25
Mixing tolerance index, BU	25	20	5	10
Stability, min	11.5	9.0	26.0	20.0
Sponge-and-dough baking test	**(40 ppm ascorbic acid)**		**(20 ppm ascorbic acid)**	
Absorption, %	67	65	66	65
Mixing: energy dough stage, W–h/kg	7.5	8.1	7.9	9.0
Mixing: time dough stage, min	6.6	6.9	7.8	8.4
Loaf volume, cm^3/100 g flour	1145	1170	1125	1120
Appearance	7.9	7.8	8.0	8.0
Crumb structure	6.0	5.8	6.0	6.0
Crumb colour	8.1	7.9	8.2	8.1
Canadian short process baking test	**(150 ppm ascorbic acid)**		**(150 ppm ascorbic acid)**	
Absorption, %	69	67	69	67
Mixing energy dough stage W–h/kg	18.9	17.0	15.2	13.1
Mixing time dough stage, min	11.9	10.1	10.2	8.6
Loaf volume, cm^3/100 g flour	1120	1165	1050	1080
Appearance	8.0	8.5	7.9	7.7
Crumb structure	6.0	6.0	6.0	6.2
Crumb colour	8.2	8.0	8.2	8.1

[1] The 2001 composite was stored and milled the same day as the 2002
[2] Data reported on 14.0% moisture basis
N/A Data not available

Table 7 • No. 2 Canada Western Red Spring wheat • 14.5% protein segregate
Comparative Buhler mill flour data • 2002 and 2001 harvest survey composites[1]

Quality parameter[2]	Straight grade		45% patent	
	2002	2001	2002	2001
Flour				
Yield, %	75.0	74.9	45.0	45.0
Protein content, %	14.1	14.3	13.1	13.2
Wet gluten content, %	39.0	39.3	35.6	37.1
Ash content, %	0.43	0.46	0.35	0.36
Grade colour	-1.6	-1.8	-3.7	-3.7
AGTRON colour, %	71	75	91	91
Amylograph peak viscosity, BU	540	710	680	800
Starch damage, %	5.9	5.7	6.3	6.1
Farinogram				
Absorption, %	64.0	62.8	63.3	61.8
Development time, min	6.25	5.75	6.75	6.00
Mixing tolerance index, BU	30	35	15	20
Stability, min	9.5	7.0	26.0	10.0
Sponge-and-dough baking test	**(40 ppm ascorbic acid)**		**(20 ppm ascorbic acid)**	
Absorption, %	66	65	64	63
Mixing: energy dough stage, W–h/kg	8.7	8.3	10.5	8.5
Mixing: time dough stage, min	7.2	6.9	9.0	8.0
Loaf volume, cm^3/100 g flour	1135	1135	1080	1075
Appearance	8.1	8.2	7.9	7.6
Crumb structure	5.7	6.2	5.9	6.0
Crumb colour	7.9	7.9	8.0	8.0
Canadian short process baking test	**(150 ppm ascorbic acid)**		**(150 ppm ascorbic acid)**	
Absorption, %	67	68	67	66
Mixing energy dough stage W–h/kg	19.3	15.3	17.9	14.2
Mixing time dough stage, min	11.8	9.5	11.2	8.9
Loaf volume, cm^3/100 g flour	1095	1115	1110	1120
Appearance	8.1	7.9	7.8	7.5
Crumb structure	6.3	6.2	6.3	6.3
Crumb colour	7.8	7.8	7.8	7.9

[1] The 2001 composite was stored and milled the same day as the 2002
[2] Data reported on 14.0% moisture basis
N/A Data not available

Noodle evaluation 2002

Canada Western Red Spring

No. 1 and No. 2 CWRS from the 2002 and 2001 crop composites, at both 13.5 and 14.5% protein, were milled on the G.R.L. Tandem Buhler mill to produce a patent flour (60% yield on a clean wheat basis) and a straight grade flour. Yellow alkaline noodles were prepared with a 1% *kansui* reagent (9:1 sodium and potassium carbonates) at a 32% water absorption level. Noodles were prepared in a temperature and humidity controlled room maintained at 23°C +/-2.0°C with relative humidity at 50% +/-2.0%. Results are found in Tables 8-11.

No. 1 Canada Western Red Spring composite

Yellow alkaline noodles prepared from either the 2002 No. 1 14.5% (Table 8) or 13.5% (Table 9) protein CWRS crop composites, patent (60%) or straight grade flours, displayed similar raw noodle brightness, L* values, at both 2 and 24 hours after production as did those of 2001. A slight reduction in noodle yellowness, b*, was observed with noodles prepared from 13.5% protein straight grade flour.

Cooked noodle brightness and yellowness were equivalent to last year in all samples with a slight improvement in noodle redness, a* values, being noted in the 2002 noodles. While a slight improvement in noodle "bite" (MCS) was observed for 13.5% protein noodles, all other textural attributes of the cooked noodles were comparable to last year.

No. 2 Canada Western Red Spring composite

Fresh yellow alkaline noodles prepared from No. 2 14.5% (Table 10) and 13.5% (Table 11) CWRS 2002 crop composite 60% patent and straight grade flours displayed comparable colour characteristics to their corresponding 2001 samples at both 2 and 24 hours post production.

No appreciable difference was detected in cooked alkaline noodle colour between years for either patent or straight grade flours at either protein level. Cooked noodle texture prepared from the No. 2 14.5% patent and straight grade flours exhibited improved bite (MCS) and slightly improved chewiness (RTC) values as compared to 2001. Noodles from either flour prepared at the 13.5% protein level were comparable in texture to last year.

Table 8 • No. 1 Canada Western Red Spring wheat - 14.5% protein segregate
Comparative noodle quality data • 2002 and 2001 harvest survey composite samples[1]

Quality parameter[2]	60% patent		Straight grade	
	2002	2001	2002	2001
Flour				
Flour yield (clean basis), %	60	60	75.0	75.6
Protein content, %	13.5	13.6	14.2	14.1
Wet gluten content, %	37.4	37.1	39.4	39.0
Ash content, %	0.34	0.35	0.44	0.44
Grade colour, K-J units	-3.2	-3.6	-1.8	-2.2
AGTRON colour, %	88	92	76	79
Starch damage, Megazyme %	6.4	6.3	6.2	6.0
Amylograph peak viscosity, BU	N/A	N/A	635	765
Farinogram				
Absorption, %	64.2	63.0	64.8	63.2
Development time, min	7.50	6.25	6.25	5.50
Mixing tolerance index, BU	10	20	25	20
Stability, min	27.0	16.5	11.5	9.0
Fresh alkaline noodles				
Raw colour at 2 h (24 h)				
Brightness, L*	80.9 (75.8)	81.7 (76.3)	77.2 (70.2)	77.7 (71.0)
Redness, a*	0.25 (0.25)	0.24 (0.17)	0.38 (0.85)	0.43 (0.80)
Yellowness, b*	26.3 (27.5)	26.7 (27.1)	28.1 (27.8)	29.0 (27.5)
Cooked colour				
Brightness, L*	70.1	71.0	67.8	69.0
Redness, a*	-2.33	-2.23	-1.88	-1.73
Yellowness, b*	26.5	26.5	26.4	26.7
Texture				
Thickness, mm	2.50	2.51	2.53	2.52
RTC, %	33.4	33.8	34.2	34.0
Recovery, %	26.4	27.1	27.6	27.8
MCS, g/mm^2	32.7	32.9	34.6	33.5

[1] The 2001 composites were stored and milled the same day as the respective 2002 composite and replicated the following day in reverse order.

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

NA Data not available

Table 9 • No. 1 Canada Western Red Spring wheat - 13.5% protein segregate
Comparative noodle quality data • 2002 and 2001 harvest survey composite samples[1]

Quality parameter[2]	60% patent		Straight grade	
	2002	2001	2002	2001
Flour				
Flour yield (clean basis), %	60	60	74.9	75.0
Protein content, %	12.4	12.5	13.2	13.1
Wet gluten content, %	34.7	34.5	35.8	35.5
Ash content, %	0.37	0.36	0.44	0.44
Grade colour, K-J units	-3.7	-4.0	-2.3	-2.6
AGTRON colour, %	91	94	79	82
Starch damage, Megazyme %	6.7	6.6	6.4	6.4
Amylograph peak viscosity, BU	N/A	N/A	605	745
Farinogram				
Absorption, %	63.1	62.0	63.1	62.0
Development time, min	7.00	6.25	6.25	5.25
Mixing tolerance index, BU	15	15	30	25
Stability, min	27.0	20.0	10.0	9.0
Fresh alkaline noodles				
Raw colour at 2 h (24 h)				
Brightness, L*	81.9 (77.4)	82.3 (77.5)	78.7 (72.5)	78.9 (72.5)
Redness, a*	0.08 (0.14)	0.09 (0.17)	0.23 (0.66)	0.23 (0.66)
Yellowness, b*	27.1 (28.1)	27.4 (28.1)	28.4 (28.1)	29.2 (28.5)
Cooked colour				
Brightness, L*	69.4	69.9	68.5	69.1
Redness, a*	-2.33	-2.15	-2.05	-1.92
Yellowness, b*	27.7	27.9	27.5	27.4
Texture				
Thickness, mm	2.35	2.35	2.41	2.39
RTC, %	32.4	32.5	33.4	32.7
Recovery, %	24.7	25.7	26.2	26.0
MCS, g/mm^2	29.2	28.9	30.0	28.5

1 The 2001 composites were stored and milled the same day as the respective 2002 composite and replicated the following day in reverse order.

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

NA Data not available

Table 10 • No. 2 Canada Western Red Spring wheat - 14.5% protein segregate
Comparative noodle quality data • 2002 and 2001 harvest survey composite samples[1]

Quality parameter[2]	60% patent		Straight grade	
	2002	2001	2002	2001
Flour				
Flour yield (clean basis), %	60	60	75.0	74.9
Protein content, %	13.4	13.6	14.1	14.3
Wet gluten content, %	37.5	38.4	39.0	39.3
Ash content, %	0.37	0.38	0.43	0.46
Grade colour, K-J units	-3.2	-3.3	-1.6	-1.8
AGTRON colour, %	87	88	71	75
Starch damage, Megazyme %	6.1	6.0	5.9	5.7
Amylograph peak viscosity, BU	660	810	540	710
Farinogram				
Absorption, %	63.0	62.4	64.0	62.8
Development time, min	7.25	6.25	6.25	5.75
Mixing tolerance index, BU	20	30	30	35
Stability, min	18.0	8.5	9.5	7.0
Fresh alkaline noodles				
Raw colour at 2 h (24 h)				
Brightness, L*	80.1 (75.4)	80.3 (75.3)	76.6 (70.8)	77.2 (70.0)
Redness, a*	0.44 (0.62)	0.48 (0.65)	0.57 (1.02)	0.56 (1.16)
Yellowness, b*	26.5 (27.9)	27.2 (27.4)	28.2 (27.4)	28.0 (27.3)
Cooked colour				
Brightness, L*	69.7	69.5	67.7	68.1
Redness, a*	-2.37	-2.28	-1.90	-1.86
Yellowness, b*	26.3	26.0	25.9	25.8
Texture				
Thickness, mm	2.48	2.45	2.50	2.47
RTC, %	33.2	32.7	33.8	32.8
Recovery, %	25.5	24.9	25.7	25.6
MCS, g/mm^2	33.2	31.8	34.3	31.3

1 The 2001 composites were stored and milled the same day as the respective 2002 composite and replicated the following day in reverse order.

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

Table 11 • No. 2 Canada Western Red Spring wheat - 13.5% protein segregate
Comparative noodle quality data • 2002 and 2001 harvest survey composite samples[1]

	60% patent		Straight grade	
Quality parameter[2]	2002	2001	2002	2001
Flour				
Flour yield (clean basis), %	60	60	75.2	74.8
Protein content, %	12.6	12.7	13.1	13.1
Wet gluten content, %	34.1	34.2	35.5	36.3
Ash content, %	0.36	0.37	0.44	0.46
Grade colour, K-J units	-3.4	-3.8	-1.8	-2.3
AGTRON colour, %	88	91	74	77
Starch damage, Megazyme %	6.5	6.3	6.3	6.0
Amylograph peak viscosity, BU	675	780	535	980
Farinogram				
Absorption, %	62.5	61.9	63.1	62.5
Development time, min	6.50	5.75	5.75	5.25
Mixing tolerance index, BU	20	25	35	35
Stability, min	14.0	11.0	8.5	7.5
Fresh alkaline noodles				
Raw colour at 2 h (24 h)				
Brightness, L*	81.0 (76.7)	81.4 (76.6)	77.5 (71.8)	77.8 (71.1)
Redness, a*	0.34 (0.45)	0.26 (0.50)	0.41 (0.89)	0.41 (1.1)
Yellowness, b*	27.3 (28.4)	27.0 (28.2)	29.2 (28.5)	28.8 (28.2)
Cooked colour				
Brightness, L*	69.5	70.2	67.7	68.7
Redness, a*	-2.29	-2.26	-1.84	-1.95
Yellowness, b*	27.4	26.9	27.1	26.6
Texture				
Thickness, mm	2.44	2.41	2.42	2.41
RTC, %	32.9	32.6	33.0	32.4
Recovery, %	24.6	24.4	24.7	24.7
MCS, g/mm^2	30.3	29.4	30.4	29.5

1 The 2001 composites were stored and milled the same day as the respective 2002 composite and replicated the following day in reverse order.

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

Canada Western Amber Durum wheat

Protein and variety survey

Table 12 lists the mean protein content values for Canada Western Amber Durum (CWAD) wheat by grade. Comparative values by grade are shown for 2001 and for the previous 10 years (1992-2001). Figure 3 shows the variation in annual mean protein content since 1963.

The average protein content of the 2002 durum crop is 13.3%, which is 0.8% lower than 2001 but 1.0% above the 10 year mean. Protein content for No. 1 increased by 0.3% but No. 2 CWAD and 3 CWAD showed decreases of 0.6 and 1.2%, respectively, compared to 2001 values. Protein content of No. 4 CWAD was comparable to that of No 3 CWAD at 13.2%. Annual mean protein content values since 1963 (Fig. 3) show that this quality factor is highly variable, mostly in response to environmental conditions.

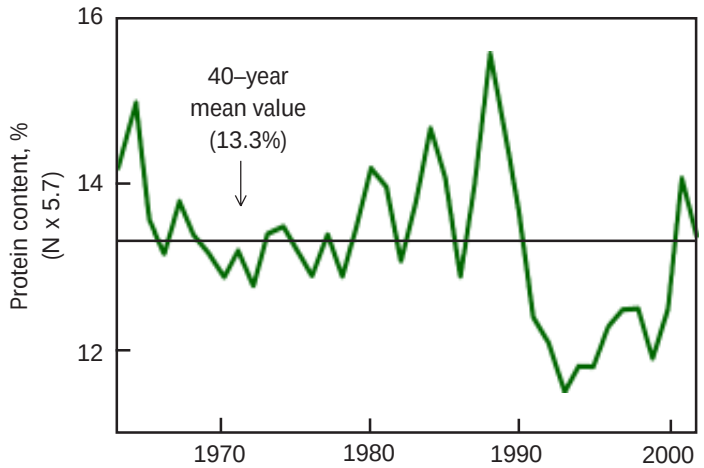
Preliminary Canadian Wheat Board 2002 variety survey information shows that Kyle remains the most popular variety grown on the prairies at 52% of acreage, a drop of 8% from 2001. AC Avonlea has increased to 24% while AC Morse represents about 13% of acreage seeded. Electrophoretic analysis of grade composites confirmed the decrease in popularity of Kyle and the increasing popularity of AC Avonlea.

Table 12 • Mean protein content of Canada Western Amber Durum wheat, by grade and year

	Protein content, %[1]		
Grade	2002	2001	1992-2001
No. 1 CWAD	14.3	14.0	12.7
No. 2 CWAD	13.4	14.0	12.2
No. 3 CWAD	13.2	14.4	12.1
All milling grades	**13.3**	**14.1**	**12.3**

[1] N x 5.7; 13.5% moisture basis

Figure 3 • Mean protein content of harvest survey Canada Western Amber Durum wheat–1963 to 2002



Wheat and pasta processing quality

Data describing the quality characteristics for composite samples of No. 1 to 4 CWAD for the 2002 crop are shown in Tables 13-14. Corresponding data for 2001 composites and mean values for the previous ten years (1992-2001) are provided for comparison for the top 3 grades. Insufficient historical data for No. 4 CWAD precluded comparison of current and previous year's data.

Physical characteristics of the top three grades of the 2002 crop show a decrease in test weight and vitreous kernel counts compared to last year. Falling numbers in the wheat and semolina of these grades are lower than 2001 values, indicative of poor growing and harvest conditions. The major grading factors in the 2002 crop year are mildew, sprout, hard vitreous kernel count, and green kernels.

Wet gluten content for the top two grades is similar for 2002 and the previous crop year. SDS sedimentation volumes are lower in 2002, which may be partially related to the lower protein content, as well as suggesting a decrease in gluten strength. In contrast, higher gluten index and alveograph P and W values denote stronger gluten strength properties. Strength parameters for No. 3 and 4 CWAD are similar. As noted in 2001, environmental conditions appear to be differentially influencing strength parameters such as SDS sedimentation, gluten index and alveograph P/L. These results further highlight the need to use more than one method to evaluate gluten strength.

Milling quality, as shown by semolina milling yield, decreased slightly from last year for the top three grades but was higher than the long-term average. Values, on a clean wheat basis, decreased as expected on going from No. 1 to No. 4 CWAD. Wheat and semolina ash values are similar to 2001.

Wheat and semolina yellow pigment values are lower than last year and the long-term averages for the top three grades. No. 3 and 4 CWAD are comparable in pigment content. The decrease in pigment content also resulted in decreased b* values in the semolina and in the dried spaghetti. The lower spaghetti b* values may also have been influenced by oxidative enzymes such as lipoxygenase whose levels may have increased over last season due to poor harvest conditions.

Cooking quality for the top two grades is superior to last year, as indicated by higher firmness (peak force) and CQP values. The improvement in these values may be associated with the increase in gluten strength illustrated by alveograph and gluten index values. Cooking quality for No. 3 CWAD was comparable to 2001 results when considering CQP values but showed a decrease in firmness, which is probably a result of a decrease in protein concentration. No. 3 and 4 CWAD had comparable cooking qualities.

Table 13• No. 1 and No. 2 Canada Western Amber Durum wheat Quality data for 2002 harvest survey grade composite samples

Quality parameter[1]	No. 1 CWAD 2002	No. 1 CWAD 2001	No. 1 CWAD 1992-01 mean	No. 2 CWAD 2002	No. 2 CWAD 2001	No. 2 CWAD 1992-01 mean
Wheat						
Test weight, kg/hl	81.8	82.8	82.1	80.6	83.1	81.9
Weight per 1000 kernels, g	44.4	42.7	42.5	43.4	43.6	42.8
Hard vitreous kernels, %	85	95	89	76	94	80
Protein content, %	14.2	14.1	12.7	13.4	14.0	12.3
Protein content, % (dry matter basis)	16.4	16.3	14.8	15.5	16.2	14.3
SDS sedimentation, ml	33	40	37	29	38	33
Ash content, %	1.60	1.52	1.55	1.65	1.64	1.60
Yellow pigment content, ppm	7.8	8.3	8.4	7.7	8.5	8.4
Falling number, s	330	430	410	280	405	385
Milling yield, %	75.8	74.5	74.2	75.9	75.9	74.2
Semolina yield, %	66.3	66.9	65.9	66.4	67.9	65.4
PSI, %	38	37	37[2]	38	39	38[2]
Semolina						
Protein content, %	13.1	12.9	11.8	12.1	12.9	11.3
Wet gluten content, %[4]	35	34	32[2]	33	33	30[2]
Dry gluten content, %[4]	12.1	11.9	11.7[2]	11.5	11.5	11.6[2]
Gluten index, %[4]	26	14	28[3]	30	16	25[3]
Ash content, %	0.67	0.65	0.65	0.67	0.69	0.66
Yellow pigment content, ppm	7.5	8.1	7.8	7.1	8.2	7.6
AGTRON colour, %	76	78	80	76	74	79
Minolta colour:						
Brightness, L*	87.3	87.5	88.1[3]	87.4	87.5	87.7[3]
Redness, a*	-3.0	-2.8	-3.1[3]	-2.9	-2.8	-3.2[3]
Yellowness, b*	31.6	32.9	33.3[3]	30.1	32.6	32.9[3]
Speck count per 50 cm^2	30	27	26	38	29	31
Falling number, s	370	505	485	355	510	455
Alveogram						
Length, mm	81	94	87[3]	81	87	88[3]
P (height x 1.1), mm	61	53	47[3]	59	52	44[3]
P/L	0.8	0.6	0.5[3]	0.7	0.6	0.5[3]
W x 10^{-4} joules	131	121	110[3]	125	111	101[3]
Spaghetti						
Dried at 70°C						
Minolta colour:						
Brightness, L*	75.6	76.9	78.8[3]	75.3	76.0	78.6[3]
Redness, a*	2.9	3.6	1.8[3]	3.5	4.1	2.0[3]
Yellowness, b*	60.8	67.3	67.7[3]	60.5	65.9	66.9[3]
Cooking quality, CQP	58	34	34	50	37	33
Firmness, g/cm	1086	996	-	983	974	-

1 Unless otherwise specified, data are reported on a 13.5% moisture basis for wheat and a 14.0% moisture basis for semolina.
2 Mean of data generated starting in 1995
3 Mean of data generated starting in 1997
4 As of 1998, AACC Method 38-12A has been used to determine Wet gluten content and Gluten index

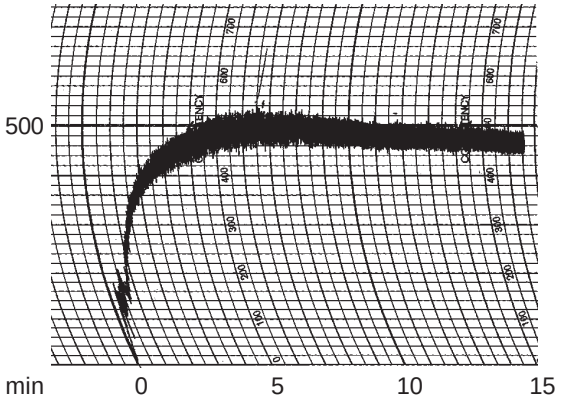
Table 14• No. 3 and No. 4 Canada Western Amber Durum wheat Quality data for 2002 harvest survey grade composite samples[1]

Quality parameter[2]	No. 3 CWAD 2002	No. 3 CWAD 2001	No. 3 CWAD 1992-01 mean[3]	No. 4 CWAD 2002
Wheat				
Test weight, kg/hl	79.7	82.5	80.7	78.6
Weight per 1000 kernels, g	42.3	40.3	46.2	41.8
Hard vitreous kernels, %	69	90	64	52
Protein content, %	13.4	14.3	12.0	13.2
Protein content, % (dry matter basis)	15.4	16.6	14.0	15.3
SDS sedimentation, ml	28	37	30	29
Ash content, %	1.67	1.70	1.62	1.66
Yellow pigment content, ppm	7.8	8.6	8.2	7.9
Falling number, s	265	410	350	240
Milling yield, %	75.3	75.2	74.2	75.0
Semolina yield, %	66.2	67.2	64.4	65.8
PSI, %	38	39	39[4]	38
Semolina				
Protein content, %	12.0	13.4	11.1	12.1
Wet gluten content, %[5]	31.8	34.0	29.6[4]	31.7
Dry gluten content, %[5]	10.9	11.7	11.2[4]	10.8
Gluten index, %[6]	30	7	-	31
Ash content, %	0.69	0.72	0.67	0.69
Yellow pigment content, ppm	7.0	8.1	7.4	7.1
AGTRON colour, %	73	70	77	70
Minolta colour:				
Brightness, L*	87.0	86.7	87.6[6]	87.0
Redness, a*	-2.8	-2.7	-3.0[6]	-2.8
Yellowness, b*	30.2	32.4	31.8[6]	30.1
Speck count per 50 cm^2	42	35	41	51
Falling number, s	320	470	410	305
Alveogram				
Length, mm	75	96	-	80
P (height x 1.1), mm	62	46	-	61
P/L	0.8	0.5	-	0.8
W x 10^{-4} joules	126	99	-	128
Spaghetti				
Dried at 70°C				
Minolta colour:				
Brightness, L*	74.9	75.1	-	74.6
Redness, a*	3.4	5.0	-	3.9
Yellowness, b*	59.1	64.8	-	58.4
Cooking quality, CQP	35	32	28	37
Firmness, g/cm	822	970	-	834

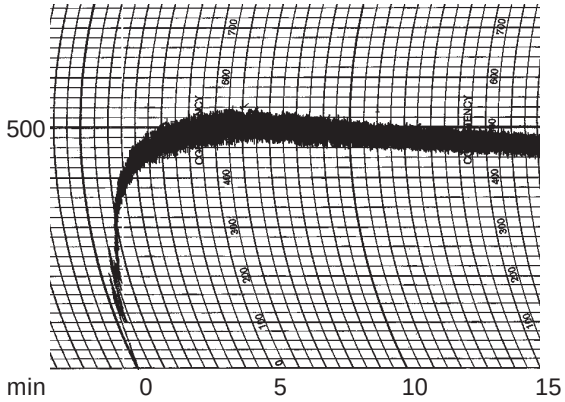
1 Insufficient data for 4 CWAD to generate a column for 2001 or to provide a meaningful average for 1992-2001
2 Unless otherwise specified, data are reported on a 13.5% moisture basis for wheat and a 14.0% moisture basis for semolina.
3 Mean does not include data for 1998 as there were too few samples submitted to produce a composite.
4 Mean of data generated starting in 1995
5 As of 1998, AACC Method 38-12A has been used to determine wet gluten content, dry gluten content and gluten index.
6 Mean of data generated starting in 1997

Farinograms
2002 crop composite samples

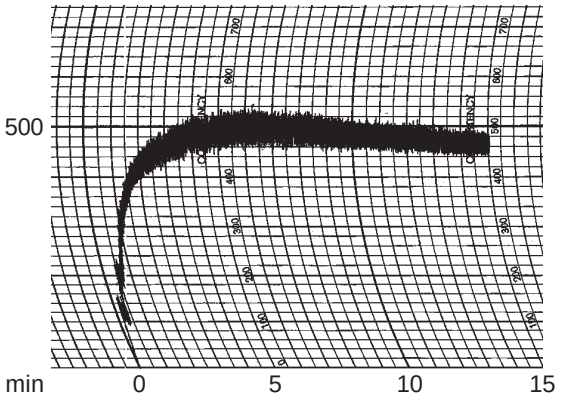
No. 1 Canada Western Red Spring wheat • 14.5



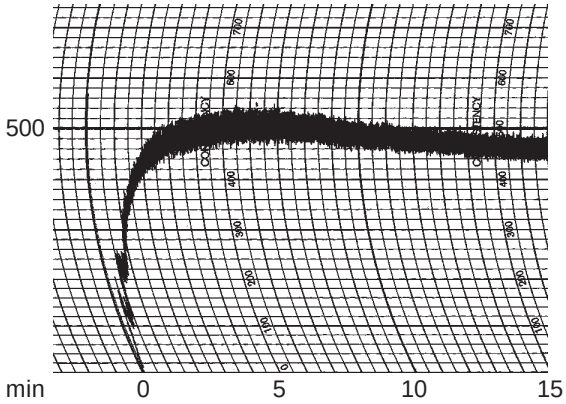
No. 1 Canada Western Red Spring wheat • 13.5



No. 2 Canada Western Red Spring wheat • 14.5



No. 2 Canada Western Red Spring wheat • 13.5



No. 3 Canada Western Red Spring wheat