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Quality of western Canadian malting barley 2006

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Quality Innovation Service

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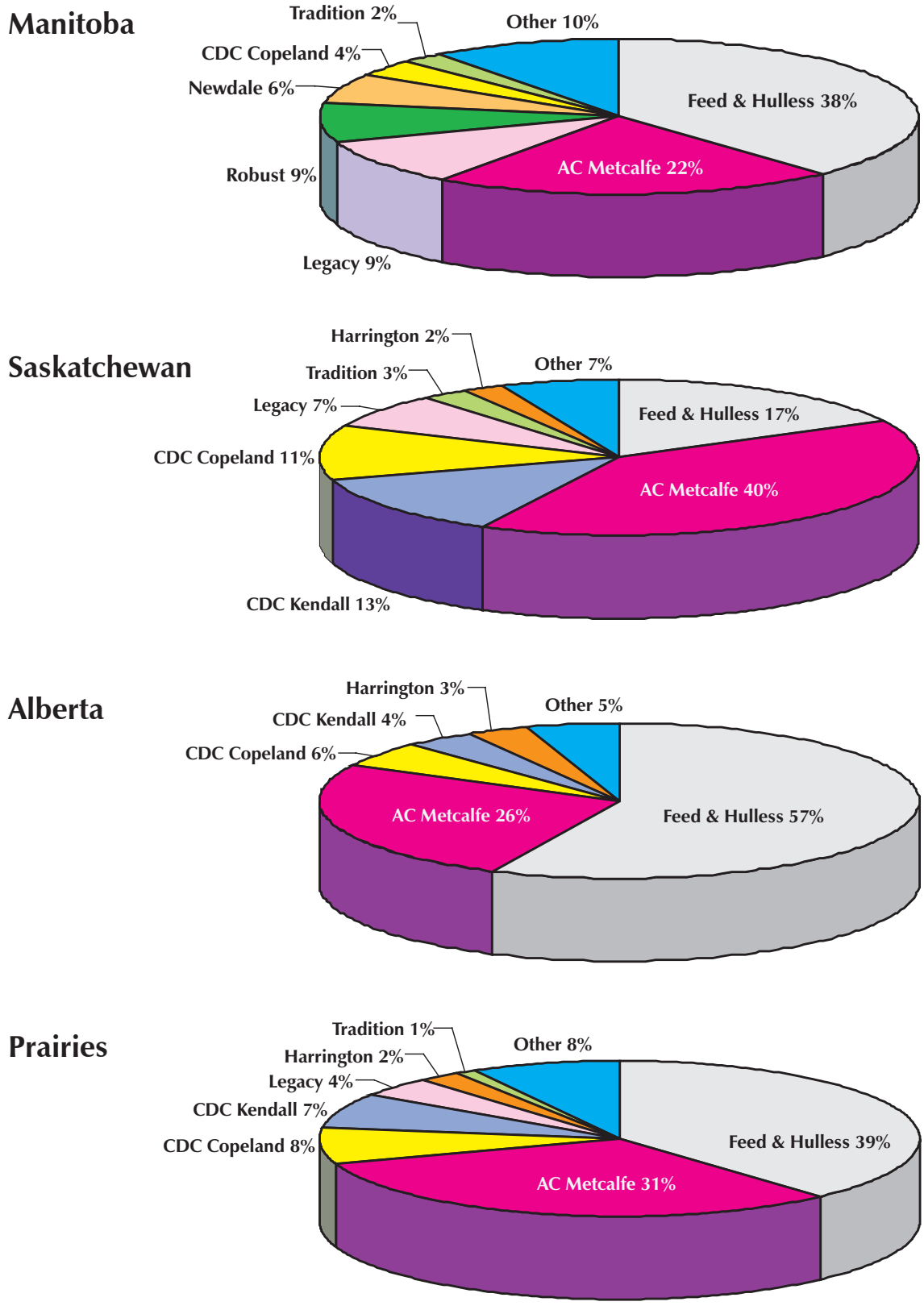
Figure 1 - Distribution of barley cultivars in 2006 by region (as a percentage of total barley seeded acreage)[1]



[1]Data obtained from the CWB Variety Survey 2006.

ABSTRACT

The quality data for the 2006 harvest was derived from 94 separate varietal composites, representing a total of 885,000 tonnes of barley selected for malting purposes. Selection rates in 2006 were relatively high, despite a generally hot and dry growing season, and expectations of elevated protein levels and decreased plumpness were largely unrealized. Manitoba experienced its best year for barley quality and volume for many years. Due to early seeding and hot dry growing season, the eastern prairie region also did not have a serious problem with Fusarium infestation.

Barley crop volume for 2006, at 9,256,000 tonnes, was about 20% lower than 2005, and 15% lower than the 10 year average of 10,997,000 tonnes. This was largely attributable to lower seeded acreages in north-east Saskatchewan due to wet conditions during the seeding period. South-west Saskatchewan and southeastern Alberta suffered from lack of moisture during seeding which also lowered the acreage seeded to barley. Barley yields were also lower than average in many areas.

In general, barley quality in 2006 was improved over that of 2005 barley. Thousand kernel weights and kernel plumpness levels were slightly lower than those of 2005, while protein levels were good, being similar to slightly higher than levels in 2005. Barley colour and appearance in 2006 was very good. Barley germination characteristics in 2006 were significantly improved over those of 2005 barley, where lowered germination energy levels and some water sensitivity was present.

Malt made from 2006 barley was of good quality with moderate levels of soluble protein, adequate enzyme levels, and low wort beta-glucan, viscosity, and colour. Extract levels were slightly lower than expected, given the relatively low barley protein. Modification rates were somewhat slower, likely due to slower uptake of water during steeping.
Overall, the 2006 malting barley crop was one of the best in recent years.

Introduction

The 2006 Malting Barley Survey is the 19th consecutive survey conducted in this format. The report is dependant on receipt of representative varietal composite samples which have been selected for domestic processing or for export as malting barley. Industry participation in preparing and submitting these composites is essential for completion of a successful survey. Submitted barley samples are analyzed for quality and then micromalted. Malt quality is analysed using ASBC standard methods of analysis.

The charts in Figure 1 illustrate the percentage of barley cultivars grown in Western Canada. AC Metcalfe, the dominant 2-rowed variety, occupied over 30% of total barley acreage, and nearly 60% of two-rowed malting barley acreage. In 2006, the production of Legacy increased to become the dominant six-rowed malting variety. Tradition, a newer 6-rowed variety, also underwent a significant increase in production this year. Cultivars which have fallen out of favor in the past few years are in the “other” category, and include Stein, CDC Stratus, Merit, CDC Sisler, and B1602. Newer cultivars such as Newdale, Calder, Lacey, CDC Select, CDC Battleford, CDC Yorkton, and CDC Tisdale did not yet reach significant acreages, and were also included in the “other” category.

This year's report focuses on the heritage and characteristics of the major varieties which make up the portfolio of malting barley varieties now being selected in Canada. In the past 10 to 15 years there have been significant changes in the types grown, their quality profiles, and in the varieties selected for malting purposes. (Tables 1 & 2)

Table 1 - Malting barley cultivars recommended for production in western Canada by the CMBTC, its members, and others in the Canadian barley industry (2007-2008)

Recommended two-rowed malting varieties

Variety	Domestic	Export	Market outlook
AC Metcalfe	Established	Established	Stable, high demand
CDC Copeland	Growing	Growing	Increasing demand
CDC Kendall	Established	Growing	Stable demand
Harrington	Established	Established	Decreasing demand
Newdale	Limited	Limited	Low demand

Recommended six-rowed barley varieties

Variety	Domestic	Export	Market outlook
Legacy	Growing	Growing	Increasing demand
Tradition	Limited	Growing	Increasing demand
Excel	Limited	Limited	Declining demand
Robust	Limited	Limited	Declining demand
Lacey	Limited	Limited	Stable demand

Table 2 - Seeded acres of malting barley cultivars (percentage of total area seeded to malting barley)[1]

Two-rowed cultivars				Six-rowed cultivars			
	2006	2005	2002-2006 average		2006	2005	2002-2006 average
AC Metcalfe	50.9	48.9	40.8	Excel	1.9	3.4	4.2
CDC Kendall	11.5	13.7	11.6	Legacy	6.9	3.4	2.9
CDC Copeland	12.3	11.0	6.4	Robust	2.8	2.1	4.8
Harrington	3.6	7.6	12.6	Lacey	1.4	0.9	0.5
Merit	1.4	1.7	3.2	Tradition	2.0	0.3	0.5
Stein	0.6	1.6	2.7	CDC Battleford	0.2	0.2	0.2
CDC Stratus	1.4	1.4	4.2	B1602	0.1	0.2	1.2
Other	0.3	1.4	1.6	Other	0.3	0.2	0.5
Newdale	1.9	1.2	0.7	CDC Yorkton	0.0	0.2	0.1
AC Bountiful	0.0	0.2	0.1	CDC Sisler	0.1	0.1	0.4

[1]Data obtained from the CWB Variety Survey 2006.

AC Metcalfe, a cross of Oxbow x Manley, was fully registered in 1997, and was crossed by Dr. R. Metcalfe at AAFC Winnipeg, and by Dr. W. Legge at AAFC Brandon. It has higher yield and earlier maturity than Manley, with good disease resistance and lodging resistance. Malting characteristics include improved peeling resistance, higher extract levels, higher enzyme levels, low wort beta-glucan, and faster modification rates. These factors translate into good brewing performance, with fast lautering and conversion times, and suitability for use in higher adjunct brewing. AC Metcalfe is now the most popular two-rowed variety, occupying over 50% of all two-rowed malt barley acreage.

CDC Kendall, a cross of Manley x SM85221, was registered in 1999, and was developed by Dr. B. Harvey, Crop Development Centre, University of Saskatchewan. It has higher yield, average maturity, and good lodging and shattering resistance compared to standard two-rowed check varieties. CDC Kendall has good resistance to peeling, average extract and soluble protein, and higher enzyme levels. It has very low wort beta-glucan and modification similar to Harrington. CDC Kendall is seen as a suitable replacement for Harrington, but with much higher DP, which also makes it suitable for higher adjunct brewing. Improved husk retention also helps with filtration in the lautering vessel. CDC Kendall has established a stable production level of nearly 15% of two-rowed malt acreage.

CDC Copeland, a two-rowed cross of WM861-5/TR118, registered in 1999, was developed by Dr. B. Harvey, Crop Development Centre, University of Saskatchewan. It is a high yielding, early maturing variety, with good resistance to disease and lodging. CDC Copeland processes easily and modifies similarly to Harrington, with similar extract and enzyme levels, but has lower soluble protein, lower colour, and lower wort beta-glucan than Harrington. It has good overall brewing characteristics, and with its quality and lower modification profile, provides an excellent balance in the portfolio of malting barley varieties. CDC Copeland production levels have risen to levels similar to CDC Kendall.

Harrington, a two-rowed cross of Klages/Gazelle/Betzes/Centennial, was fully registered in 1984, and was developed by Dr. B. Harvey, Crop Development Centre, University of Saskatchewan. Harrington occupied a position of dominance in the Canadian two-rowed barley sector for almost two decades, due to its popularity amongst both domestic and foreign maltsters and brewers. Although still grown in significant quantities, its production levels have decreased remarkably in the last few years. It has average yield and is relatively early maturing. It has poor disease resistance and poor resistance to peeling. Malt modification parameters are moderate across the board, with modification profiles that are very forgiving and flexible. This has been a key to its enduring popularity. End users still ask for this variety, but due to declining agronomic performance, available quantities are in steep decline.

Legacy, a six-rowed barley, a cross of Excel/Bumper/Karl/Manker, was registered in 2002, and was developed by Dr. B. Cooper, Busch Agricultural Resources Inc., Ft. Collins, CO, USA. It has very good yield potential, maturity similar to CDC Sisler, 2-3 days later than Robust, and 1 day later than Excel. Legacy has fair lodging resistance, low grain protein, and better disease resistance than most other six-rowed varieties. Malt characteristics include higher extract and enzyme levels, lower wort beta-glucan, and faster modification rates. Legacy has shown satisfactory brewhouse performance, with fast conversion times and satisfactory lautering times. Legacy's high enzyme package makes it ideal for high adjunct brewing. Legacy now occupies more than 40% of acreage devoted to six-rowed malting barley in western Canada.

Tradition, a six-rowed barley, a cross of 6B89-2126/ND10981, received full registration in Canada in 2004. It was developed by Dr. B. Cooper, Busch Agricultural Resources Inc., Ft. Collins, CO, USA. Tradition has good yield potential, better kernel plumpness, and better lodging resistance than B1602 or CDC Sisler. Tradition has higher extract, and higher levels of DP with adequate alpha amylase levels, when compared to B1602 or CDC Sisler. Soluble protein levels are intermediate between B1602 and CDC Sisler. Tradition has satisfactory brewhouse performance, with fast conversion times and satisfactory lautering times. Its higher enzyme package makes it ideal for high adjunct brewing, similar to Legacy. Tradition is now being grown in increasing quantities in western Canada.

Growing and harvesting conditions

Seeding

The soil moisture supply in Western Canada was good-to-excellent in most regions for seeding of the 2006 crop, although excess moisture caused delays in northern Saskatchewan. The source of the excess moisture was precipitation received during the 2005 harvest season, as the winter precipitation was generally below normal. The exception to this winter precipitation trend was in northeastern Saskatchewan, which received near record amounts of snowfall during the winter. The combination of above-normal snowfall and excessively wet soils from the fall precipitation caused planting delays in northeastern Saskatchewan. Conversely, the southwestern areas of Saskatchewan and the Peace River region were quite dry during the seeding period. This caused some seeding delays, as farmers waited for rainfall before seeding crops.

Seeding began in the southern areas of the Prairies at the end of April, with slow progress reported until the second week of May. Progress rapidly accelerated during the middle of May and reached 75-per-cent completion by May 22. Planting progress slowed during the next few weeks as heavy rains fell in the northern growing areas of Saskatchewan. Seeding continued in northern Saskatchewan into the third week of June, but farmers were unable to plant all the intended area to annual crops. Approximately 800 000 hectares were left fallow due to the wet conditions in northeastern Saskatchewan. Temperatures were mostly above normal during seeding, which resulted in rapid germination and emergence of the crop. Crops in the southern and central Prairies were about one week ahead of normal development by the end of June.

Growing Season

The above-normal temperatures experienced during the spring continued through the months of July and August. Average monthly temperatures were generally one-to-four degrees above normal across the Prairies, with the largest deviations seen in the eastern growing areas. Maximum temperature deviations were even higher, but relatively cool evening temperatures helped crops survive the hot weather. Precipitation amounts were well below normal in all areas of the Prairies during the July-through-August period. Southern and central areas received between 25 and 50 per cent of normal precipitation, while northern growing areas received between 50 and 75 per cent of normal. The combination of hot temperatures and a lack of moisture stressed crops and lowered yield potential. The dry conditions did keep disease pressure in the crop to a minimum and the stressful conditions advanced crop development two-to-three weeks ahead of normal in most growing areas. The northeastern areas of Saskatchewan were an exception to this trend, as crop development was close to normal due to the late planting during the spring. Spring cereal harvest was early and most regions were beginning to harvest by mid-August.

Harvest

The early start to the harvest was a sharp contrast to the delayed harvests of the previous two growing seasons. The hot, mostly dry conditions experienced during August resulted in rapid maturation of cereal crops. Spring wheat and barley harvesting proceeded rapidly in the second half of August, and approximately 40 per cent of the spring cereal crops were

harvested at the end of August. The dry, warm conditions continued into September, which allowed 90 per cent of barley crops to be harvested by mid-month. Cooler, wet conditions prevailed in the last half of September, which slowed the harvest and prevented completion of the harvest until October.

Production, Yields and Quality

The area seeded to barley in western Canada decreased by 24% in 2006. Production levels of malting barley in Western Canada in 2006 were 15% lower than the 10 year average (Table 3), with yields significantly lower than in 2005. Excess rainfall in some areas and lack of moisture in other areas resulted in some loss of seeded acreage. A warm, dry growing season and relatively early harvest meant that barley quality and appearance was reasonably good. Protein and plumpness levels were better than expected from the hot, dry summer conditions. Germination energy characteristics were excellent, with little or no water sensitivity present. Colour and appearance was very good on early harvested grain, with some staining present in later harvested grain. Environmental conditions were regionally quite variable in 2006, resulting in some variability in the quality of barley depending upon its region of production.

RVA (Rapid Viscometric Analysis) values this year indicated very little pre-harvest sprouting. (see www.grainscanada.gc.ca/qualitymatters)

Table 3 - Barley production in western Canada for 2006, 2005 and the 1997-2006 average[1]

	Seeded area			Production		
	2006	2005	1997-2006 average	2006	2005	1997-2006 average
	(thousands of hectares)			(thousands of tonnes)		
Manitoba	405	364	463	1,228	681	1314
Saskatchewan	1,437	1,943	1,868	3,418	5,345	4,324
Alberta[2]	1,773	1,858	2,100	4,610	5,637	5,358
Total	**3,615**	**4,165**	**4,430**	**9,256**	**11,663**	**10,997**

[1] Statistics Canada, *Field Crop Reporting Series, No. 7,* October 5, 2006
[2] Alberta figures include small amounts grown in British Columbia

Table 3 shows the following:

- Total seeded acreage was 18% lower than ten-year average levels.
- Total barley production in Western Canada was 20% lower than in 2005.
- Total production of barley in 2006 was 15% less than ten-year average levels.
- Alberta's production decreased 18% on 5% smaller seeded acreage than in 2005.
- Saskatchewan production decreased by 35%, on 25% less seeded acreage to 2005.
- Manitoba's production increased 80%, on 11% greater seeded acres than in 2005.

Sampling and General Crop Quality

The 2006 malting barley survey was based on 885 000 tonnes of malting barley selected for purchase by Agricore-United Ltd., Busch Ag Resources Inc., Cargill Grain Co. Ltd., Canada Malting Co.Ltd., James Richardson International Ltd., Prairie Malt Co. Ltd, and Saskatchewan Wheat Pool Ltd. The total tonnage included in this survey represented over 50 per cent of the total volume of malting barley selected in western Canada through mid-October. Some later selections not included in this survey may vary slightly in quality from the weighted averages.

Selectors from these companies sent separate one-kilogram composites of barley to the Applied Barley Research Unit of the Grain Research Laboratory. Composites were based upon cultivar, province or region, tonnage, and selection period. Samples were received from the beginning of harvest until the 9th of October, at which time composite sample receival was terminated.

Samples received at the GRL were kept unique, and not further composited. A total of 94 composites of selected barley, representing 6 different malting varieties, were processed in the production of this report.

Malting Quality Data

The 2006 malting barley crop, with early seeding in many areas, showed promise through early summer for the best crop in many years. Excess heat and lack of rain gave indications of lower volume and higher protein levels. However, the barley ultimately had low protein and average plumpness levels. Germination energies were high, with no evidence of water sensitivity. Micromalting test runs indicated that normal malting conditions for Canadian barley would produce malt of reasonable quality. Barley from the 2006 harvest tended to absorb water at a significantly slower rate than the previous year had indicated. As the 2005 malting schedule had been established to deal with slight water sensitivity, moderate increases in wet steeping times were required to enhance water absorption and modification rates in 2006 barley. Steep out moisture levels were near targeted levels, although lower than those produced in 2005, and kiln out moisture levels were in the desirable range. (See the Methods section at the end of this bulletin for the complete malting schedule).

This year's study resulted in malts with slightly lower levels of extract, moderate levels of protein modification, low beta-glucan levels, and slightly higher levels of enzyme activity. Friability levels were similar to levels of 2005. Good quality malt was readily produced from 2006 barley, with only slight adjustments to malting conditions being applied.

western Canadian malting barley

AC Metcalfe

Barley plumpness and kernel weight levels for AC Metcalfe were slightly lower than those of 2005 (Table 4). Protein levels were good, slightly lower than those of 2005 barley. Germination energy levels were excellent, with virtually no water sensitivity present. General appearance and levels of staining for all malting barley varieties in 2006 was very good in early harvested material. Selected barley which was harvested in mid-September or later, in certain regions, tended to have some staining. AC Metcalfe barley in 2006, however, generally had moderate levels of staining, less than in 2005.

The quality of malt made from composites of selected AC Metcalfe barley was of good quality, with some slight differences in measures of quality from those of 2005. Notably, malt extract levels in 2006 were slightly lower than those of 2005. This characteristic was not limited to AC Metcalfe, as most varieties, both two and six-rowed, showed this characteristic. Beta-glucan levels in wort were similar to those of 2005, but viscosity levels were substantially lower than those of 2005 malt. Fan levels were adequate, but lower than the previous year, and wort colour was substantially lower than 2005 AC Metcalfe malt. Enzyme levels indicated higher DP, while alpha amylase levels were similar to those of 2005.

Table 4 - Quality data for 2006 harvest survey composite samples of AC Metcalfe malting barley

Variety	AC Metcalfe							
Origin of selected samples	Manitoba/ Saskatchewan		Saskatchewan		Alberta/ Saskatchewan		Prairie Provinces[1]	
Crop year	2006	2005	2006	2005	2006	2005	2006	2005
Thousands of tonnes	49	20	241	102	104	213	394	336
Barley								
Physical characteristics								
1000 kernel weight, g	43.0	43.2	42.1	42.6	44.0	44.0	42.7	43.5
Heavy grade, over 6/64" sieve, %	89.0	87.1	87.4	87.7	91.4	91.4	88.7	90.0
Intermed grade, over 5/64" sieve, %	10.1	11.0	11.7	10.4	7.8	7.7	10.5	8.7
Chemical analysis								
Moisture, %[2]	12.1	13.0	11.7	11.9	11.9	12.2	11.8	12.2
Protein, %	11.5	12.1	12.4	12.1	11.7	11.7	12.1	11.9
Germination, 4 ml (3 Day), %	99	100	99	97	99	98	99	98
Germination, 8 ml (3 Day), %	96	99	94	88	96	86	95	88
Malt								
Physical characteristics								
Yield, %	92.7	93.0	92.5	91.1	92.3	92.0	92.5	91.8
Steep-out moisture, %	45.7	45.6	45.7	46.3	45.8	46.6	45.7	46.5
Friability, %	83.9	81.4	76.9	71.6	80.7	78.1	78.8	76.5
Chemical analysis								
Moisture, %	5.5	4.4	4.8	4.6	5.3	5.0	5.0	4.8
Wort								
Fine grind extract, %	80.0	80.3	79.5	79.5	79.9	80.4	79.7	80.1
Coarse grind extract, %	79.4	80.0	78.9	79.2	79.5	80.0	79.1	79.8
F/C difference, %	0.7	0.3	0.6	0.3	0.4	0.4	0.6	0.4
ß-glucan, ppm	55	78	65	52	59	62	63	60
Viscosity, cps	1.39	1.44	1.41	1.43	1.40	1.44	1.40	1.44
Soluble protein, %	4.51	4.79	4.54	5.00	4.46	4.76	4.52	4.83
Ratio S/T, %	39.5	39.9	37.3	39.3	38.8	40.2	38.0	39.9
FAN, mg/L	178	214	179	213	183	201	180	205
Colour, ASBC units	1.71	2.43	1.80	2.69	1.73	2.26	1.77	2.39
Diastatic power, °L	150	123	151	157	156	135	152	141
Alpha-amylase, D.U.	54.9	61.4	57.5	58.1	57.1	59.0	57.1	58.9

[1] Weighted average values

[2]Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture proof containers

western Canadian malting barley

CDC Copeland

This is the third year that CDC Copeland has been included in this survey (Table 5). It's acreages and selection rates continued to increase substantially in 2006 to where it now slightly exceeds CDC Kendall. The barley quality of composites of CDC Copeland received at the GRL was very good. Levels of thousand kernel weight and plumpness were good, but slightly lower than levels in 2005. Protein levels were near optimum for two-rowed malting barley, but slightly higher than in 2005. Germination energy levels were very good, and no water sensitivity was evident in the CDC Copeland composites. Barley colour was excellent especially in early harvested material. Later harvested CDC Copeland had moderate levels of staining and colour.

The malt made from composites of CDC Copeland in 2006 was of good quality. Friability levels were slightly lower than those of 2005, while fine extract levels were the same as in 2005. Fine-coarse extract difference was lower due to lower coarse extract levels. Beta-glucan levels, although still low, were somewhat higher than those of 2005 CDC Copeland malt, while wort viscosity levels were slightly lower. Protein modification indices were moderate, with slightly lower soluble protein and Kolbach values than those measured in 2005. Wort colour levels were substantially lower in 2006, while diastatic power and alpha amylase levels were increased over those of 2005.

Table 5 - Quality data for 2006 harvest survey composite samples of CDC Copeland barley

Variety	CDC Copeland						
Origin of selected samples	Manitoba/ Saskatchewan	Saskatchewan		Alberta/ Saskatchewan		Prairie Provinces[1]	
Crop year	2006	2006	2005	2006	2005	2006	2005
Thousands of tonnes	19	61	47	41	86	121	133
Barley							
Physical characteristics							
1000 kernel weight, g	44.4	42.8	44.5	45.0	45.0	43.8	44.8
Heavy grade, over 6/64" sieve, %	90.6	88.4	90.0	90.9	92.7	89.6	91.8
Intermediate grade, over 5/64" sieve, %	8.5	10.8	8.3	8.1	6.1	9.5	6.9
Chemical analysis							
Moisture, % [2]	12.0	11.2	11.7	11.8	11.4	11.5	11.5
Protein, %	11.3	11.6	11.5	11.7	11.1	11.6	11.2
Germination, 4 ml (3 Day), %	100	99	98	99	96	99	97
Germination, 8 ml (3 Day), %	98	98	94	97	91	98	92
Malt							
Physical characteristics							
Yield, %	92.8	92.8	90.8	92.1	91.4	92.6	91.2
Steep-out moisture, %	45.5	45.8	46.6	45.9	46.4	45.8	46.4
Friability, %	88.2	76.4	83.2	82.4	85.6	80.3	84.9
Chemical analysis							
Moisture, %	5.1	4.3	4.8	5.1	4.7	4.7	4.7
Wort							
Fine grind extract, %	79.9	79.4	79.3	79.6	79.7	79.6	79.6
Coarse grind extract, %	79.2	78.7	78.8	78.6	79.2	78.7	79.1
F/C difference, %	0.7	0.7	0.4	1.0	0.5	0.8	0.5
ß-glucan, ppm	66	67	40	69	51	68	48
Viscosity, cps	1.41	1.42	1.43	1.41	1.43	1.42	1.43
Soluble protein, %	4.58	4.56	4.79	4.60	4.61	4.58	4.66
Ratio S/T, %	40.9	39.3	39.9	38.7	40.7	39.3	40.5
FAN, mg/L	181	174	192	181	191	177	191
Colour, ASBC units	1.69	1.83	2.18	1.88	2.52	1.83	2.41
Diastatic power, °L	133	119	121	131	109	125	113
Alpha-amylase, D.U.	45.4	47.8	46.2	48.9	44.3	47.8	44.9

[1] Weighted average values

[2]Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture proof containers

western Canadian malting barley

CDC Kendall

Thousand kernel weights measured in composites of CDC Kendall in 2006 were slightly lower than those from 2005 (Table 6). Plumpness levels were also slightly lower than in 2005. Protein levels were good, matching those of 2005. Germination energy levels were good, with significantly lower levels of water sensitivity compared to 2005. CDC Kendall barley grown in 2006 had good barley colour and levels of staining were light to moderate.

Malt made from composites of selected CDC Kendall barley in 2006 was of very good quality. Extract levels were comparable to those of 2005, with beta-glucan levels simlar in magnitude, and viscosity levels that were substantially lower than in 2005. Soluble protein and Kolbach indices were slightly lower in 2006 along with FAN values. Wort colour was significantly lower than those measured in 2005 CDC Kendall malt. Diastatic power levels were significantly higher than levels of 2005, while alpha amylase levels were only slightly higher.

Table 6 - Quality data for 2006 harvest survey composite samples of CDC Kendall malting barley

Variety	CDC Kendall						
Origin of selected samples	Manitoba/ Saskatchewan	Saskatchewan		Alberta/ Saskatchewan		Prairie Provinces[1]	
Crop year	2006	2006	2005	2006	2005	2006	2005
Thousands of tonnes	22	53	9	55	111	130	120
Barley							
Physical characteristics							
1000 kernel weight, g	42.6	40.5	42.3	43.4	43.3	42.1	43.2
Heavy grade, over 6/64" sieve, %	94.3	91.3	93.4	93.8	94.1	92.9	94.0
Intermediate grade, over 5/64" sieve, %	4.9	8.1	5.6	5.3	4.9	6.4	4.9
Chemical analysis							
Moisture, %[2]	11.2	11.1	10.6	11.9	11.8	11.5	11.7
Protein, %	11.5	12.3	11.7	11.5	11.7	11.8	11.7
Germination, 4 ml (3 Day), %	100	100	98	99	98	100	98
Germination, 8 ml (3 Day), %	93	93	86	95	89	94	88
Malt							
Physical characteristics							
Yield, %	92.8	92.7	91.3	92.2	90.9	92.5	90.9
Steep-out moisture, %	45.6	46.4	46.4	46.6	47.0	46.4	47.0
Friability, %	88.2	84.2	82.8	88.8	84.3	86.8	84.2
Chemical analysis							
Moisture, %	5.7	4.2	4.5	4.9	4.4	4.7	4.5
Wort							
Fine grind extract, %	80.7	79.6	80.4	79.9	80.0	79.9	80.0
Coarse grind extract, %	80.4	79.1	79.9	79.7	79.6	79.6	79.7
F/C difference, %	0.3	0.5	0.4	0.2	0.4	0.3	0.4
ß-glucan, ppm	61	56	42	48	40	54	40
Viscosity, cps	1.40	1.40	1.43	1.40	1.42	1.40	1.43
Soluble protein, %	4.46	4.90	5.14	4.64	4.93	4.72	4.95
Ratio S/T, %	39.5	40.0	40.9	40.4	42.1	40.1	42.0
FAN, mg/L	171	178	216	181	193	178	195
Colour, ASBC units	1.70	2.10	2.80	1.90	2.40	1.94	2.50
Diastatic power, °L	159	153	142	161	141	158	141
Alpha-amylase, D.U.	59.1	61.1	59.1	57.7	57.1	59.3	57.3

[1]Weighted average values

[2]Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture proof containers

western Canadian malting barley

Harrington

Harrington barley grown in 2006 had slightly higher levels of thousand kernel weight and plumpness, compared to 2005 (Table 7). Protein levels were very good, slightly lower than the previous year. Germination energy levels were good, with no evidence of water sensitivity. Barley appearance was good, with moderate levels of staining present.

The malt made from Harrington barley in 2006 was of good quality, with higher friability values than those of 2005 malt. Extract levels were also higher than those of 2005 Harrington malt, opposing the trend in other varieties. Beta-glucan and viscosity levels were moderately low. Protein modification was moderate, only slightly lower than in 2005 Harrington malt. FAN levels were lower than those in 2005 Harrington malt, but still adequate. Wort colour in 2006 was substantially lower than 2005 levels. Enzyme levels in 2006 Harrington malt were the same as those measured in 2005.

Table 7 - Quality data for 2006 harvest survey composite samples of Harrington malting barley

Variety	Harrington				
Origin of selected samples	Alberta	Alberta/ Saskatchewan		Prairie Provinces[1]	
Crop year	2006	2006	2005	2006	2005
Thousands of tonnes	4	10	21	14	21
Barley					
Physical characteristics					
1000 kernel weight, g	41.2	41.0	40.5	41.1	40.5
Heavy grade, over 6/64" sieve, %	88.2	89.2	88.2	88.9	88.2
Intermediate grade, over 5/64" sieve, %	10.8	9.2	10.3	9.6	10.3
Chemical analysis					
Moisture, % [2]	11.3	11.3	11.6	11.3	11.6
Protein, %	11.1	10.8	11.5	10.9	11.5
Germination, 4 ml (3 Day), %	99	99	95	99	95
Germination, 8 ml (3 Day), %	99	98	90	98	90
Malt					
Physical Characteristics					
Yield, %	92.4	92.2	90.7	92.3	90.7
Steep-out moisture, %	45.3	45.7	46.5	45.6	46.5
Friability, %	86.7	88.3	82.1	87.8	82.1
Chemical Analysis					
Moisture, %	5.1	4.5	5.0	4.7	5.0
Wort					
Fine grind extract, %	80.1	80.0	79.2	80.0	79.2
Coarse grind extract, %	79.3	79.0	78.4	79.1	78.4
F/C difference, %	0.7	1.0	0.8	0.9	0.8
ß-glucan, ppm	118	87	77	96	77
Viscosity, cps	1.40	1.40	1.43	1.42	1.43
Soluble protein, %	4.30	4.40	4.74	4.35	4.74
Ratio S/T, %	40.2	41.5	40.2	41.1	40.2
FAN, mg/L	169	186	203	181	203
Colour, ASBC units	1.70	1.90	2.20	1.83	2.20
Diastatic power, °L	120	133	127	129	127
Alpha-amylase, D.U.	51.7	54.9	54.9	54.0	54.9

[1] Weighted average values

[2] Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture proof containers

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Legacy

This is the second year for Legacy to appear in this report. Production levels of Legacy and its selection rate as malting barley has expanded significantly in 2006. Legacy barley composites received in 2006 had thousand kernel weight and plumpness levels that were of good quality, similar to those of 2005 composites (Table 8). Protein levels were slightly lower than in 2005. Germination energy levels were good, with no significant levels of water sensitivity present.

The malt made from Legacy barley in 2006 was of good quality, and did not suffer from the effect of water sensitivity on modification rate during malting. Friability and fine extract levels were significantly higher than those of 2005 Legacy malt. Beta-glucan and viscosity levels were slightly higher in 2006, but still acceptable. Protein modification was moderate, with FAN and wort colour levels slightly lower than those of 2005 Legacy malt. Diastatic power levels were higher, while alpha amylase levels were lower than those measured in 2005. There was scope for further modification of Legacy malt in 2006 to improve even more upon the malt quality characteristics.

Table 8 - Quality data for 2006 harvest survey composite samples of Legacy malting barley

Variety	Legacy					
Origin of selected samples	Manitoba/ Saskatchewan	Saskatchewan		Alberta/ Saskatchewan	Prairie Provinces[1]	
Crop year	2006	2006	2005	2006	2006	2005
Thousands of tonnes	28	6	31	11	45	31
Barley						
Physical characteristics						
1000 kernel weight, g	36.7	37.8	37.4	37.9	37.1	37.4
Heavy grade, over 6/64" sieve, %	84.8	88.5	88.8	88.3	86.2	88.8
Intermediate grade, over 5/64" sieve, %	13.9	10.5	9.3	9.9	12.4	9.3
Chemical analysis						
Moisture, % [2]	12.0	11.3	11.7	11.9	11.9	11.7
Protein, %	11.6	11.5	12.1	11.9	11.7	12.1
Germination, 4 ml (3 Day), %	98	99	96	99	98	96
Germination, 8 ml (3 Day), %	98	94	79	97	97	79
Malt						
Physical Characteristics						
Yield, %	92.3	92.6	88.1	92.2	92.3	88.1
Steep-out moisture, %	45.8	45.4	44.5	46.1	45.8	44.5
Friability, %	82.8	83.7	74.1	80.5	82.3	74.1
Chemical Analysis						
Moisture, %	5.2	4.7	5.9	4.7	5.0	5.9
Wort						
Fine grind extract, %	78.7	79.0	76.7	78.1	78.6	76.7
Coarse grind extract, %	77.7	78.3	76.2	77.2	77.6	76.2
F/C difference, %	1.0	0.7	0.5	0.9	1.0	0.5
ß-glucan, ppm	174	225	137	166	179	137
Viscosity, cps	1.43	1.46	1.42	1.43	1.43	1.42
Soluble protein, %	4.65	4.65	4.91	4.54	4.62	4.91
Ratio S/T, %	40.6	41.7	38.1	39.0	40.4	38.1
FAN, mg/L	192	194	210	193	192	210
Colour, ASBC units	2.07	2.12	2.13	1.96	2.05	2.13
Diastatic power, °L	166	159	151	163	164	151
Alpha-amylase, D.U.	50.0	56.2	56.2	53.8	51.8	56.2

[1]Weighted average values

[2] Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture proof containers

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Tradition

Sufficient quantities of Tradition barley are now being grown and selected to warrant inclusion in this report (Table 9). Selected composites of Tradition barley had good quality, with high levels of plumpness and good kernel weights. Protein levels were good as well, averaging just below the 12% level. Germinative energy levels were good, however, there was some indication of water sensitivity present. Barley colour was good with moderate levels of kernel staining.

Malt made from selected composites of Tradition barley in 2006 was of average quality. Extract levels were normal for six-rowed malt, while beta-glucan and viscosity levels were slightly elevated. Protein modification levels were moderate, and FAN levels were adequate. Wort colour was relatively low for malt of any type. Enzyme levels were moderate to slightly low when compared to long term six-rowed averages. Overall, Tradition malt appeared to exhibit the effects of slight water sensitivity and the reduction in modification rate that ensues from it.

Table 9 - Quality data for 2006 harvest survey composite samples of Tradition malting barley

Variety	Tradition		
Origin of selected samples	Manitoba/ Saskatchewan	Saskatchewan	Prairie Provinces[1]
Crop year	2006	2006	2006
Thousands of tonnes	9	33	42
Barley			
Physical characteristics			
1000 kernel weight, g	38.3	38.3	38.3
Heavy grade, over 6/64" sieve, %	90.0	89.8	89.8
Intermediate grade, over 5/64" sieve, %	8.8	9.7	9.5
Chemical analysis			
Moisture, % [2]	11.4	11.3	11.3
Protein, %	11.4	12.1	11.9
Germination, 4 ml (3 Day), %	99	99	99
Germination, 8 ml (3 Day), %	90	89	90
Malt			
Physical Characteristics			
Yield, %	92.5	92.7	92.7
Steep-out moisture, %	45.8	45.6	45.6
Friability, %	79.1	75.6	76.4
Chemical Analysis			
Moisture, %	5.4	4.2	4.5
Wort			
Fine grind extract, %	78.7	78.7	78.7
Coarse grind extract, %	77.4	77.7	77.6
F/C difference, %	1.3	1.0	1.1
ß-glucan, ppm	234	225	227
Viscosity, cps	1.48	1.48	1.48
Soluble protein, %	4.19	4.33	4.30
Ratio S/T, %	36.4	36.9	36.8
FAN, mg/L	157	156	156
Colour, ASBC units	1.51	1.65	1.62
Diastatic power, °L	162	141	145
Alpha-amylase, D.U.	43.9	44.0	44.0

[1]Weighted average values

[2]Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture proof containers

Methods of analysis western Canadian malting barley

This section describes methods used at the Grain Research Laboratory. Unless otherwise specified, analytical results for barley and malt are reported on a dry weight basis. The ASBC methods cited are those of the American Society of Brewing Chemists, Ninth Edition, (2004).

Dockage and assortment

Dockage - Dockage-free barley is obtained by passing an uncleaned sample through a Carter Dockage Tester arranged as described in the Canadian Grain Commission's Official Grain Grading Guide for dockage determination. This involves passing the barley over a #6 riddle, #6 and #5 Buckwheat sieves, and a #4.5 round hole sieve. Material retained above the #4.5 round hole sieve is considered to be dockage-free. Assortment - All samples are passed through a Carter Dockage Tester equipped with a No. 6 riddle to remove foreign material and two slotted sieves to sort the barley. Heavy Grade barley is the material retained on a 6/64″ (2.38 mm) x 3/4″ slotted sieve. Intermediate Grade is barley that passes through the 6/64″ x 3/4″ sieve but is retained on a 5/64″ (1.98 mm) x 3/4″ slotted sieve.

Weight per thousand kernel

A 500 gram sample of dockage-free barley is divided several times in a mechanical divider to obtain two equal portions of 40 grams. All foreign material and broken kernels are removed from one 40 gram portion and the net weight determined. The number of kernels is then counted with a mechanical counter and thousand kernel weight is calculated (as is basis) (Institute of Brewing's Recommended Methods of Analysis, Barley 1.3 (1997)).

Moisture content of barley

Moisture content of barley is predicted using NIR equipment that has been calibrated by the standard ASBC method (ASBC Barley 5C).

Moisture content of malt

Moisture content of malt — Moisture content of malt is determined on a ground sample at 104°C for 3 hours in a convection oven (ASBC Malt-3).

Protein content (N x 6.25)

Protein content is predicted on dockage-free barley using NIR equipment that has been calibrated by Combustion Nitrogen Analysis (CNA). CNA is determined on a LECO Model FP-428 CNA analyser calibrated by EDTA. Samples are ground on a UDY Cyclone Sample Mill fitted with a 1.0-mm screen. A 200-mg sample is analysed as received (it is not dried prior to analysis). A moisture analysis is also performed and results are reported on a dry matter basis (ASBC Barley 7C).

Germination energy

Germination energy is determined by placing 100 kernels of barley on two layers of Whatman #1 filter paper, in a 9.0 cm diameter petri dish, and adding 4.0 ml of purified water. Samples are controlled at 20 degrees Celcius and 90% relative humidity in a germination chamber. Germinated kernels are removed after 24 and 48 hours and a final count is made at 72 hours (ASBC Barley 3C, IOB, and EBC procedure).

Water sensitivity

Water sensitivity is determined exactly as described for germination energy, except that 8.0 ml of purified water is added to each petri dish (ASBC 3C, IOB and EBC procedure). The actual water sensitivity value is the numerical difference between the 4ml and 8ml tests. (Note: the water sensitivity value is not reported in the data tables but is inferred by inclusion of the result of the 8 ml test).

Malting conditions	Malting conditions — Malts are prepared using an Automatic Phoenix Micromalting System designed to handle twenty-four 500 g samples of barley per run. Samples were steeped at 13°C using the following regime; 10 h wet steep, 18 h air rest, 8 h wet steep, 12 h air rest. Samples were germinated for 96 hours at 15°C, with 100% relative humidity. Kilning was carried out over 24 h as follows:12 hours at 55˚C; 6 hours at 65˚C; 2 hours at 75˚C; 4 hours at 85˚C.
Malt mills	Fine-grind malt is prepared with a Buhler-Miag disc mill set to fine-grind. Coarse-grind malt is prepared with the same mill set to coarse-grind. The settings for fine- and coarse-grinds are calibrated quarterly, based on the screening of a ground ASBC standard check malt (ASBC Malt-4).
Fine-grind and coarse-grind extracts	Extracts are prepared using an Industrial Equipment Corporation (IEC) mash bath and the Congress mashing procedure from 45°C to 70°C. Specific gravities are determined at 20°C with an Anton Paar DMA 5000 digital density meter (ASBC Malt-4).
Wort-soluble protein	Wort-soluble protein is determined spectrophotometrically using the method of Haslemore and Gill (1995), Journal of the Institute of Brewing 101:469 (ASBC Wort-17).
Kolbach index (ratio S/T)	Kolbach index is calculated from the formula, (% Soluble protein/% Malt protein) x 100.
Free Amino Nitrogen (FAN)	Free amino nitrogen is determined on the fine extract according to the official ASBC method Wort-12, automated to run on a Skalar segmented flow analyzer.
Diastatic power	Diastatic power is determined on a Skalar segemented flow analyzer, using an automated neocuproin assay for reducing sugars, which is calibrated using malt standards analysed using the official ferricyanide reducing sugar method, (ASBC Malt 6A).
α-Amylase activity	α-Amylase activity is determined using ASBC method MALT 7B automated to run on a Skalar segmented flow analyser, using ASBC dextrinized starch as the substrate, and calibrated with standards that have been determined by method ASBC Malt 7A.
ß-Glucan content	ß-Glucan content is determined in malt extract on a Skalar segmented flow analyser using Calcofluor staining of soluble, high molecular weight ß-glucan and detection by a Fluorescence Spectrometer (Jorgensen (1988) Carlsberg Res. Commun. 53:277) (ASBC Wort-18).
Viscosity	Viscosity is measured on fine grind Congress wort using an automated Schott AVS 500 Micro-Ubbelodhe glass capillary viscometer, which has been calibrated according to ASTM method D-445 (ASBC Wort-13).

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