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Quality of western Canadian malting barley 2012

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Quality of western Canadian malting barley 2012

Summary

The 2012 western Canadian malting barley harvest survey was based on 77 separate varietal composites, representing a total of 586,273 tonnes of barley selected for malting purposes in Western Canada.

Total western Canadian barley crop production for 2012 was estimated at 8,122,000 tonnes, an increase of 11% from 2011, but still 16% lower than the 10-year average. Acres seeded to barley rose for the first time in five years to 2,840,000 hectares, up 15% from 2011. The growing season was characterized by warm temperatures and low levels of precipitation over the majority of the barley growing area.

Malting barley selected in 2012 had lower plumpness and kernel weights, and higher protein levels due to the primarily hot and dry growing season. Germination energy was excellent; with some water sensitivity present. The majority of samples showed high RVA values, indicating low incidence of pre-harvest sprouting in selected barley.

Well modified malt was easily obtained from 2012 barley resulting in low wort β-glucan, higher friability, and increased levels of soluble protein and free amino nitrogen (FAN). Although higher grain protein combined with smaller kernel size resulted in lower malt extract, levels of diastatic enzymes were well above average. This year's malt has the potential for good brewing performance.

Introduction

The 2012 western Canadian malting barley survey is the 25th consecutive survey conducted in this general format. The data generated for this report were based on the analysis of representative varietal composite samples which had been selected for domestic malt processing or for export as malting barley. Industry participation in preparing and submitting these composites was essential for completion of a successful survey. Submitted barley samples are micromalted and analysed using ASBC standard methods of analysis.

Barley is a duel purpose crop grown in a widespread area across the Canadian Prairies. Although the majority of barley produced ends up as feed or forage, a relatively high percentage of the acreage is seeded to malting barley varieties. The predominate type of barley grown in western Canada is two-rowed malting, with just two varieties, AC Metcalfe and CDC Copeland, occupying the majority of acres in recent years. Six-rowed malting barley, traditionally produced in the eastern prairies and exported to the United States, continues to decline in acres, now representing only a small fraction of total barley production.

The Canadian Malting Barley Technical Center (CMBTC), in collaboration with its member organizations and other barley industry groups, produces an annual Recommended Malting Barley Varieties List which is intended as a guide to assist producers in the selection of varieties for seeding in the coming year (Table 1). Although not appearing in this survey, several newer varieties are beginning to attract interest from brewers, suggesting that the portfolio of cultivars being grown and selected may expand in the coming years.

Table 1 – Malting barley cultivars recommended for production in western Canada in 2013-2014.

Recommended two-rowed malting varieties

Variety	Domestic	Export	Market outlook
AC Metcalfe	Established	Established	Stable Demand
CDC Copeland	Established	Established	Stable Demand
CDC Meredith	Established	Limited	Increasing Demand
Newdale	Established	Limited	Stable Demand
CDC PolarStar	Limited	Limited	Stable Demand
Merit 57	Limited	Limited	Limited Demand
Major	Limited	Limited	Limited Demand

Recommended six-rowed barley varieties

Variety	Domestic	Export	Market outlook
Legacy	Established	Established	Stable Demand
Stellar-ND	Established	Established	Declining Demand
Tradition	Established	Established	Declining Demand
Celebration	Limited	Limited	Limited Demand

Source: Canadian Malting Barley Technical Centre

Growing and harvesting conditions

A combination of dry conditions during the preceding fall and low snowfall during winter resulted in lower than normal soil moisture levels across most of Alberta and southern Saskatchewan. Seeding in these areas started early and proceeded rapidly; with most of the crop in the ground ahead of normal schedule. However, in east-central regions of Saskatchewan and central Manitoba soils remained saturated from 2011 floods preventing some acres from being seeded, but far fewer barley acres were abandoned overall than in the previous year.

Rainfall during April and May was favourable for emerging crops before weather in southern growing regions turned hot and dry during July and August. Continuing heavy rains in central Saskatchewan and eastern Alberta with some locations receiving near record amounts of precipitation. While warm temperatures generally boosted crop development, above average temperatures in southern Saskatchewan and the Peace River area resulted in some heat stress for crops.

Dry conditions in August allowed harvest to begin earlier than normal in much of Saskatchewan and central Alberta and continuing warm temperatures into September allowed most of the crop to be harvested in good condition with the majority in the bin by the first week of October.

Crop Production

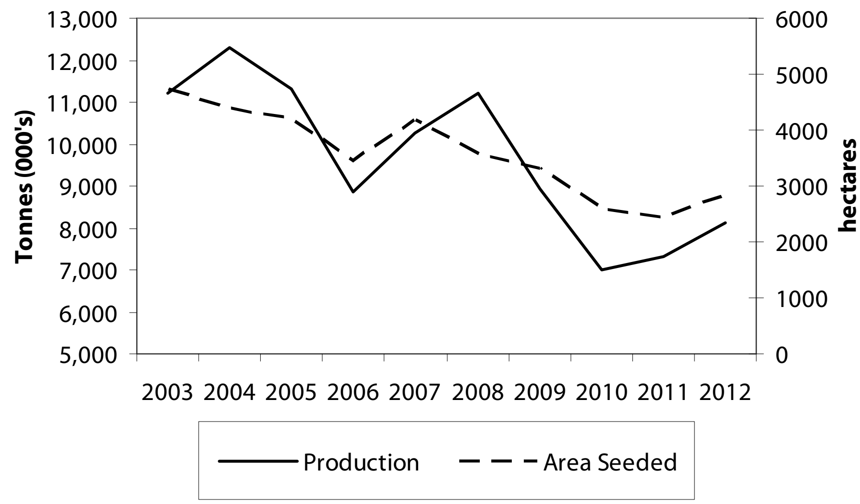
Barley production increased in 2012 for the second year in a row due to more favourable seeding and growing conditions. Total western Canadian barley production for 2012 was estimated at 8,122,000 tonnes, increasing 11% from 2011, but remaining lower than the 10-year average (Table 2). While the acreage seeded to malting barley rose in for the first time in five years, up 15% from 2011, the long term trend continues to see acres decline (Figure 1).

Table 2 – Barley production in western Canada for 2012, 2011 and the ten year average[1]

	Seeded area			Production		
	2012	2011	2003-2012 average	2012	2011	2003-2012 average
	thousand hectares			thousand tonnes		
Manitoba	230	138	315	569	261	896
Saskatchewan	1 068	880	1 494	2 639	2 439	3 745
Alberta[2]	1 564	1 442	1 767	4 914	4 607	5 009
Total	**2 840**	**2 460**	**3 575**	**8 122**	**7 307**	**9 650**

[1] Statistics Canada, Table 001-0010 *Estimated areas and production of principle field crops.* http://www5.statcan.gc.ca/cansim (Accessed October 5th 2012)
[2] Alberta figures include small amounts grown in British Columbia

Figure 1. Annual production and area seeded to malting barley, 2003-2012



Sampling and survey methodology

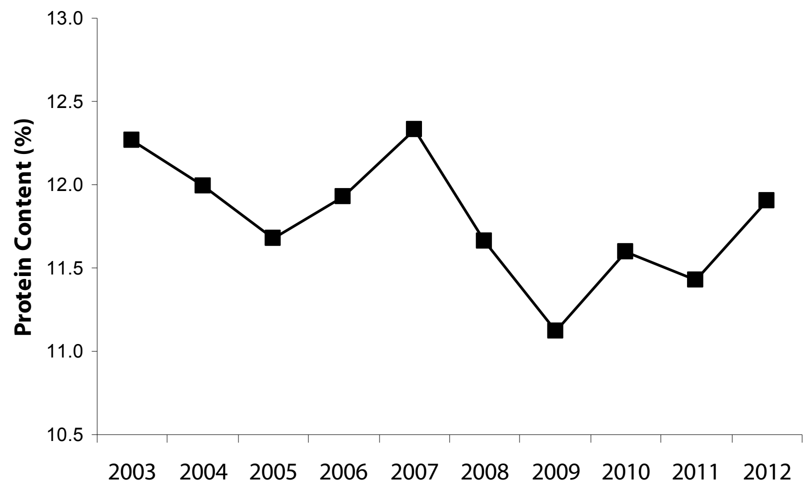
The 2012 malting barley survey was based on 77 composites representing 586,273 tonnes of malting barley selected for purchase by Cargill Inc., Canada Malting Co. Ltd., Parrish and Heimbecker Co. Ltd., Rahr Malting Co. Ltd., Richardson International, and Viterra Inc. The tonnage included in this survey represent only a portion of the total volume of malting barley selected in western Canada through the end of October, and may not reflect the actual amounts selected.

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, tonnage, and selection period. All samples received were kept unique, and not further composited. Samples were received from the beginning of harvest until the 26th of October.

Barley Quality

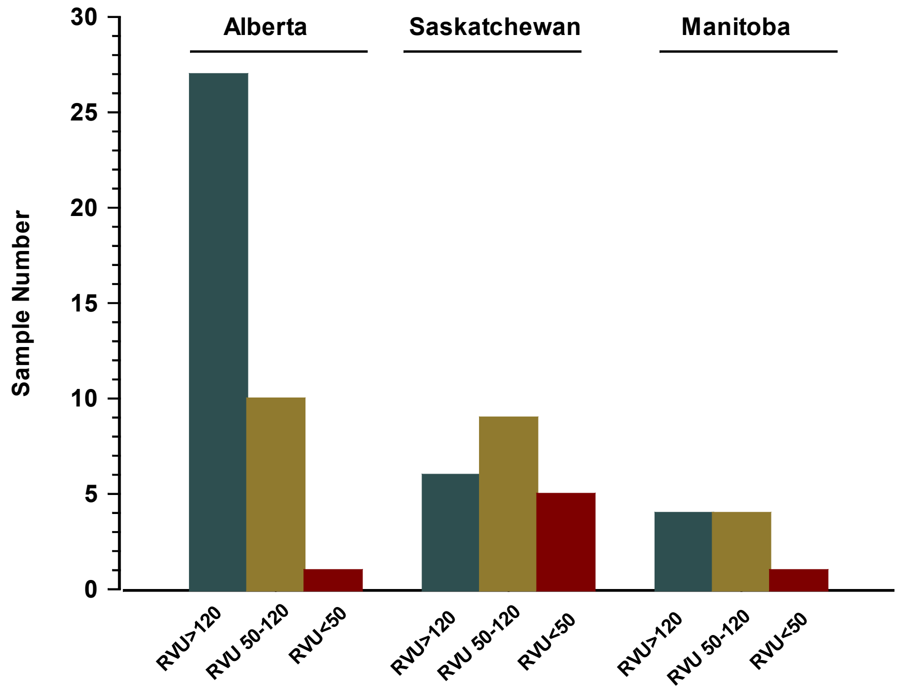
Both protein and plumpness were affected by the hot and dry growing season across most of the prairies. Following several successive wet and cool growing conditions in recent years, barley protein increased in 2012 to more historically average levels (Figure 2). Germination energy was excellent, with slight water sensitivity present in most samples.

Figure 2. Average protein content of malting barley selected from 2003-2012



Rapid visco analysis (RVA) is used by barley selectors to identify sound, moderately and strongly pre-germinated barley, and manage their supply accordingly. This year's RVA results have reflected generally favorable harvest conditions with only localized areas experiencing above average precipitation. Among the total of 77 barley samples analyzed this year, 52% of the samples showed very high RVA values, ranging from 120 to 180 RVU (rapid visco units), and indicating a high degree of soundness and a high probability of retaining germination energy during a long-term storage. Thirty eight percent (38%) of the samples exhibited moderate pre-germination (50-110 RVU) and, therefore, good potential for storability provided proper cool and dry storage conditions. Only 10% of the samples showed the RVA values lower than 50 RVU stressing the need for identification of barley that should be malted promptly unless stored in cold and dry conditions for a short period. Figure 3 shows the distribution of RVA results for barley samples by province.

Figure 3. Summary of RVA data by province for the 2012 crop year



Malting quality

Hot and dry conditions across most of the prairies resulted in barley with higher protein levels and smaller, lighter kernels. Good germination energy with only slight water sensitivity supported the use of a standard micro-malting schedule with two wet steep cycles (Table 4), as was used in 2011. The use of the same schedule facilitates year-to-year comparisons.

This year's study resulted in well modified malts with low β-glucan and good protein modification resulting in higher levels of soluble protein and free amino nitrogen. This was accompanied by an increase in wort colour. Higher than average grain protein resulted in high levels of diastatic enzymes, but lower than average extracts. The smaller kernels took up water easily, and modified rapidly, leading to higher malt losses, suggesting the malts produced in this study were somewhat over-modified as indicated by lower than normal malt yields.

Table 3 - Malting conditions used with Phoenix Micromalting System in 2012

Steeping	10 h wet steep, 18 h air rest, 8 h wet steep, 12 h air rest @ 13°C
Germination	96 h @ 15°C
Kilning	12h @ 60°C, 6h@ 65°C, 2h @ 75°C, 4h @ 85°C

AC Metcalfe

AC Metcalfe continues to be the dominant malting barley variety grown in Western Canada. With high levels of extract and diastatic enzymes, its reputation for excellent brewing performance generates strong demand from both domestic and export markets.

Composites of AC Metcalfe barley in 2012 were less plump and had lower kernel weight than in 2011. Barley protein increased from 2011 to above average levels, with a greater increase seen in barley from Saskatchewan compared to that from Alberta. Germination energy was excellent, but with slightly more water sensitivity than seen in 2011.

Good quality malt was obtained from AC Metcalfe barley in 2012. Extract levels, while decreased from 2011, were only slightly below the long term average. Endosperm modification was excellent with significantly lower β-glucan levels than in 2011, and higher than average friabilities. Protein modification was also good in 2012, with higher than average levels of soluble protein and FAN, along with higher wort colour. Levels of diatatic power and α-amylase also increased in 2012, both higher than average.

Table 4. Quality data for 2012 harvest survey composite samples of AC Metcalfe malting barley

Origin of selected samples	Saskatchewan		SK/ AB	Alberta		Prairie Provinces[1]		
Crop year	2012	2011	2012	2012	2011	2012	2011	5 Year Avg.
Thousands of tonnes	74	313	54	108	121	236	434	402
Barley								
Physical characteristics								
Test Weight, Kg/hL [2]	64.9	68.1	65.1	66.5	69.8	65.7	68.6	66.8
1000 kernel weight, g	39.9	44.1	39.9	40.9	45.3	40.4	44.4	43.2
Heavy grade, over 6/64" sieve, %	87.4	92.8	87.8	88.1	94.1	87.8	93.1	91.9
Intermed grade, over 5/64"sieve, %	9.6	5.6	7.6	8.3	4.6	8.5	5.3	6.1
Chemical analysis								
Moisture, % [3]	11.0	11.5	9.3	11.2	11.8	10.7	11.6	11.4
Protein, %	12.3	11.8	12.1	11.9	11.2	12.1	11.6	11.7
Germination, 4 ml (3 day), %	99	99	99	99	99	99	99	99
Germination, 8 ml (3 day), %	87	93	89	87	92	88	93	88
Malt								
Physical characteristics								
Yield, %	90.9	94.4	90.8	91.8	95.0	91.3	94.6	93.0
Steep-out moisture, %	44.7	43.8	44.9	44.7	42.8	44.8	43.6	46.3
Friability, %	68.6	67.6	75.6	72.5	63.3	72.0	66.4	70.5
Chemical analysis								
Moisture, %	5.4	5.2	4.8	5.2	5.3	5.2	5.2	5.2
Wort								
Fine grind extract, %	80.0	80.9	80.0	80.1	81.4	80.1	81.1	80.2
Coarse grind extract, %	79.6	80.2	79.7	79.4	80.5	79.5	80.3	79.7
F/C difference, %	0.4	0.7	0.4	0.7	0.9	0.5	0.8	0.5
ß-Glucan, mg/L	57	91	44	62	134	56	103	79
Viscosity, cps	1.41	1.43	1.41	1.41	1.46	1.41	1.44	1.40
Soluble protein, %	5.06	4.77	5.07	4.78	4.36	4.93	4.66	4.70
Ratio S/T, %	40.6	39.4	41.1	39.7	37.6	40.3	38.9	40.0
FAN, mg/L	222	183	215	202	165	211	178	193
Colour, ASBC units	2.29	1.83	2.33	1.94	1.63	2.14	1.77	2.00
Diastatic power, °L	177	161	154	169	148	168	158	159
α-amylase, D.U.	69.7	64.1	68.8	66.9	58.4	68.2	62.5	66.8

[1] Weighted average values
[2] Average based on four years of data
[3] Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture-proof containers.

CDC Copeland

CDC Copeland is the second major two-rowed malting variety grown on the prairies. Its excellent brewing characteristics combined with lower protein and enzyme levels, provides an excellent balance within the portfolio of malting barley varieties.

Thousand kernel weight and plumpness of CDC Copeland barley grown in 2012 were lower than average. Protein levels were higher than in 2011. Germination was very good, with only slight water sensitivity present.

Malt produced from CDC Copeland barley in 2012 was well modified, resulting in lower than average levels of wort β-glucan and viscosity. An increase in soluble protein levels in 2012 malts resulted in higher than average wort colour, along with more than adequate amounts of FAN. Higher grain protein was responsible for slightly lower than average extract but also contributed to an increase in diastatic power from 2011 levels.

Table 5. Quality data for 2012 harvest survey composite samples of CDC Copeland malting barley

Origin of selected samples	Saskatchewan		SK/AB	Alberta		Prairie Provinces[1]		
Crop year	2012	2011	2012	2012	2011	2012	2011	5 year Avg.
Thousands of tonnes	62	177	54	117	65	233	241	184
Barley								
Physical characteristics								
Test Weight, kg/hL [2]	63.7	66.8	64.9	65.2	68.9	64.7	67.3	66.0
1000 kernel weight, g	42.2	45.5	42.9	43.7	47.2	43.1	45.9	45.2
Heavy grade, over 6/64" sieve, %	87.7	92.8	88.0	89.3	94.5	88.6	93.3	92.7
Intermed grade, over 5/64"sieve, %	9.4	5.6	7.3	8.3	4.3	8.4	5.3	5.6
Chemical analysis								
Moisture, % [3]	11.1	11.5	9.4	11.7	12.0	11.0	11.7	11.7
Protein, %	11.8	11.1	11.7	11.7	10.6	11.7	11.0	11.2
Germination, 4 ml (3 day), %	98	99	98	99	99	98	99	98
Germination, 8 ml (3 day), %	93	95	93	93	95	93	95	93
Malt								
Physical characteristics								
Yield, %	91.2	94.6	92.0	92.3	95.6	91.9	94.9	93.3
Steep-out moisture, %	45.3	43.6	44.2	44.2	42.1	44.5	43.2	46.3
Friability, %	77.9	77.8	79.2	77.2	71.0	77.8	76.1	78.5
Chemical analysis								
Moisture, %	5.1	5.1	5.2	5.0	5.1	5.1	5.1	5.1
Wort								
Fine grind extract, %	79.8	80.8	80.3	79.8	81.2	79.9	80.9	80.0
Coarse grind extract, %	79.2	80.1	79.5	79.0	80.3	79.2	80.1	79.4
F/C difference, %	0.6	0.7	0.7	0.9	0.9	0.8	0.8	0.6
ß-Glucan, mg/L	46	81	69	81	143	69	96	72
Viscosity, cps	1.40	1.42	1.41	1.42	1.47	1.41	1.43	1.42
Soluble protein, %	5.45	4.96	5.01	4.67	4.32	4.96	4.80	4.79
Ratio S/T, %	43.9	42.5	40.5	39.7	39.6	41.0	41.8	41.4
FAN, mg/L	236	184	206	192	159	207	178	192
Colour, ASBC units	2.84	2.01	2.19	1.98	1.70	2.26	1.93	2.03
Diastatic power, °L	154	134	142	145	115	146	129	136
α-amylase, D.U.	51.7	50.6	50.5	49.2	42.7	50.2	48.6	51.1

[1] Weighted average values
[2] Average based on four years of data
[3] Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture-proof containers.

Newdale

Newdale continues to represent a small, but consistent, share of barley selected each year. With good friability, and low levels of β-glucan, it performs well in the brewhouse. Its more moderate levels of enzymes, soluble protein and FAN make Newdale well suited for all-malt brewing.

Protein levels of the Newdale composites received in 2012 were above average, increasing from 2011. Plumpness and kernel weights also decreased significantly from 2011 to lower than average levels. While germination energy remained high, moderate levels of water sensitivity was seen in composites from the eastern growing areas, with samples from Alberta being less affected.

The quality of malt obtained from Newdale barley in 2012 was variable, depending on the growing location. Composites originating from the eastern prairies took up water easily, resulting in better overall modification with good friability and only slightly lower than average extracts. Whereas composites from Alberta had lower steep-out moistures, resulting in lower extracts and poorer friability. All malts had more than adequate amounts of soluble protein, FAN and diastatic enzymes. Levels of wort β-glucan were also decreased from 2011 to below average levels.

Table 6. Quality data for 2012 harvest survey composite samples of Newdale malting barley

Origin of selected samples	Manitoba/ Saskatchewan		Alberta		Prairie Provinces		
Crop year	2012	2011	2012	2011	2012	2011	5 Year Avg
Thousands of tonnes	6	7	11	3	17	10	9
Barley							
Physical characteristics							
Test Weight, Kg/hL [2]	62.2	66.5	64.6	68.6	63.8	67.0	64.9
1000 kernel weight, g	41.4	45.3	43.8	44.5	43.1	45.1	43.9
Heavy grade, over 6/64" sieve, %	85.8	91.8	88.7	92.3	87.7	92.1	90.6
Intermed grade, over 5/64"sieve, %	9.8	6.4	9.0	5.9	9.3	6.2	7.1
Chemical analysis							
Moisture, % [3]	12.8	12.3	13.7	12.2	13.4	12.2	12.5
Protein, %	12.6	11.9	12.6	11.8	12.6	11.8	11.8
Germination, 4 ml (3 day), %	97	99	99	99	98	99	99
Germination, 8 ml (3 day), %	75	95	91	97	85	96	90
Malt							
Physical characteristics							
Yield, %	91.3	95.3	91.6	94.1	91.6	95.0	93.2
Steep-out moisture, %	46.1	43.9	45.6	43.7	45.8	43.8	46.9
Friability, %	80.8	80.7	75.5	72.6	77.1	78.7	80.2
Chemical analysis							
Moisture, %	5.2	5.1	5.2	5.1	5.2	5.1	5.0
Wort							
Fine grind extract, %	79.1	80.3	78.6	80.2	78.8	80.2	79.3
Coarse grind extract, %	78.5	79.6	78.5	79.8	78.5	79.7	78.9
F/C difference, %	0.6	0.6	0.1	0.4	0.3	0.5	0.4
ß-Glucan, mg/L	46	71	41	82	43	74	60
Viscosity, cps	1.40	1.39	1.39	1.42	1.39	1.39	1.40
Soluble protein, %	4.86	4.97	4.68	4.84	4.74	4.93	4.57
Ratio S/T, %	38.5	40.7	37.4	40.6	37.7	40.7	38.2
FAN, mg/L	187	176	178	166	181	174	164
Colour, ASBC units	2.20	1.69	1.86	1.56	1.98	1.65	1.86
Diastatic power, °L	152	142	155	155	154	145	140
α-amylase, D.U.	60.4	59.9	61.3	59.8	60.9	59.8	58.6

1 Weighted average values
2 Average based on four years of data
3 Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture-proof containers.

CDC Meredith

Appearing in this report for the second year, amounts of CDC Meredith barley being grown and selected continued to increase in 2012. With its good agronomics and disease resistance, CDC Meredith has the potential to produce superior yields making it an attractive choice for producers. Good malting characteristics such as consistently lower protein, higher extracts and moderate levels of enzymes translate into good overall brewing potential.

Protein levels of CDC Meredith barley in 2012 remained the lowest of the two-rowed varieties, despite increasing significantly from 2011. Barley kernel weight and plumpness was lower than 2011, while germination energy remained excellent. Slight water sensitively was present in most composites received.

Good quality malt was obtained from CDC Meredith barley in 2012. Despite an increase in protein levels from 2011, CDC Meredith malt produced higher extracts than any of the other two-rowed varieties. Protein modification was good with higher levels of both soluble protein and FAN, however wort colour was also increased significantly. Endosperm modification was also improved over 2011, resulting in lower β-glucan levels and higher friability. Levels of diastatic power and α-amylase were more than adequate.

Table 7. Quality data for 2012 harvest survey composite samples of CDC Meredith malting barley

	Manitoba	Saskatchewan		Alberta		Prairie Provinces	
Crop year	2012	2012	2011	2012	2011	2012	2011
Thousands of tonnes	1	4	6	38	11	43	17
Barley							
Physical characteristics							
Test Weight, Kg/hL [2]	61.3	63.0	67.2	64.8	68.2	64.5	67.8
1000 kernel weight, g	39.7	41.1	47.8	44.3	47.5	43.9	47.6
Heavy grade, over 6/64" sieve, %	84.5	88.8	95.1	92.0	95.1	91.6	95.1
Intermed grade, over 5/64"sieve, %	12.3	9.0	3.8	5.8	3.8	6.2	3.8
Chemical analysis							
Moisture, % [3]	12.1	12.8	13.5	11.9	12.1	12.0	12.6
Protein, %	12.1	12.0	10.8	11.0	10.6	11.2	10.7
Germination, 4 ml (3 day), %	98	99	99	99	99	99	99
Germination, 8 ml (3 day), %	88	91	98	91	94	91	96
Malt							
Physical characteristics							
Yield, %	88.8	92.2	93.2	91.1	93.4	91.2	93.4
Steep-out moisture, %	46.6	45.6	45.8	45.5	45.0	45.5	45.3
Friability, %	79.2	81.7	78.6	84.5	77.6	84.1	78.0
Chemical analysis							
Moisture, %	5.5	4.5	5.3	5.1	5.1	5.0	5.2
Wort							
Fine grind extract, %	79.9	79.8	81.5	80.7	81.6	80.6	81.6
Coarse grind extract, %	79.7	78.9	81.0	79.6	80.9	79.5	80.9
F/C difference, %	0.2	0.9	0.5	1.1	0.7	1.1	0.6
ß-Glucan, ppm	40	126	96	70	122	76	113
Viscosity, cps	1.39	1.41	1.40	1.40	1.43	1.40	1.42
Soluble protein, %	5.55	5.34	5.07	4.80	4.64	4.87	4.80
Ratio S/T, %	45.9	42.6	45.4	43.6	42.5	43.5	43.5
FAN, mg/L	257	208	196	200	179	201	185
Colour, ASBC units	2.87	2.63	2.46	2.28	1.92	2.33	2.11
Diastatic power, °L	174	150	156	158	146	158	149
α-amylase, D.U.	64.9	58.3	55.7	57.5	53.3	57.7	54.2

1 Weighted average values
2 Average based on four years of data
3 Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture-proof containers.

Legacy

While acres planted to six-rowed malting barley are in decline, small amounts of Legacy barley continue to be grown and selected. Legacy's high enzyme package makes it ideal for adjunct brewing.

Plumpness and test weight of Legacy barley decreased significantly from 2011 to below average levels in 2012. Protein was higher than average, increasing from 2011. While germination energy was lower than average, water sensitivity suggests the presence of dormancy, which is typical for this variety, and germination characteristics may improve with storage.

Legacy barley produced good quality malt in 2012. Despite showing signs of water sensitivity, Legacy barley took up water easily, resulting in good endosperm modification with lower than average levels of β-glucan and good friability. Extract levels, though lower than 2011, remained slightly above average. Overall protein modification was also high, resulting in above average levels of soluble protein and FAN, and also contributing to higher than average wort colour. Levels of diastatic power received a significant boost from the higher grain protein, while α-amylase also increased from 2011.

Table 8. Quality data for 2012 harvest survey composite samples of Legacy malting barley.

Origin of selected samples	Saskatchewan	SK/AB	Prairie Provinces		
Crop year	2012	2012	2012	2011	5 Year Avg
Thousands of tonnes	4	30	34	86	85
Barley					
Physical characteristics					
Test Weight, Kg/hL [2]	63.4	62.4	62.5	65.1	64.0
1000 kernel weight, g	36.4	34.8	35.0	38.2	38.1
Heavy grade, over 6/64" sieve, %	88.9	87.8	87.9	93.0	91.9
Intermed grade, over 5/64"sieve, %	6.9	7.5	7.5	5.5	5.9
Chemical analysis					
Moisture, % [3]	10.6	9.8	10.0	11.2	11.2
Protein, %	12.6	12.8	12.7	11.8	12.0
Germination, 4 ml (3 day), %	98	93	94	99	97
Germination, 8 ml (3 day), %	47	66	64	85	80
Malt					
Physical characteristics					
Yield, %	90.8	91.9	91.8	95.4	93.4
Steep-out moisture, %	45.5	45.9	45.8	43.1	46.1
Friability, %	72.8	74.1	73.8	68.9	73.4
Chemical analysis					
Moisture, %	4.6	5.3	5.2	5.1	5.2
Wort					
Fine grind extract, %	78.6	79.0	78.9	79.4	78.8
Coarse grind extract, %	77.6	78.1	78.0	78.4	78.0
F/C difference, %	1.0	0.9	0.9	0.9	0.8
ß-Glucan, ppm	147	133	140	219	243
Viscosity, cps	1.42	1.40	1.40	1.45	1.45
Soluble protein, %	6.50	6.05	6.07	5.30	5.27
Ratio S/T, %	50.8	46.8	47.1	44.2	43.8
FAN, mg/L	274	268	267	201	221
Colour, ASBC units	3.44	2.67	2.74	1.92	2.21
Diastatic power, °L	183	201	198	169	180
α-amylase, D.U.	62.0	65.5	64.9	57.3	62.0

[1] Weighted average values
[2] Average based on four years of data
[3] Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture-proof containers.

Methods

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, (2009).

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.

β-Glucan content

B-Glucan content is determined in malt extract by Skalar segmented flow analysis using Calcofluor staining of soluble, high molecular weight ß-glucan (ASBC Wort-18).

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).

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. Material retained above the #5 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.

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).

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.

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).

Kolbach index (ratio S/T)

Kolbach index is calculated from the formula, (% Soluble protein/% Malt protein) x 100.

Micromalting Malts are prepared using an Automatic Phoenix Micromalting System designed to handle twenty-four 500 g samples of barley per batch.

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).

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 is determined on a ground sample by oven drying at 104°C for 3 hours (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).

Rapid Viscometric Analysis

The degree of pre-germination in barley was determined as described by Izydorczyk (2005); see the CGC website at www.grainscanada.gc.ca. Click on Grain research tab on left side, scroll down to technologies . There find project report: Prediction of germination energy of malting barley during long term storage. Grain Research Lab, Canadian Grain Commission, Winnipeg, Canada. Samples were analyzed using the RVA-4 (Newport Scientific) and the Stirring Number Program. Final viscosity values were presented in Rapid Visco Units (RVU).

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).

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 water sensitivity value is the numerical difference between the 4ml and 8ml tests.

Weight per thousand kernels

A 500 gram sample of dockage-free barley is divided several times in a mechanical divider to obtain one representative 40g sub-sample. 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)).

Wort-soluble protein Wort-soluble protein is determined spectrophotometrically using ASBC method Wort-17.

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