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Quality of western Canadian malting barley 2011

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Summary

The 2011 western Canadian malting barley harvest survey was based on 140 separate varietal composites, representing a total of 815,708 tonnes of barley selected for malting purposes in Western Canada.

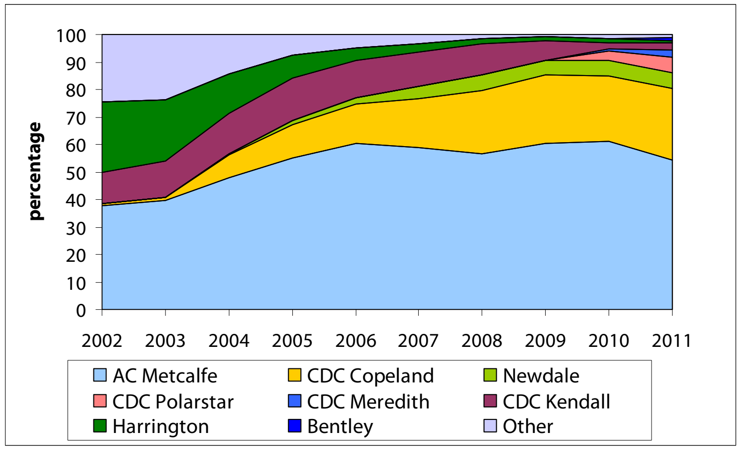
Total western Canadian barley crop production for 2011 was estimated at 7,425,000 tonnes, which is 22% lower than the 10-year average of 9,489,000 tonnes. Wet spring conditions and flooding in many growing regions delayed planting or resulted in abandonment contributing to reductions in total acres seeded to barley. Variable weather conditions throughout the growing season limited yields in some regions resulting in lower overall production.

The quality of malting barley selected in 2011 was greatly improved over that seen in 2010. Kernel weights and plumpness were higher than average. Protein levels were well below long term averages. Germination characteristics were very good; with only slight water sensitivity appearing in some samples. RVA values were high, indicating low incidence of pre-harvest sprouting throughout the crop. Some dormancy was present in six-rowed varieties as might be expected.

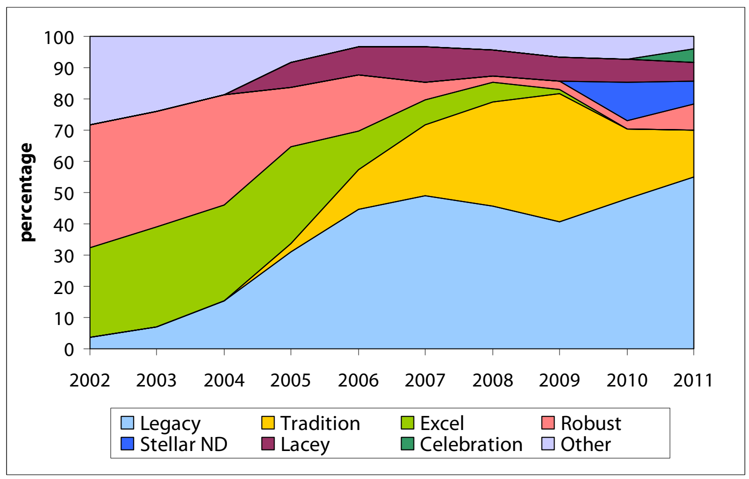
Barley from 2011 made good quality malt. Lower grain protein combined with plump kernels resulted in higher than average malt extract. Moderate levels of protein modification, and average enzyme levels are sufficient to promote good brewing performance. Large kernels can slow the uptake of water during steeping, but good modification can be achieved with appropriate steep schedules.

Figure 1 – Trends in seeded acres of malting barley cultivars, 2002-2011

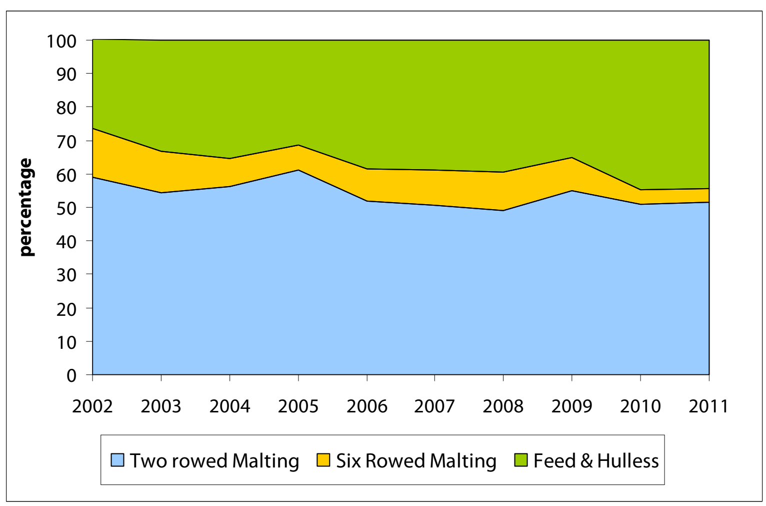
Two-rowed malting varieties



Six-rowed malting varieties



All barley varieties



[1] Data obtained from the CWB Variety Survey 2011.

Introduction

The 2011 western Canadian malting barley survey is the 24th 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 were analysed for quality and then micromalted. Barley and malt quality are analysed using ASBC standard methods of analysis.

In the past few years, a small number of varieties have dominated the portfolio of malting barley cultivars currently being grown and selected in western Canada. AC Metcalfe remained the most popular malting variety occupying 50.0% of total acres sown to malting barley in 2011 (Table 1). CDC Copeland remained in second place with seeded area increasing to 24.2% of malting barley acres. Acres seeded to six-rowed malting varieties continued to decline with Legacy still the top six-rowed malting variety but at just 4.3% of total malting barley acres. The charts in figure 1 illustrate the distribution of barley cultivars grown in the prairie provinces over the past 10 years.

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 with anticipated market demand, which is intended as a guide to assist producers in the selection of varieties for seeding in the coming year (Table 2). Two new varieties, CDC Meredith and Stellar-ND are increasing in production and are included in this report for the first time.

Table 1 – Seeded acres of malting barley cultivars (as a percentage of total area seeded to malting barley)[1]

Two-rowed cultivars				Six-rowed cultivars			
	2010	2010	2007-2011 average		2011	2010	2007-2011 average
AC Metcalfe	50.0	56.3	50.3	Legacy	4.3	3.9	6.4
CDC Copeland	24.2	21.9	19.1	Tradition	1.2	1.8	3.9
Newdale	5.3	4.9	4.5	Robust	0.6	0.2	0.5
CDC PolarStar	5.2	3.3	0.8	Stellar ND	0.6	1.0	0.3
CDC Meredith	2.4	0.6	0.2	Lacey	0.5	0.6	1.2
CDC Kendall	2.3	2.2	6.8	Celebration	0.3	0.0	0.1
Harrington	0.8	1.2	1.7	Other	0.3	0.6	1.2
Bentley	0.8	0.0	0.0				
Other	1.3	1.5	1.5				

[1]Data obtained from the CWB Variety Survey 2011.

Table 2 – Malting barley cultivars recommended for production in western Canada by the CMBTC, its members, and others in the Canadian barley industry (2012-2013)

Recommended two-rowed malting varieties

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

Recommended six-rowed barley varieties

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

CDC Meredith, a two-rowed cross of SM98427/SM98787, received full registration in 2008. It was developed by Drs. B. Harvey and B. Rossnagel at the University of Saskatchewan. With its good agronomics and disease resistance CDC Meredith has the potential to produce superior yields while maturing 1-2 days later than AC Metcalfe. CDC Meredith barley has consistently low protein and high kernel weight and plumpness, resulting in high levels of malt extract. Other malt characteristics include good friability and protein modification, with moderate levels of enzymes and slightly higher β-glucan compared with other two-rowed malts. These factors translate into good overall brewing potential.

Stellar-ND is a six-rowed cross of Foster/ND12200/6B88-3213 developed by Dr. R. Horsely at the North Dakota Agricultural Experimental Station and is well adapted for growth in the mid-western United States and western Canada. It is high yielding, with one day shorter maturity than Legacy, and above average resistance to lodging. Overall malting profile is equivalent to Legacy, with well balanced modification, consistently high levels of malt extract, and lower β-glucan than other six rowed varieties. With high levels of diastatic enzymes, malt quality of Stellar ND is consistent with requirements for modern high adjunct brewing.

Growing and harvesting conditions

The start of planting season in western Canada was delayed due to excessive soil moisture conditions resulting from heavier than normal snowfall during the winter period, compounded by cool weather during April and early May. While dry weather in northern growing regions allowed planting to proceed, heavy rains during May and June in southern Saskatchewan and south-west Manitoba flooded fields and resulted in near record levels of abandoned acres.

During July and August, weather in the southern regions turned hot and dry, while moderate to heavy rains covered the northern growing areas. Summer temperatures were significantly above normal in Manitoba and eastern Saskatchewan. Western areas of the Prairies were cooler than normal, which slowed crop development. The warm temperatures in the eastern Prairies helped boost crop development and significant harvest progress occurred during the last week of August in Manitoba.

Warm and dry conditions continued well into September across the prairies, giving much needed growing time for late seeded crops. As a result, harvesting proceeded on schedule in all areas of the Prairies. A severe frost was reported in the middle of September in parts of Alberta, Saskatchewan and Manitoba, but damage to barley was minimal as most crops were mature. Dry weather during the last half of September allowed the harvest to progress to near completion.

Production, yields and quality

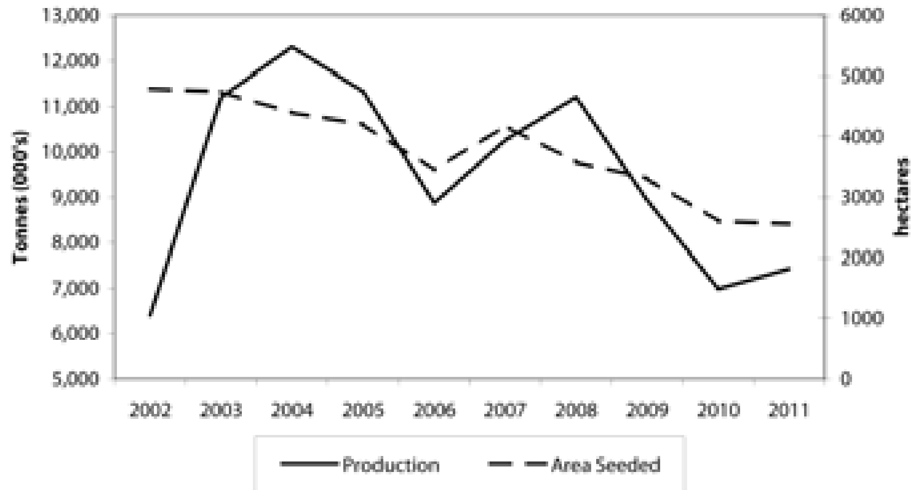
September estimates list total barley production in western Canada for 2011 at 7.4 million tonnes, which represents an increase of 6% compared to 2010 but still 22% below the 10-year average (Table 3). However, actual production may be higher than predicted due to warm and dry weather continuing into early fall which extended the harvest. While the acreage seeded to barley was similar to last year, an overall decreasing trend over the past ten years is contributing to record low production levels (Figure 2).

Table 3 – Barley production in western Canada for 2011, 2010 and the 2002-2011 average[1]

	Seeded area			Production		
	2011	2010	2002-2011 average	2011	2010	2002-2011 average
	thousand hectares			thousand tonnes		
Manitoba	130	194	338	261	487	956
Saskatchewan	911	864	1 601	2 526	1 938	3 742
Alberta[2]	1 511	1 540	1 841	4 638	4 559	4 791
Total	**2 552**	**2 598**	**3 780**	**7 425**	**6 984**	**9 489**

[1] Statistics Canada, *Field Crop Reporting Series, No. 7*, October 2011
[2] Alberta figures include small amounts grown in British Columbia

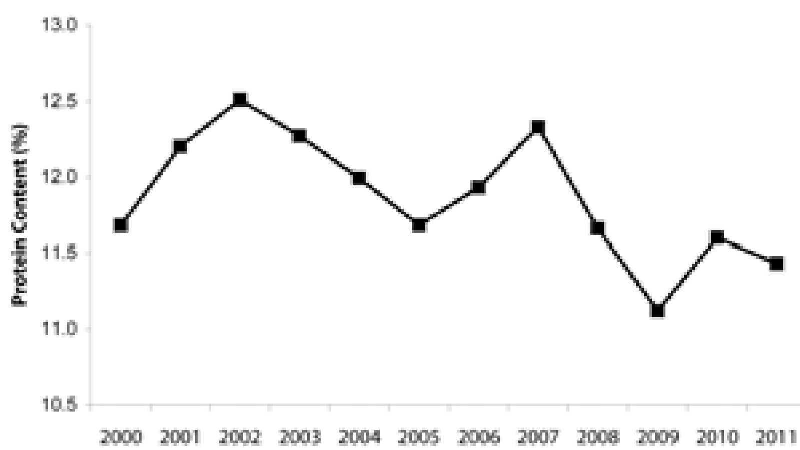
Figure 2. Annual production and area seeded to malting barley, 2002-2011



Barley kernel weights and plumpness in were higher than average in 2011. Protein levels, which have been lower in recent years due to cooler growing conditions across the prairies, were the second lowest in a decade (Figure 3). Germination characteristics were also very good; with only slight water sensitivity appearing in some samples.

Rapid visco analysis has been used by barley selectors to identify sound, moderately and strongly pre-germinated barley, and manage their supply accordingly. This year's RVA results have confirmed an excellent quality of the 2011 malting barley crop. The vast majority of samples (>90%) showed very high RVA values, ranging from 120 to 180 RVA units, and indicating a high degree of soundness and a high probability of retaining germination energy during a long-term storage. Barley exhibiting moderate pre-germination (50-110 RVA units) has good potential for storability provided proper cool and dry storage conditions.

Figure 3. Average protein content of malting barley selected from 2002-2011



Sampling and survey methodology

The 2011 malting barley survey was based on 815,708 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 total tonnage included in this survey represented a significant percentage of the total volume of malting barley selected in western Canada through the end of October.

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. Samples were received from the beginning of harvest until the 25th of October.

Samples received at the GRL were kept unique, and not further composited.

Malting quality

The high quality barley crop of 2011 was met with great anticipation due to short supply after 2010. Good germination energy with low levels of water sensitivity suggested the use of a standard micro-malting schedule with two wet steep cycles (Table 4). However, the larger barley kernel size resulted in lower than anticipated steep out moistures due to slower water uptake. The result was less endosperm modification than desired but slightly higher than normal malt yields.

This year's study resulted in malts with high levels of extract, moderate levels of protein modification, slightly elevated β-glucan levels, and adequate levels of enzyme activity. Good quality, well modified malt can be obtained from 2011 barley with an appropriate malting schedule to provide sufficient moisture during steeping.

Table 4 - Malting conditions used with Phoenix Micromalting System in 2011

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 was the dominant malting barley variety grown in Western Canada for the tenth year in a row. This year's barley had many good quality characteristics. Thousand kernel weights and plumpness levels were higher than average (Table 5). Protein levels were even lower than 2010. Germination energy was high with only slight indications of water sensitivity.

The malt produced from AC Metcalfe barley was of good quality. Higher than average levels of extract were obtained due to lower protein and good kernel plumpness. Modification was adequate despite low steep out moistures resulting in wort β-glucan levels slightly above average. Overall protein modification was poorer than last year, as indicated by lower levels of soluble protein and free amino nitrogen which contributed to lower wort colour. Diastatic power and alpha-amylase levels were average, but lower than 2010.

Table 5. Quality data for 2011 harvest survey composite samples of AC Metcalfe malting barley

Origin of selected samples	Saskatchewan		Alberta		Prairie Provinces[1]		
Crop year	2011	2010	2011	2010	2011	2010	5 Year Avg.
Thousands of tonnes	313	78	121	58	434	230	436
Barley							
Physical characteristics							
Test Weight, Kg/hL [2]	68.1	63.6	69.8	65.1	68.6	65.4	67.1
1000 kernel weight, g	44.1	39.7	45.3	43.4	44.4	41.3	43.0
Heavy grade, over 6/64" sieve, %	92.8	90.0	94.1	93.3	93.1	91.6	91.1
Intermediate grade, over 5/64"sieve, %	5.6	7.5	4.6	4.9	5.3	6.5	7.3
Chemical analysis							
Moisture, % [3]	11.5	11.9	11.8	13.5	11.6	11.8	11.7
Protein, %	11.8	11.6	11.2	11.6	11.6	11.8	11.8
Germination, 4 ml (3 day), %	99	96	99	91	99	96	98
Germination, 8 ml (3 day), %	93	78	92	66	93	78	90
Malt							
Physical characteristics							
Yield, %	94.4	92.1	95.0	92.1	94.6	91.8	93.3
Steep-out moisture, %	43.8	49.8	42.8	49.5	43.6	49.5	46.8
Friability, %	67.6	66.1	63.3	61.4	66.4	65.1	72.3
Chemical analysis							
Moisture, %	5.2	5.5	5.3	5.6	5.2	5.5	5.1
Wort							
Fine grind extract, %	80.9	79.6	81.4	80.0	81.1	79.7	80.0
Coarse grind extract, %	80.2	78.8	80.5	79.2	80.3	79.2	79.5
F/C difference, %	0.7	0.8	0.9	0.8	0.8	0.5	0.5
ß-Glucan, mg/L	91	158	134	158	103	115	82
Viscosity, cps	1.43	1.44	1.46	1.45	1.44	1.45	1.43
Soluble protein, %	4.77	4.79	4.36	4.77	4.66	4.84	4.75
Ratio S/T, %	39.4	40.8	37.6	41.1	38.9	40.8	39.9
FAN, mg/L	183	198	165	199	178	205	191
Colour, ASBC units	1.83	2.13	1.63	2.09	1.77	2.14	2.00
Diastatic power, °L	161	167	148	160	158	170	155
α-amylase, D.U.	64.1	64.8	58.4	60.6	62.5	67.6	65.9

1 Weighted average values
2 Average based on three 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 occupying nearly 25% of acres seeded to malting barley. Composites of CDC Copeland barley received in 2011 were of good quality (Table 6). Kernel weight and plumpness increased from 2010 to above average levels, while protein levels remained low. Germination energy was very high, an improvement from 2010 with a great reduction in water sensitivity as well.

Good quality malt was produced from CDC Copeland barley in 2011. Extract levels were well above average, as adequate modification was achieved with lower steep out moisture, resulting is less malting loss. Friability and levels of wort β-glucan were similar to 2010 while protein modification was below average resulting in lower, but still adequate, levels of soluble protein and FAN. Levels of diastatic power and α-amylase decreased from 2010 to average levels.

Table 6. Quality data for 2011 harvest survey composite samples of CDC Copeland malting barley

Origin of selected samples	Saskatchewan		Alberta		Prairie Provinces[1]		
Crop year	2011	2010	2011	2010	2011	2010	5 year Avg.
Thousands of tonnes	177	21	65	27	241	92	180
Barley							
Physical characteristics							
Test Weight, kg/hL [2]	66.8	63.0	68.9	65.2	67.3	64.5	66.4
1000 kernel weight, g	45.5	42.6	47.2	45.7	45.9	43.0	44.6
Heavy grade, over 6/64" sieve, %	92.8	90.3	94.5	94.5	93.3	92.3	91.8
Intermediate grade, over 5/64"sieve, %	5.6	7.1	4.3	4.0	5.3	6.0	6.7
Chemical analysis							
Moisture, % [3]	11.5	13.8	12.0	13.7	11.7	12.0	12.0
Protein, %	11.1	11.2	10.6	10.7	11.0	11.2	11.2
Germination, 4 ml (3 day), %	99	96	99	90	99	96	98
Germination, 8 ml (3 day), %	95	80	95	72	95	83	93
Malt							
Physical characteristics							
Yield, %	94.6	92.6	95.6	92.3	94.9	92.0	93.5
Steep-out moisture, %	43.6	49.2	42.1	49.3	43.2	49.1	46.7
Friability, %	77.8	77.3	71.0	73.7	76.1	76.0	80.2
Chemical analysis							
Moisture, %	5.1	5.3	5.1	5.6	5.1	5.4	5.0
Wort							
Fine grind extract, %	80.8	79.5	81.2	80.0	80.9	79.8	79.9
Coarse grind extract, %	80.1	78.8	80.3	79.1	80.1	79.1	79.4
F/C difference, %	0.7	0.7	0.9	0.8	0.8	0.7	0.6
ß-Glucan, mg/L	81	113	143	165	96	97	72
Viscosity, cps	1.42	1.42	1.47	1.46	1.43	1.43	1.42
Soluble protein, %	4.96	4.86	4.32	4.36	4.80	4.82	4.89
Ratio S/T, %	42.5	43.4	39.6	39.8	41.8	43.1	42.2
FAN, mg/L	184	200	159	169	178	194	196
Colour, ASBC units	2.01	2.48	1.70	2.01	1.93	2.29	2.05
Diastatic power, °L	134	140	115	131	129	143	131
α-amylase, D.U.	50.6	52.7	42.7	42.7	48.6	51.5	51.9

[1] Weighted average values
[2] Average based on three 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 is included in this survey for the fifth consecutive year with low but consistent tonnage selected annually. Thousand kernel weight and plumpness of Newdale barley grown in 2011 was higher than average, increasing significantly from 2010. Protein decreased from 2010, returning to average levels. Germination was excellent with little evidence of water sensitivity.

Newdale barley from 2011 produced good quality malt. Well modified malt with above average extract was achieved despite lower steep-out moistures. Wort β-glucan levels and friability were similar to 2010 while soluble protein and FAN increased slightly to above average levels. Enzyme levels were also slightly above average; similar to those of 2010.

Table 7. Quality data for 2011 harvest survey composite samples of Newdale malting barley

Origin of selected samples	Manitoba/ Saskatchewan		Alberta		Prairie Provinces[1]		
Crop year	2011	2010	2011	2010	2011	2010	5 Year Avg
Thousands of tonnes	7	3	3	2	10	5	17
Barley							
Physical characteristics							
Test Weight, Kg/hL [2]	66.5	61.5	68.6	62.8	67.0	62.1	65.3
1000 kernel weight, g	45.3	41.0	44.5	41.3	45.1	40.9	43.7
Heavy grade, over 6/64" sieve, %	91.8	86.3	92.3	88.8	92.1	87.3	89.0
Intermediate grade, over 5/64"sieve, %	6.4	9.6	5.9	8.7	6.2	9.2	8.7
Chemical analysis							
Moisture, % [3]	12.3	14.8	12.2	13.8	12.2	14.4	12.6
Protein, %	11.9	12.4	11.8	12.1	11.8	12.3	11.8
Germination, 4 ml (3 day), %	99	95	99	99	99	97	99
Germination, 8 ml (3 day), %	95	83	97	90	96	86	93
Malt							
Physical characteristics							
Yield, %	95.3	92.3	94.1	89.6	95.0	91.2	93.6
Steep-out moisture, %	43.9	50.4	43.7	50.9	43.8	50.6	46.8
Friability, %	80.7	72.3	72.6	78.7	78.7	74.8	83.4
Chemical analysis							
Moisture, %	5.1	4.7	5.1	5.7	5.1	5.1	4.9
Wort							
Fine grind extract, %	80.3	78.9	80.2	78.2	80.2	78.6	79.4
Coarse grind extract, %	79.6	78.0	79.8	77.9	79.7	77.9	79.0
F/C difference, %	0.6	0.9	0.4	0.4	0.5	0.7	0.5
ß-Glucan, mg/L	71	105	82	35	74	77	65
Viscosity, cps	1.39	1.41	1.42	1.39	1.39	1.40	1.40
Soluble protein, %	4.97	4.78	4.84	4.86	4.93	4.81	4.50
Ratio S/T, %	40.7	38.9	40.6	40.1	40.7	39.3	38.2
FAN, mg/L	176	174	166	193	174	181	158
Colour, ASBC units	1.69	1.88	1.56	2.32	1.65	2.05	1.80
Diastatic power, °L	142	131	155	166	145	145	137
α-amylase, D.U.	60.0	54.9	59.8	63.8	59.8	58.5	57.4

[1] Weighted average values
[2] Average based on three 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

Significant quantities of CDC Meredith barley were grown and selected in 2011 to warrant inclusion in this report for the first time (Table 8). Selected composites of CDC Meredith barley had good quality with high levels of plumpness and good kernel weight. Protein levels were nearly one percent lower than other two-rowed varieties. Germination was excellent with little evidence of water sensitivity.

Good quality malt was obtained from CDC Meredith barley. Extract levels were higher than other two rowed varieties due to the lower grain protein, while wort β-glucan was only slightly elevated. Protein modification was good delivering higher soluble protein and FAN resulting in elevated wort colour. Enzymes levels were moderate, slightly lower than AC Metcalfe.

Table 8. Quality data for 2011 harvest survey composite samples of CDC Meredith malting barley

	Saskatchewan	Alberta	Prairie Provinces[1]
Crop year	2011	2011	2011
Thousands of tonnes	6	11	17
Barley			
Physical characteristics			
Test Weight, Kg/hL	67.2	68.2	67.8
1000 kernel weight, g	47.8	47.5	47.6
Heavy grade, over 6/64" sieve, %	95.1	95.1	95.1
Intermed grade, over 5/64"sieve, %	3.8	3.8	3.8
Chemical analysis			
Moisture, % [2]	13.5	12.1	12.6
Protein, %	10.8	10.6	10.7
Germination, 4 ml (3 day), %	99	99	99
Germination, 8 ml (3 day), %	98	94	96
Malt			
Physical characteristics			
Yield, %	93.2	93.4	93.4
Steep-out moisture, %	45.8	45.0	45.3
Friability, %	78.6	77.6	78.0
Chemical analysis			
Moisture, %	5.3	5.1	5.2
Wort			
Fine grind extract, %	81.5	81.6	81.6
Coarse grind extract, %	81.0	80.9	80.9
F/C difference, %	0.5	0.7	0.6
ß-Glucan, ppm	96	122	113
Viscosity, cps	1.40	1.43	1.42
Soluble protein, %	5.07	4.64	4.80
Ratio S/T, %	45.4	42.5	43.5
FAN, mg/L	196	179	185
Colour, ASBC units	2.46	1.92	2.11
Diastatic power, °L	156	146	149
α-amylase, D.U.	55.7	53.3	54.2

1 Weighted average values

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

Legacy

While occupying only a small fraction of total malting barley acres, Legacy continues to be the most popular six-rowed malting barley variety with selected tonnages returning to average levels in 2011 (Table 9). Plumpness and test weight of Legacy barley increased from 2010 to above average levels in 2011. Protein was average, decreasing from 2010. Germination energy was excellent, and only moderate water sensitivity was present, an improvement from the situation in 2010.

Malt made from Legacy barley in 2011 had higher than average extract while friability and levels of wort β-glucan were similar to 2010. Overall protein modification was good, resulting in above average levels of soluble protein. Enzyme levels decreased to average levels from 2010 due to lower protein content.

Stellar ND

Although selected tonnages are still relatively low, Stellar ND is an emerging new variety and is appearing in this report for the first time. Barley composites had good plumpness and kernel weights, with higher than average protein content. Germination energy was excellent with moderate water sensitivity present, similar to Legacy.

Stellar ND barley produced good quality malt with high levels of extract and lower wort β-glucan than other six-rowed varieties. Moderate protein modification resulted in lower levels of soluble protein and FAN, contributing to low wort colour. Diastatic power was enhanced by higher barley protein content, but α-amylase levels were low.

Table 9. Quality data for 2011 harvest survey composite samples of Legacy and Stellar ND malting barley.

	Legacy			Stellar ND
Origin of selected samples	Saskatchewan		Prairie/ Provinces	Manitoba/ Saskatchewan
Crop year	2011	2010	5 Year Avg	2011
Thousands of tonnes	85	5	85	6
Barley				
Physical characteristics				
Test Weight, Kg/hL [1]	65.1	63.0	64.5	63.8
1000 kernel weight, g	38.2	36.7	38.0	41.3
Heavy grade, over 6/64" sieve, %	93.0	91.2	91.1	92.7
Intermed grade, over 5/64"sieve, %	5.5	7.1	7.2	4.8
Chemical analysis				
Moisture, % [2]	11.2	11.6	11.6	11.7
Protein, %	11.8	12.3	11.8	12.2
Germination, 4 ml (3 day), %	99	96	98	99
Germination, 8 ml (3 day), %	85	69	86	86
Malt				
Physical characteristics				
Yield, %	95.4	91.4	93.6	95.7
Steep-out moisture, %	43.1	49.3	46.4	43.3
Friability, %	68.9	68.6	74.8	72.3
Chemical analysis				
Moisture, %	5.1	5.6	5.1	5.3
Wort				
Fine grind extract, %	79.4	78.2	78.6	79.2
Coarse grind extract, %	78.4	77.7	77.9	78.4
F/C difference, %	0.9	0.6	0.8	0.9
ß-Glucan, ppm	219	214	263	166
Viscosity, cps	1.45	1.46	1.46	1.44
Soluble protein, %	5.30	5.42	5.07	5.10
Ratio S/T, %	44.2	44.4	43.0	40.5
FAN, mg/L	201	243	209	184
Colour, ASBC units	1.92	2.33	2.10	1.60
Diastatic power, °L	169	207	171	191
α-amylase, D.U.	57.3	63.9	61.1	41.1

[1] Average based on three years of data

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

Tradition

Selected composites of Tradition barley in 2011 was of average quality. While plumpness was higher than average, kernel weights were lower than in 2010. Protein content decreased from 2010 to below average levels, but was still high in the eastern Prairies due to warm and dry growing conditions in that region. Germination energy was lower than 2010 but still acceptable, along with moderate water sensitivity indicating the presence of dormancy.

Tradition barley from 2011 produced malt of acceptable quality. Higher than average extracts were obtained from barley with lower protein contents. Wort β-glucan levels were elevated, as typically seen with this variety, indicating limited endosperm modification due to dormancy. Levels of soluble protein and FAN were lower than in 2010, but close to average values. Diastatic power levels were also dependent on barley protein content, but α-amylase levels were below average.

Table 10. Quality data for 2011 harvest survey composite samples of Tradition malting barley

Origin of selected samples	Manitoba	Saskatchewan		Prairie Provinces[1]		
Crop year	2011	2011	2010	2011	2010	5 Year Avg
Thousands of tonnes	1	6	1	7	5	28
Barley						
Physical characteristics						
Test Weight, Kg/hL [2]	65.1	65.9	67.2	65.8	65.6	66.0
1000 kernel weight, g	38.7	38.7	41.1	38.7	39.3	38.7
Heavy grade, over 6/64" sieve, %	90.3	95.8	92.4	95.4	94.1	92.5
Intermed grade, over 5/64"sieve, %	7.7	3.0	5.6	3.4	4.6	6.0
Chemical analysis						
Moisture, % [3]	12.6	12.2	13.1	12.3	11.3	11.6
Protein, %	12.9	11.5	12.5	11.6	12.2	12.0
Germination, 4 ml (3 day), %	96	95	95	95	98	97
Germination, 8 ml (3 day), %	73	84	57	83	78	85
Malt						
Physical characteristics						
Yield, %	93.6	93.7	91.4	93.7	90.2	93.3
Steep-out moisture, %	44.4	46.4	48.1	46.3	49.2	47.1
Friability, %	50.0	67.7	67.6	66.5	72.4	69.9
Chemical analysis						
Moisture, %	5.8	4.9	5.3	4.9	5.7	5.1
Wort						
Fine grind extract, %	78.7	79.7	78.7	79.6	78.2	78.4
Coarse grind extract, %	77.7	78.6	78.0	78.6	77.5	77.4
F/C difference, %	1.0	1.0	0.7	1.0	0.6	1.0
ß-Glucan, ppm	157	248	180	241	93	258
Viscosity, cps	1.49	1.50	1.50	1.50	1.44	1.48
Soluble protein, %	5.07	4.54	4.77	4.58	4.78	4.56
Ratio S/T, %	37.9	40.2	38.6	40.1	39.2	38.0
FAN, mg/L	169	167	183	167	192	171
Colour, ASBC units	1.54	1.54	1.63	1.54	1.89	1.66
Diastatic power, °L	209	185	197	187	214	182
α-amylase, D.U.	48.9	44.2	59.1	44.6	61.9	50.4

[1] Weighted average values
[2] Average based on three 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 (RVA).

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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