Malting and Brewing with New Barley Varieties

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CANADIAN MALTING BARLEY TECHNICAL CENTRE

Summary of Presentation

- Barley Quality Analysis
- Pilot Malting Trials
- Pilot Brewing Trials
- Final Beer Analysis
- Meredith and Reserve
- Landis, Bentley and Norman

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Barley Quality Analysis

Variety	Moisture %	Protein %	Germ. 4mL %	Germ. 8mL %	1000 K weight (g)
CDC Meredith 2008 (n=7)	12.4	11.3	99	86	53.4
CDC Meredith 2009 (n=7)	12.7	11.2	99	87	50.2
CDC Reserve 2008 (n=7)	12.3	11.8	98	56	55.4
CDC Reserve 2009 (n=3)	13.5	10.8	99	47	50.3

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Pilot Malting Trials

STEEPING CYCLES
2008 CDC Meredith – 46 hours (8W-13D-8W-14D-3W) at 15°C
2009 CDC Meredith – 41 hours (6W-14D-6W-10D-5W) at 15°C
2008 CDC Reserve – 45 hours (9W-12D-8W-12D-4W) at 15°C
2009 CDC Reserve – 44 hours (7W-14D-7W-13D-3W) at 14°C
GERMINATION CONDITIONS
2008 CDC Meredith– Day 1 @16°C, Day 2,3 @15.5°C, Day 4 @15°C
2009 CDC Meredith– Day 1, 2, 3, 4 @15°C
2008 CDC Reserve – Day 1 @16°C, Day 2,3 @15.5°C, & Day 4 @15°C
2009 CDC Reserve – Day 1,2 @15°C, Day 3,4 @14°C
KILNING CONDITIONS
A 21 hour cycle with a 4hrs of curing stage at 82°C

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Pilot Malting Processing Data

Variety	Moisture at cast %	Chitting rate %
2008 CDC Meredith	45.1	100
2009 CDC Meredith	44.0	95
2008 CDC Reserve	44.3	100
2009 CDC Reserve	43.3	95

Variety	At the end of germination (96 Hrs)		
Acrospire growth %	½ to ¾	¾ to 1	>1
2008 CDC Meredith	10	65	25
2009 CDC Meredith	0	65	35
2008 CDC Reserve	5	75	20
2009 CDC Reserve	5	75	20

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Final Malt Analysis

Parameter	2008 CDC Meredith	2009 CDC Meredith	2008 CDC Reserve	2009 CDC Reserve	2008 AC Metcalfe	2008 CDC Copeland
Moisture, %	**4.2**	***4.0***	**4.6**	***3.7***	4.5	3.9
Friability, %	**91.4**	***96.2***	**86.6**	***95.8***	83.4	95.8
F Ext, %	**81.4**	***81.7***	**80.3**	***81.0***	81.5	81.3
C Ext, %	**80.9**	***81.2***	**78.8**	***80.7***	80.9	80.8
F/C Diff, %	**0.5**	***0.5***	**1.5**	***0.3***	0.6	0.5
S Prot, %	**5.13**	***5.00***	**4.69**	***4.48***	5.40	5.12
T Prot, %	**11.17**	***9.45***	**11.35**	***9.96***	11.86	11.12
KI, %	**45.9**	***52.9***	**41.3**	***45.0***	46.7	47.3
β- Glu, ppm	**84**	***75***	**298**	***139***	116	86
Visc, cps	**1.40**	***1.43***	**-**	***1.45***	1.43	1.41
DP, °L	**153**	***151***	**162**	***130***	144	137
α-Amyl, DU	**55.1**	***67.1***	**50.1**	***62.9***	60.7	55.9
W Col	**2.05**	***2.63***	**1.69**	***1.83***	1.86	1.88
pH	**5.80**	***5.87***	**5.78**	***5.82***	5.82	5.82
FAN, mg/L	**234**	***205***	**203**	***167***	250	219

Pilot Brewing Trials

Mash Tun

- 100% malt brew – 40 kg of malt and 125L of water added to mash tun
- Mash in at 48°C, hold for 30 min
- Raise to 65°C, hold for 30 min
- Raise to 76°C
- Pump over to Lauter Tun

Lauter Tun

- Rest for 5 minutes, vorlauf for 10 minutes
- Rakes at 20 cm above bottom, on slow for entire lautering
- 25L underlet
- 100L sparge water at 75°C

Brew Kettle

- First hop (Nugget) boiled for 90 min – 37g
- Second hop ( ) boiled for 5 min – 75g

Fermentation, aging, filtering and bottling conditions for the brewing trials

- Cooled to 13.5ºC, pitched with lager yeast at 1.25 million cells per mL
- Fermented for 7 days, cooled to 1.5ºC and then transferred to storage
- Stored at -0.5 ºC for 10 days
- Filtered through a 1 µm pad filter system, carbonated to 2.5 volumes CO_2
- Stored 2 days at -2ºC, and packaged
- Pasteurized to 15 PU

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Pilot Brewing Processing Data

Brewing Parameter	2008 CDC Meredith	2009 CDC Meredith	2008 CDC Reserve	2009 CDC Reserve	2008 AC Metcalfe	2008 CDC Copeland
Conversion time (minutes)	14	10	11	-	10.5	14
Time to clear (minutes)	8	7.5	10	-	6.5	7
Lautering time (minutes)	59	59	66	-	62	60
Malt Material Yield (%)	90.1	94.3	91.5	-	91.8	90.8
Wort pH	5.16	5.23	5.10	-	5.16	5.16
Wort Colour (SRM)	3.75	4.73	3.18	-	3.48	2.08
Attenuation Limit (%)	85.7	87.9	81.9	-	85.0	85.1

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Final Beer Analysis

Beer Parameter	2008 CDC Meredith	2009 CDC Meredith	2008 CDC Reserve	2009 CDC Reserve	2008 AC Metcalfe	2008 CDC Copeland
Real Extract (Plato)	3.23	3.55	3.56	-	2.99	2.89
Alcohol (%)	5.16	5.52	4.91	-	5.19	5.09
Color, (ASBC)	3.08	3.76	2.40	-	2.71	2.30
pH	4.10	4.31	4.16	-	4.15	4.12
Foam (sec)	196	237	154	-	116	126
Initial Turbidity (FTU)	28.6	27.1	28.2	-	9.8	19.1
Chill Turbidity (FTU) 24 Hr	29	29.3	32.3	-	10.9	22.2

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Sensory Notes

- **2008 CDC Meredith** - rated as an normal good and fresh beer. Appearance - nice colour and clear, with very nice foam. Slightly grainy and sour with some estery notes. Overall mark 2.7
- **2009 CDC Meredith** - rated as an normal good and fresh beer. Appearance - pleasant golden colour and clear, excellent foam. Good body, slightly sour, with nice estery notes. Overall mark 2.7
- **2008 CDC Reserve** - rated as an excellent beer with no defects and many good characteristics. Appearance - nice yellow colour and clear, good foam. Nice body with very pleasant estery notes. Overall mark 3.0

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CDC Meredith Summary

Malting Performance	2008	2009
Water Uptake	Good	Good
Chitting at end of Steep	Excellent	Normal
Acrospire Growth	Good	Good
Malt Quality	**2008**	**2009**
Modification	Good	Good
Extract	Higher	Higher
Enzymes	Low to Moderate	Higher
Beta-glucan	Low	Low
FAN Level	Good	Lower
Brewing Performance	**2008**	**2009**
Extraction/Lautering – timing	Normal	Normal
Extraction/Lautering- efficiency	Normal	Higher
Wort Clarity	Normal	Normal
Beer Quality	**2008**	**2009**
Fermentability	High	Excellent
Foam Stability	Very High	Excellent
Physical Stability	Normal	Normal
Colour	Higher	Higher
Taste	Acceptable	Acceptable

Green = better than controls, Red= poorer than controls, Yellow= marginal result

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CDC Reserve Summary

Malting Performance	2008	2009
Water Uptake	Good	Lower
Chitting at end of Steep	Excellent	Lower
Acrospire Growth	Good	Good
Malt Quality	**2008**	**2009**
Modification	Unbalanced	Good
Extract	Lower	Good
Enzymes	Moderate	Good
Beta-glucan	High	High
FAN Level	Lower	Lower
Brewing Performance	**2008**	**2009**
Extraction/Lautering – timing	Slower	ND
Extraction/Lautering- efficiency	Normal	ND
Wort Clarity	Normal	ND
Beer Quality	**2008**	**2009**
Fermentability	Lower	ND
Foam Stability	High	ND
Physical Stability	Normal	ND
Colour	OK	ND
Taste	Good	ND

Green = better than controls, Red= poorer than controls, Yellow= marginal result

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Barley Quality Analysis

Variety	Moisture %	Protein %	Germ. 4mL %	Germ. 8mL %	1000 K weight (g)
CDC Landis 2008	11.8	11.1	99	89	48.3
Norman 2008	9.4	12.2	100	76	44.2
Bentley 2008	11.8	12.2	99	90	50.5

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Pilot Malting Trials

STEEPING CYCLES
CDC Landis – 47 hours (9W-13D-9W-13D-3W) at 15°C
Norman – 44 hours (8W-13D-8W-12D-3W) at 15°C
Bentley – 45 hours (9W-12D-8W-12D-4W) at 15°C
GERMINATION CONDITIONS
CDC Landis – Day 1,2 @16°C, Day 3 @15.5°C, Day 4 @15°C
Norman – Day 1, 2 @15°C, Day 3, 4 @14°C
Bentley – Day 1 @15°C, Day 2,3,4 @14°C
KILNING CONDITIONS
A 21 hour cycle with a 4hrs of curing stage at 82°C

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Malt Analysis

Parameter	CDC Landis	Norman	Bentley
Moisture, %	4.0	4.1	3.9
Friability, %	94.6	95.5	71.7
F Ext, %	84.2	82.1	80.2
C Ext, %	83.4	81.8	79.9
F/C Diff, %	0.7	0.3	0.3
S Prot, %	5.36	5.69	5.6
T Prot, %	10.44	11.65	11.98
KI, %	51.3	48.8	46.7
β- Glu, ppm	96	61	217
Visc, cps	1.41	1.41	1.44
DP, °L	148	176	123
α-Amyl, DU	54.8	81.3	60.7
W Col	2.42	2.20	2.01
pH	5.71	5.69	5.93
FAN, mg/L	259	263	236

Brewing and Beer Analysis

Parameter	CDC Landis	Norman	Bentley
Conversion time	13	6	6
Time to clear	10	8	9
Lautering time	61	64	105
Malt Material Yield (%)	90.5	89.0	86.2
Wort pH	5.18	5.11	5.23
Attenuation Limit (%)	82.7	86.7	84.4
Real Extract (Plato)	3.96	3.48	3.65
Alcohol (%)	5.21	5.34	5.03
Color, (ASBC)	4.53	4.00	3.96
Foam (sec)	141	142	156
Chill Turbidity (FTU) 24 Hr	36.5	25.0	17

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