What Can We Expect from Newer Canadian Malting Barley Varieties?

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CMBTC™ CANADIAN MALTING BARLEY TECHNICAL CENTRE

The Science of Beer

Outline

1. Barley quality of newer varieties
2. Malting characteristics
3. Brewing characteristics

Objective

To evaluate malting and brewing characteristics and the quality of end products of newer Canadian malting varieties under CMBTC standard processing conditions

Materials and Methods

Barley samples:

Two-rowed varieties, AAC Synergy, Bentley, Cerveza, CDC Meredith, CDC Kindersley, CDC Clear and Major barley samples of 2011-2013 crop

Pilot malting and pilot brewing trials:

Conducted at CMBTC's 85-100 kg pilot malting system and 2.5HL brewery under CMBTC's standard conditions

Parameters assessed:

Barley quality; malting characters and malt quality; brewing characters and beer quality

Materials and Methods

Standard malting conditions

Steeping Cycles:

- Total 44 hrs (7 hrs Wet- 14 hrs Dry- 7 hrs Wet- 14 hrs Dry-2 hrs Wet) at 14° C

Germination Conditions:

- Day 1 @ 15°C; Day 2@ 15°C; Day 3 @ 15°C; Day 4 @ 14°C

Kilning Conditions:

- A 21 hour cycle with a 4-hour curing phase at 82° C

Materials and Methods

Standard Brewing Parameters :

- 100% all malt brew 40 kg malt charge.
- Water : malt ratio in mash tun was 3.75:1
- Mash profile: Mash in at 48°C, hold for 30 minutes, raise at 1°C per minute to 65°C, hold for 30 minutes (measure conversion every minute), raise at 1°C per minute to 76°C and hold one minute
- Set in lauter tun 10 minutes, then vorlauf until wort turbidity less than 100 FTU
- Lautering run with rakes up at slow speed, sparge volume 125 L
- Kettle full to 275 L
- Boil 90 minutes to 250 L
- Transfer to whirlpool and rest for 15 minutes

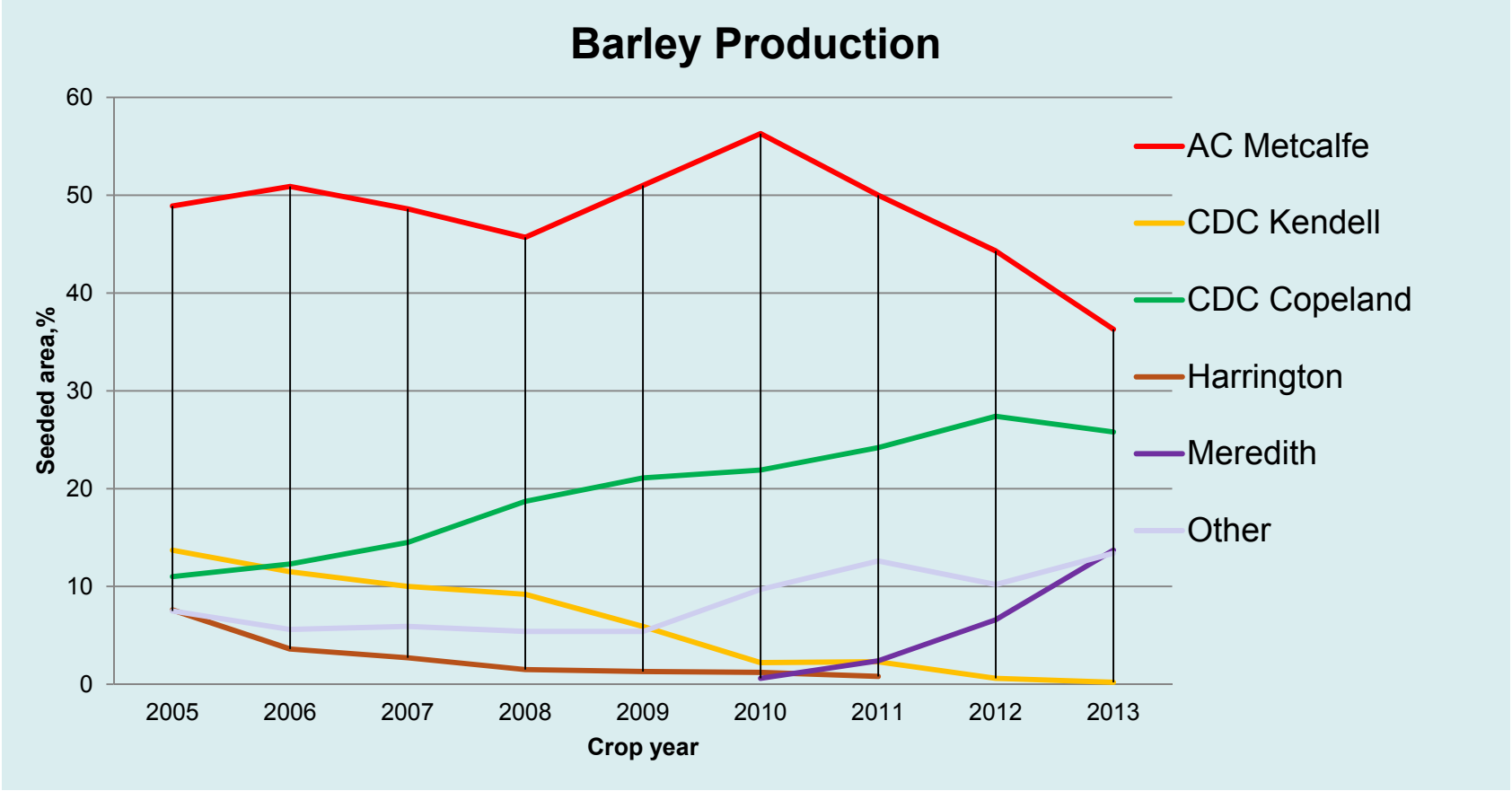
Materials and Methods

Standard Brewing Parameters :

- Cooled to 12ºC, pitched with lager yeast at 12 million cells per mL
- Free rise to 13.5ºC
- Fermented for 7 days (4 days at 13.5ºC and 3 days at 15ºC)
- Cooled and stored at -1 ºC for 7 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

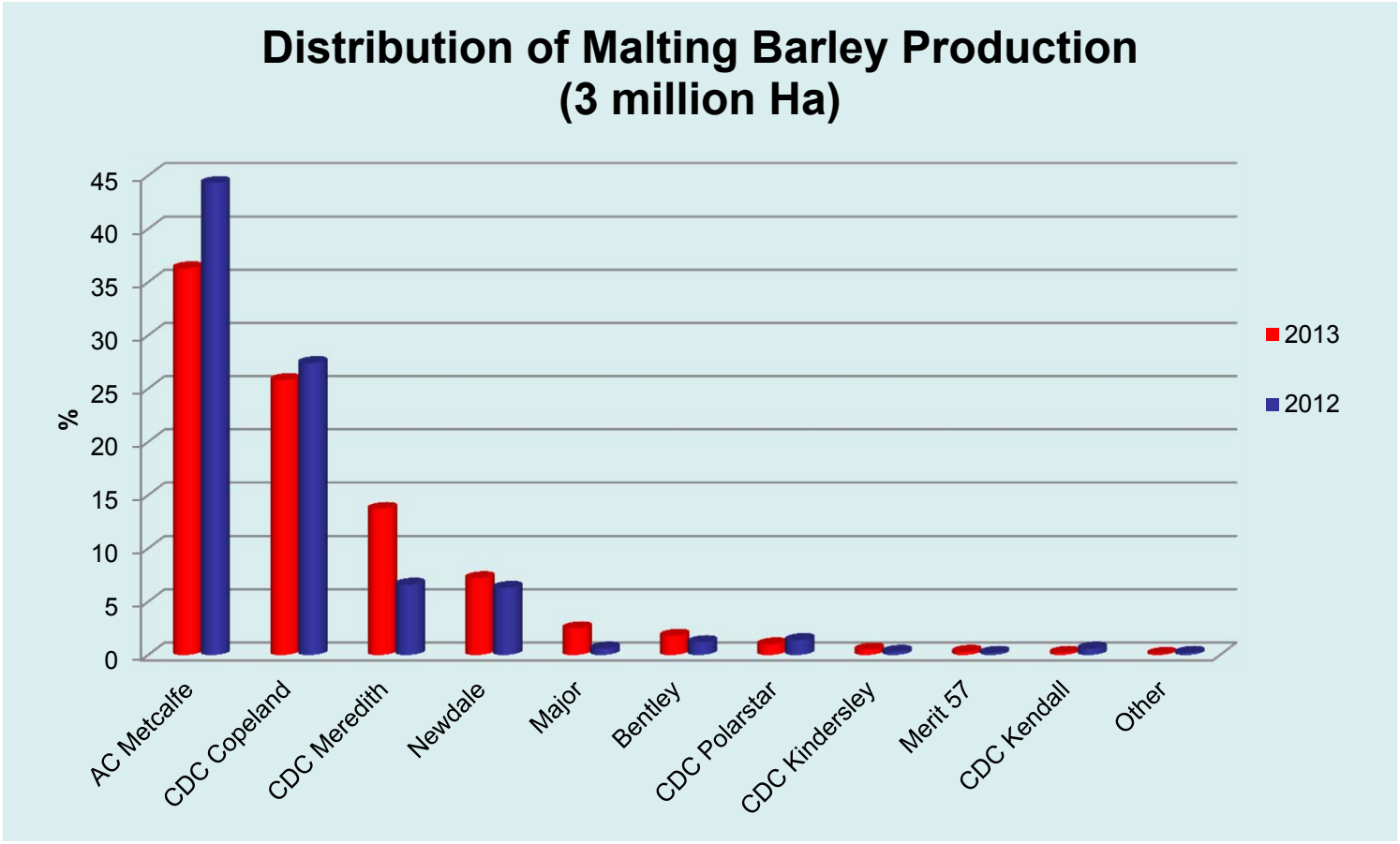
1. Barley Quality of Newer Varieties

Production of Canadian Two-Rowed Malting Barley Varieties



Since 2000, AC Metcalfe and CDC Copeland have become the dominant two-row malting varieties.

Production of Canadian Two-Row Malting Barley Varieties



AC Metcalfe and CDC Copeland are being challenged by the newer varieties.

Yield/Disease Comparison

New Variety	Year Registration/ breeder	Compared to AC Metcalfe	Compared to CDC Copeland	Disease resistance
Bentley	2008/P.Juskiw	9.4-11.0%		Good
CDC Meredith	2010/ B. Rossnagel	13%	14%	Good
Major	2011/ B. Legge	5-11%		Good
Ceveza	2011/B Legge	8.7%	5.9%	Superior
CDC Kindersley	2013/B. Rossnagel	6.0 %	2%	Good
AAC Synergy	2013/ B. Legge	13%		Good
CDC Clear	2013/A. Beattie	Similar	3-5% less	good

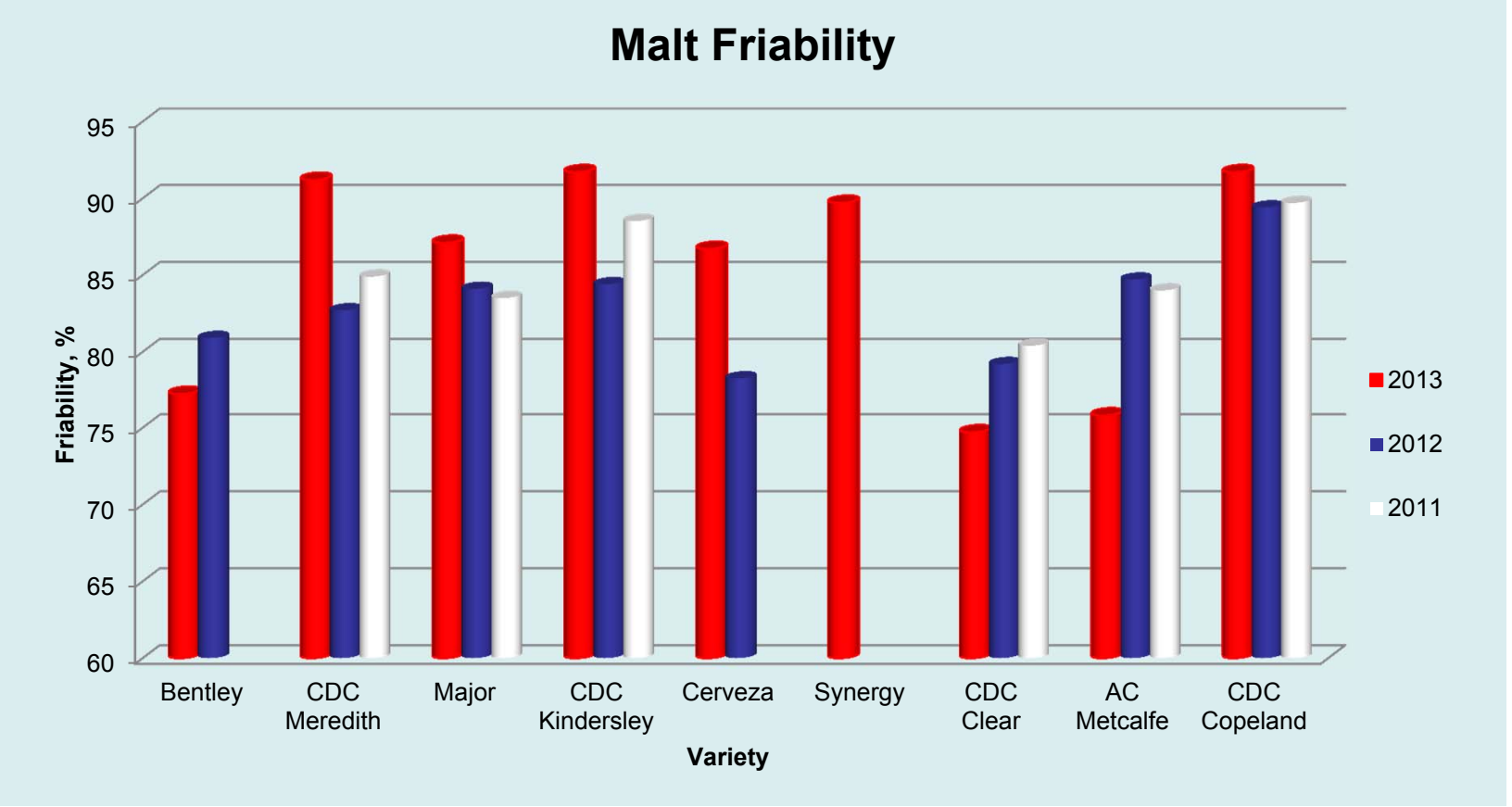
These newer varieties showed higher yield and improved disease resistance packages compared to AC Metcalfe and CDC Copeland

Barley Quality Comparison

Variety	Protein, %	Germination % (4ml,	Germination % (8ml	1000 Kernel wt, g	Plumpness, % >6/64 sieve	RVA
Bentley	12.5	99.0	79.4	42.9	88.71	146
CDC Meredith	11.5	98.6	91.2	46.0	89.61	137
Major	11.7	99.3	87.2	49.6	83.43	139
Ceveza	11.7	97.3	72.1	45.7	93.36	138
CDC Kindersley	11.9	98.7	87.6	43.9	92.01	139
AAC Synergy	10.7	97.8	90.5	51.1	95.34	128
CDC Clear	11.7	97.3	93.0	54.0	98.26	184
AC Metcalfe	12.3	98.0	83.0	43.9	89.88	124
CDC Copeland	11.3	98.7	90.0	47.1	91.4	146
Data are the averages of 2011, 2012 and 2013 crop years						

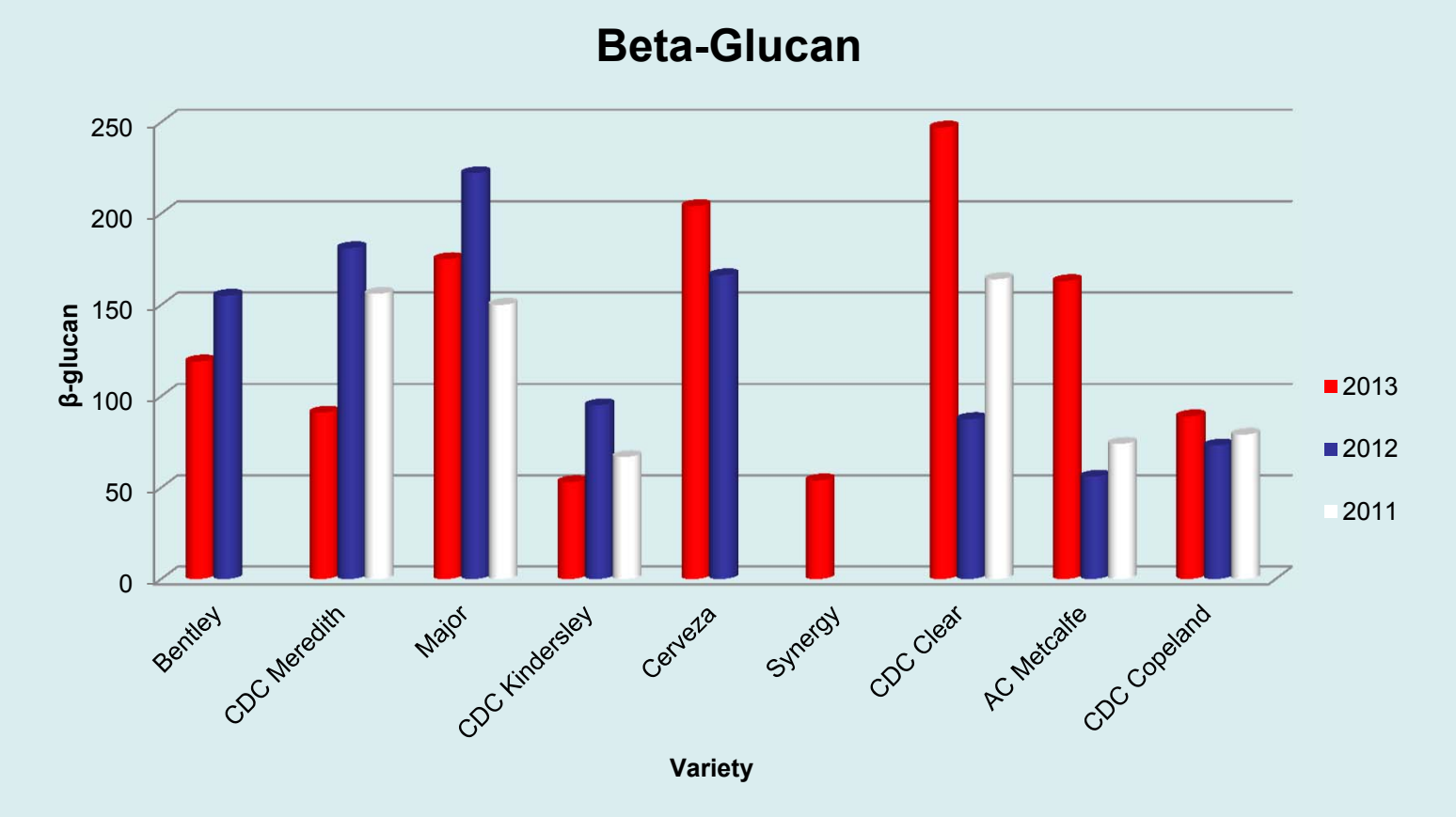
2. Malting Characteristics

Malt Modification



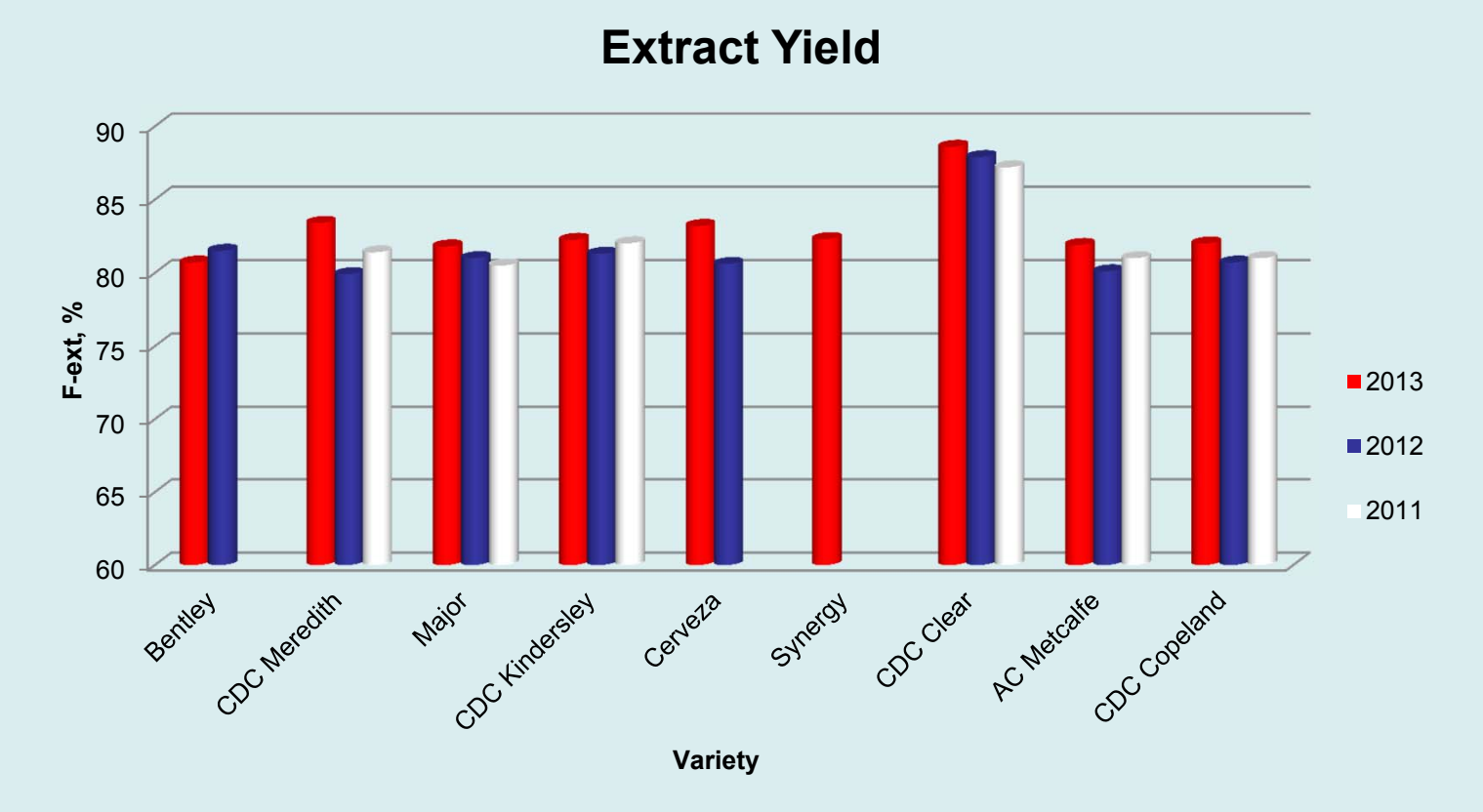
In all malting trials the new varieties recorded acceptable friability when compared to AC Metcalfe and CDC Copeland

Malt Modification



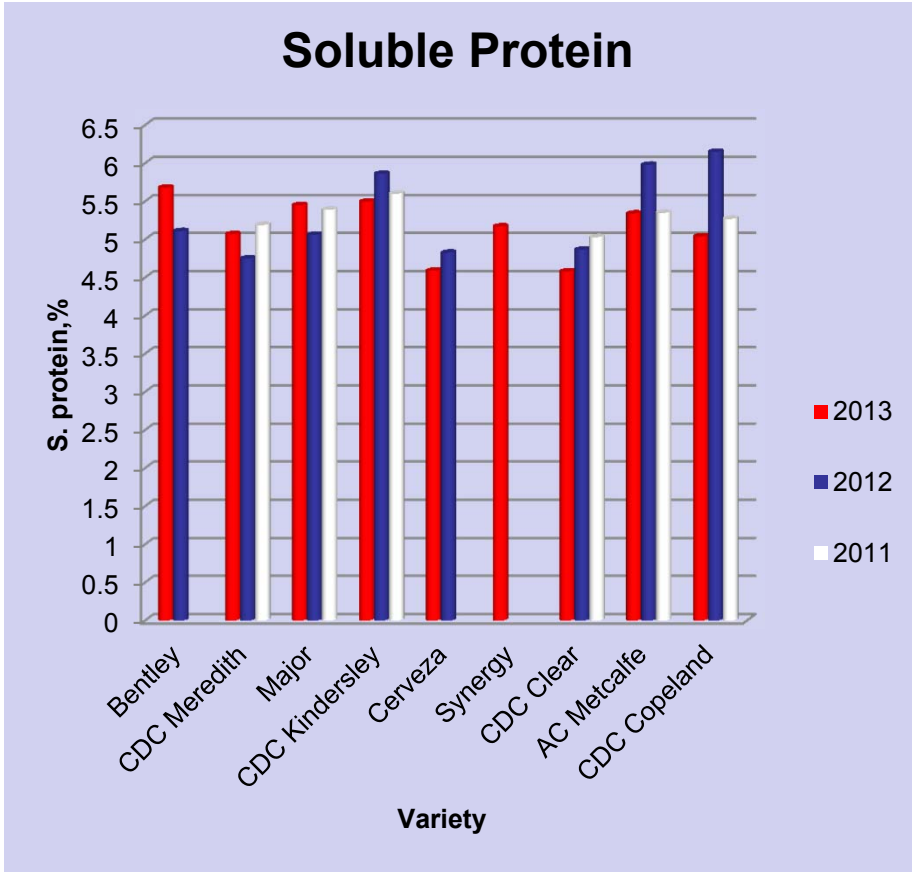
Significant varietal differences in β-glucan breakdown were recorded, Meredith, Cerveza and Clear showed higher β-glucan in some crop years when compared to AC Metcalfe and CDC Copeland

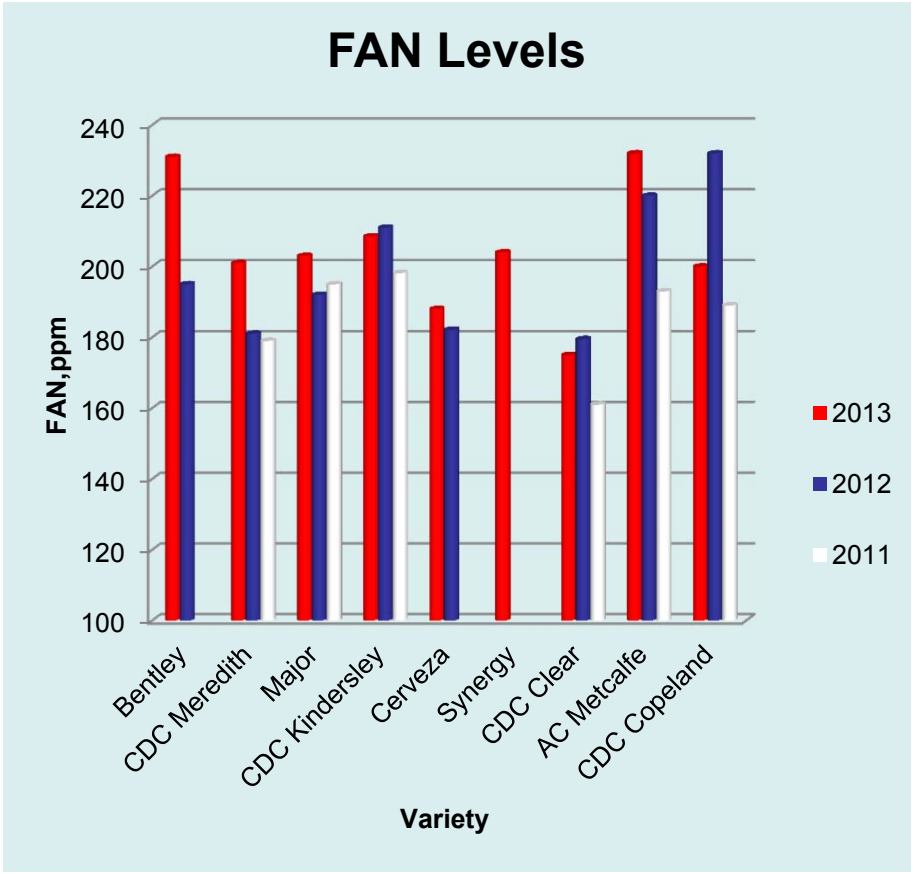
Malt Extract Yield



CDC Clear showed the highest extract yield as expected; the rest of the newer varieties showed extract yield higher or equal to AC Metcalfe and CDC Copeland

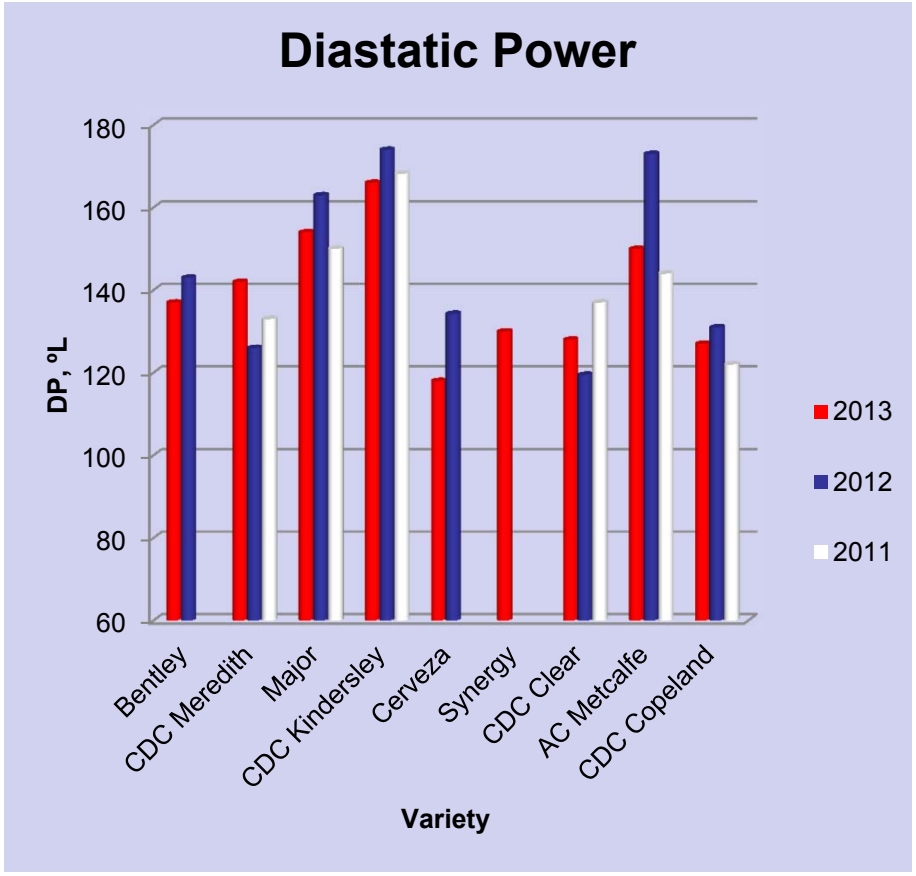
Proteins

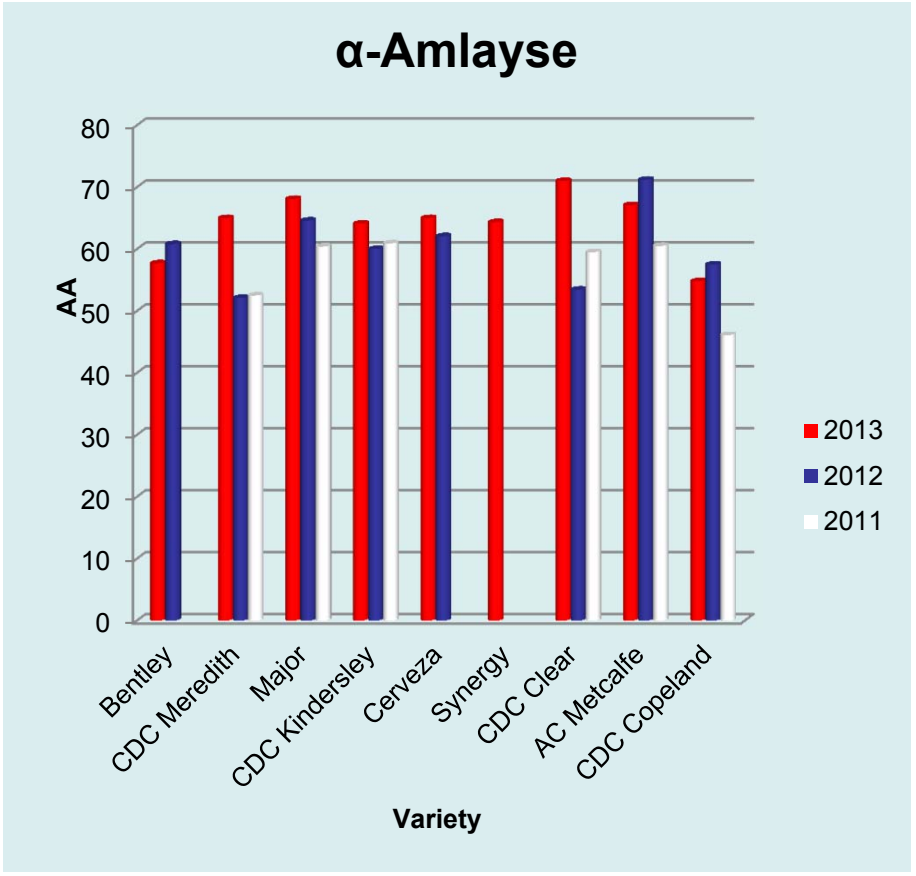




The newer varieties showed good protein solublisation; they offer good soluble protein and adequate FAN levels.

Enzymes





The newer varieties show good enzyme levels; Major and CDC Kindersley show enzymes comparable to AC Metcalfe and the rest of the newer varieties show enzyme levels closer to CDC Copeland

3. Brewing Characteristics

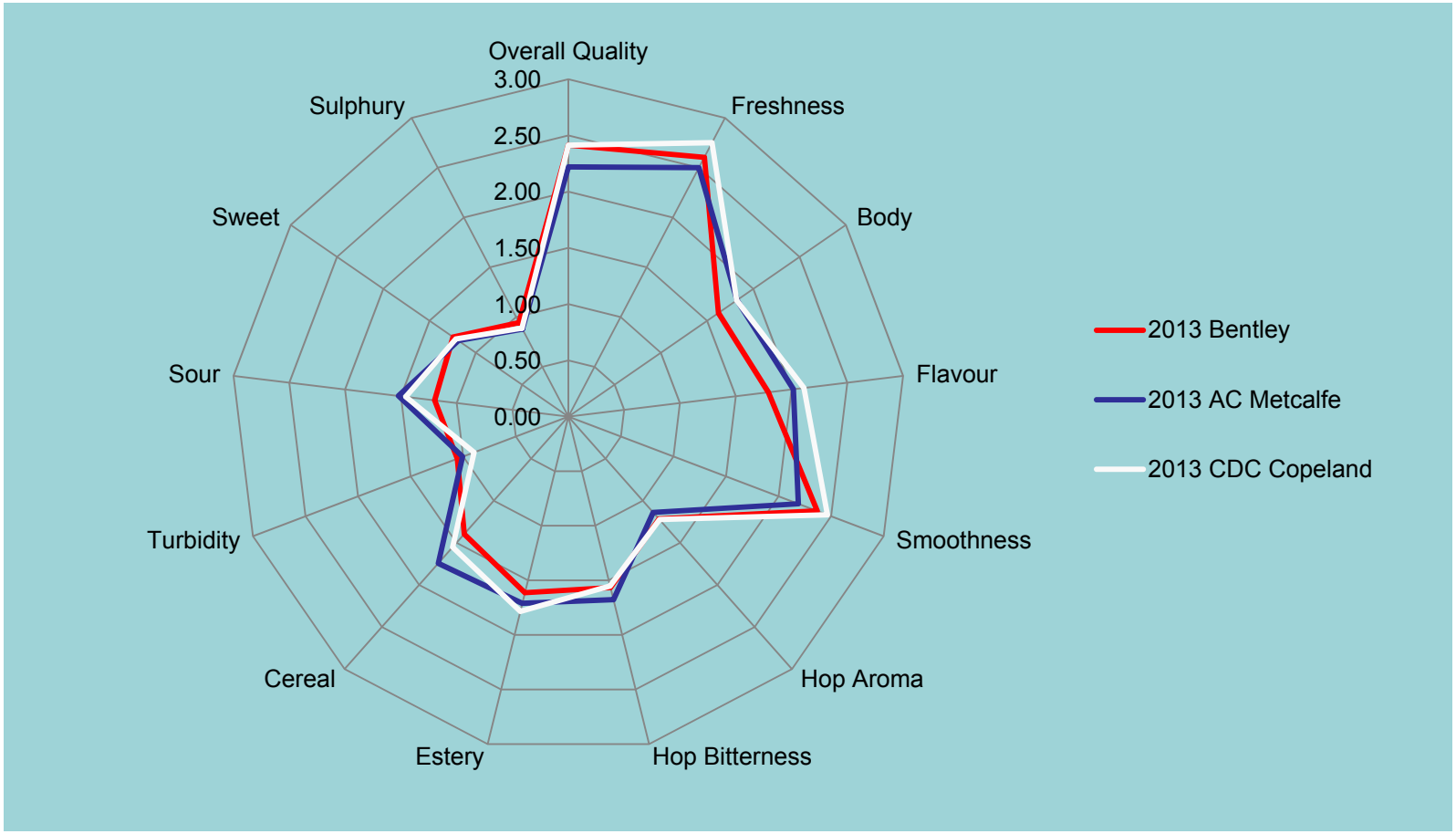
Brewing Performance

Parameter	Conversion time (min.)	Time to clear (min.)	Lautering time (min.)	Malt Material Yield (%)	Wort pH	Wort Colour (SRM)	Ferment-ability (%)
2013 Bentley	15.0	11.0	74.0	75.6	5.18	3.81	84.5
2013 Meredith	15.0	12.0	47.0	78.7	5.27	5.27	91.8
2013 Major	14.3	6.3	40.0	*74.4*	5.33	3.53	90.4
2013 Kindersley	21.5	9.0	41.5	74.9	5.20	4.68	89.6
Cerveza	24	7.0	65	76.8	5.04	3.34	87.5
2013 AAC Synergy	8.0	9.0	42.0	76.9	5.38	6.15	92.1
CDC Clear	24	7.0	65	76.8	5.04	3.34	87.5
2013 AC Metcalfe	9.5	6.0	42.0	75.4	5.28	5.32	89.6
2013 CDC Copeland	14.0	5.5	42.0	75.5	5.28	4.57	90.1

Beer Analysis

Parameter	Apparent Ext. (Plato)	Real Ext. (Plato)	Alcohol (v/v %)	Color (ASBC)	pH	Foam (Nibem)	Initial Turbidity (FTU)	Chill Turbidity (FTU) 24 Hr
2013 Bentley	1.92	3.91	5.52	5.49	4.39	161	28.1	31.3
2013 Meredith	1.14	3.13	5.48	4.91	4.23	154	28.1	31.3
2013 Major	1.33	3.21	5.15	3.17	4.24	136	14.9	16.1
2013 Kindersley	1.49	3.33	5.06	3.25	4.04	146	67.5	68.2
2013Cerveza	1.82	3.57	4.77	2.33	4.04	153	48.7	51.7
2013 AAC Synergy	1.06	3.08	5.56	2.96	4.29	210	26.4	35.2
2011 Clear,100%	2.29	4.29	5.55	3.59	4.27	133	11.9	13.6
2013 AC Metcalfe	1.41	3.33	5.28	4.68	4.20	164	36.2	37.5
2013 CDC Copeland	1.32	3.48	5.20	3.78	4.25	166	28.3	29.3

Bentley

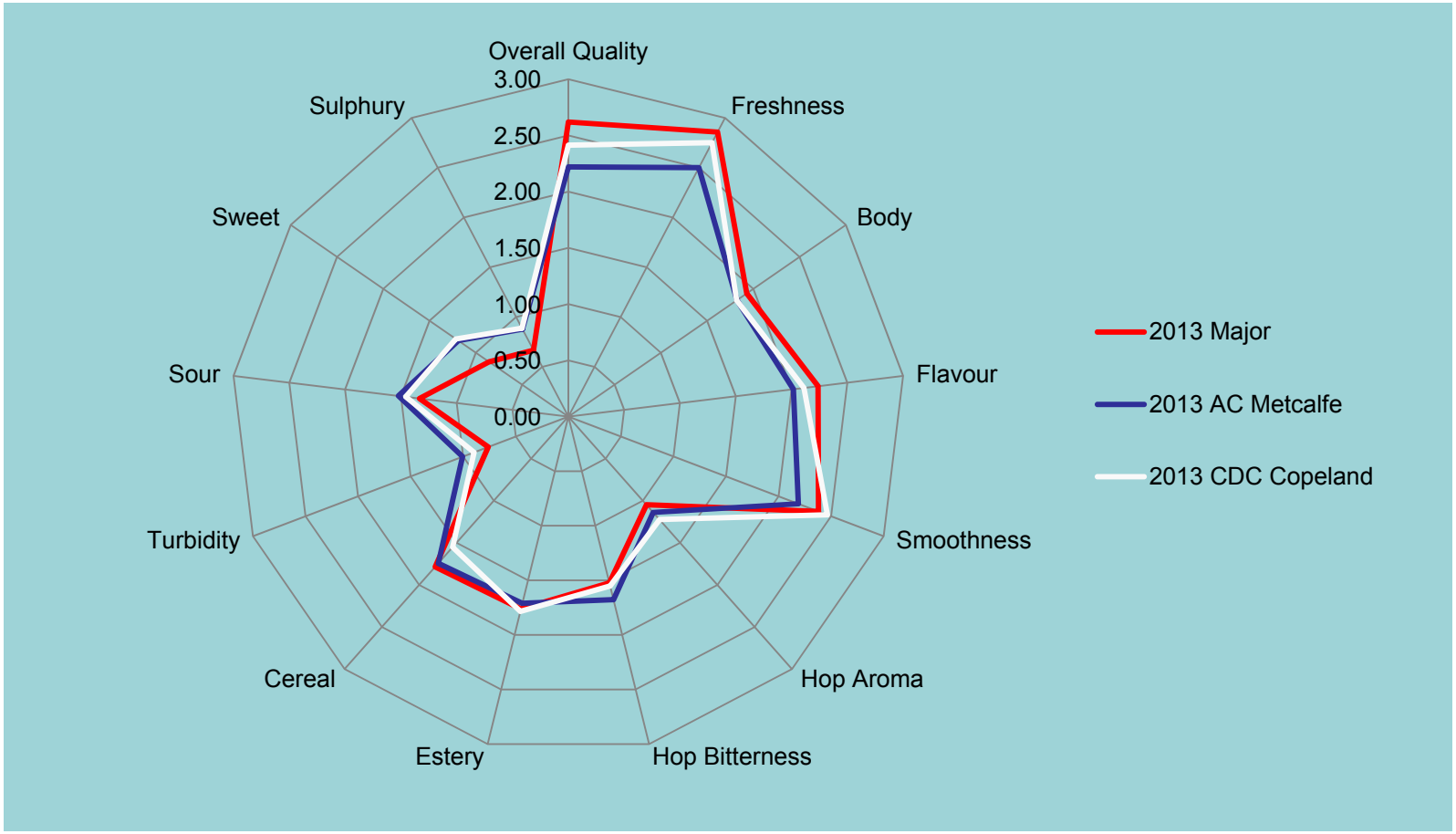


Sensory spider plot of 2013 Crop Bentley beer compared to CDC Copeland and AC Metcalfe beers

CDC Meredith

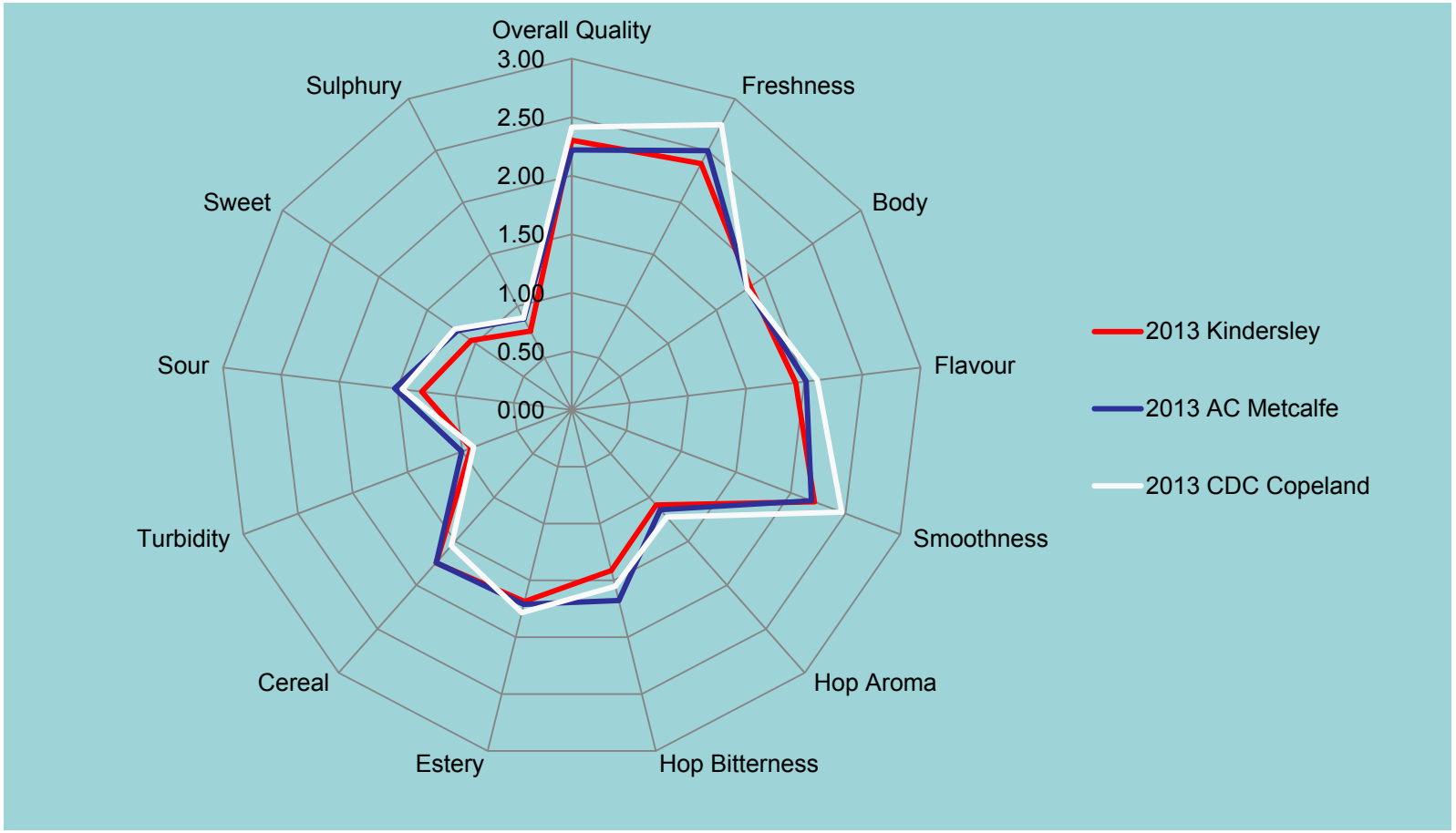
Sensory Spider plot of CDC Meredith beer compared to CDC Copeland and AC Metcalfe beers

Major



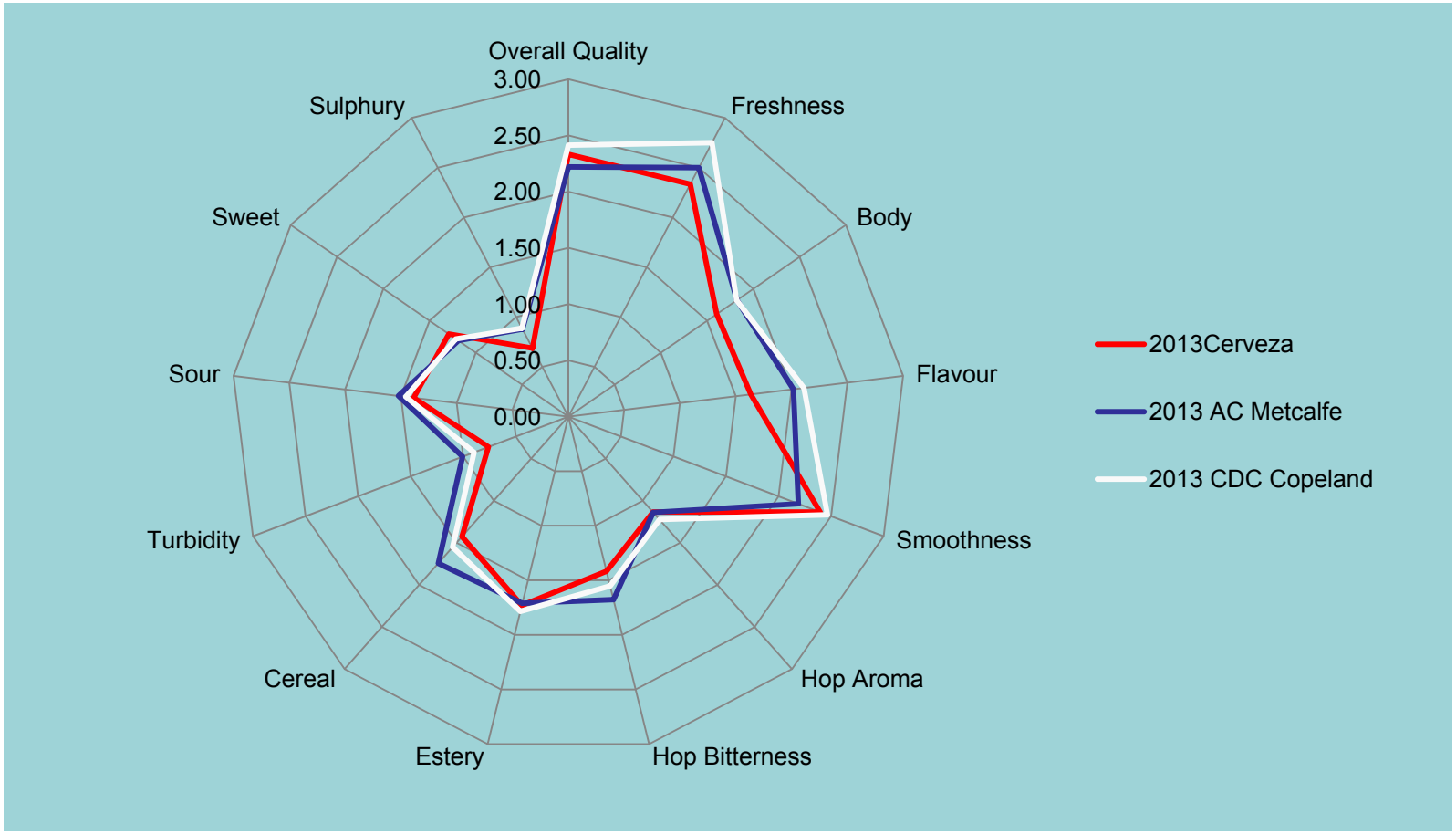
Sensory Spider plot of Major beer compared to CDC Copeland and AC Metcalfe beers

CDC Kindersley



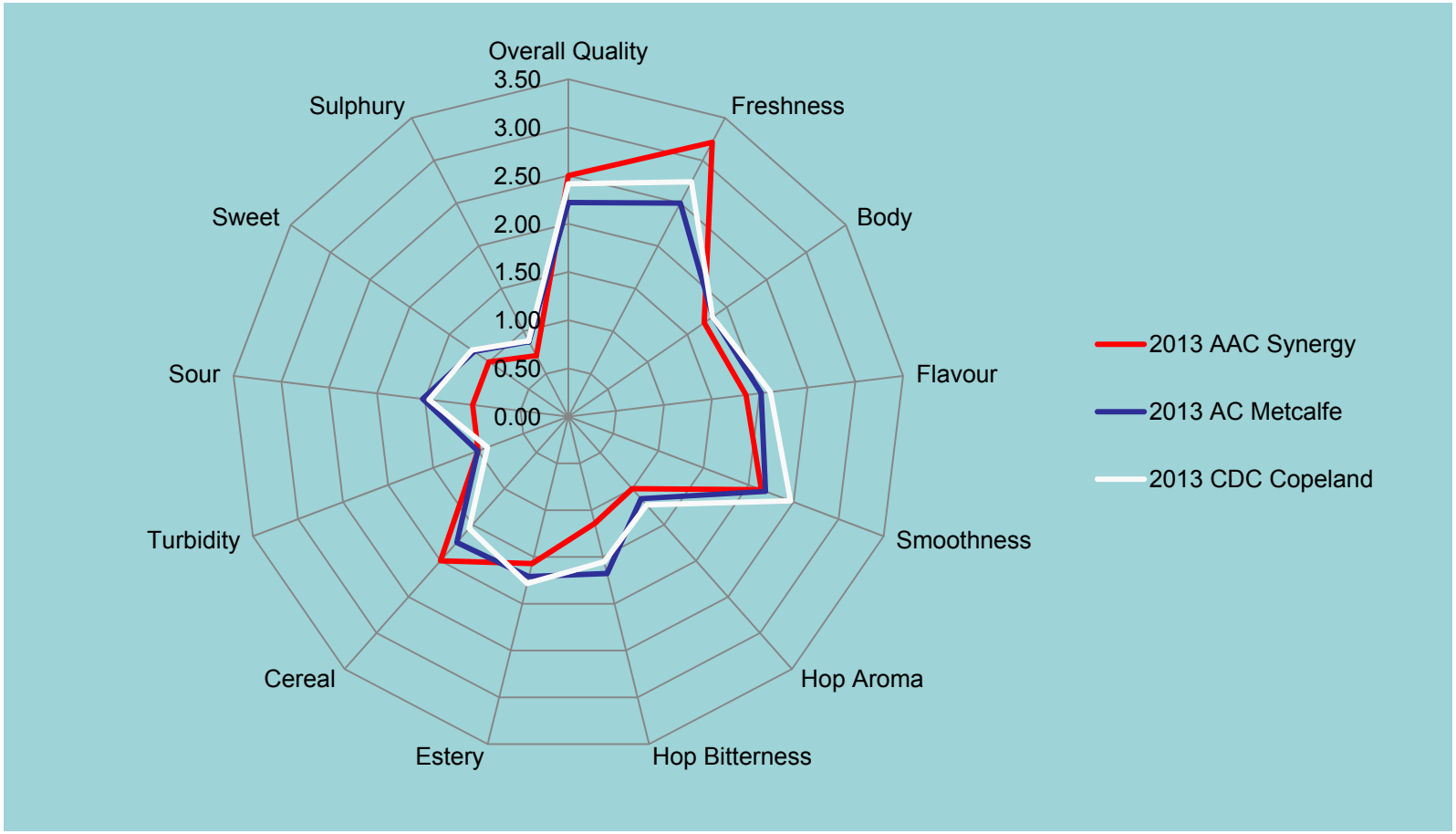
Sensory spider plot of 2013 CDC Kindersley beer compared to CDC Copeland and AC Metcalfe beers

Cerveza



Sensory spider plot of 2013 Crop Cerveza compared to CDC Copeland and AC Metcalfe beers

AAC Synergy



Sensory Spider plot of 2013 AAC Synergy beer compared to CDC Copeland and AC Metcalfe beers

CDC Clear

Sensory spider plot of 2013 Crop CDC Clear compared to CDC Copeland and AC Metcalfe beers

Conclusions

- Good agronomics and disease resistance make the newer Canadian malting barley varieties more attractive for the farmers.
- Testing results generated from this study suggest that these new barley varieties can be processed under malting and brewing conditions similar to that used for processing AC Metcalfe and CDC Copeland.
- These barley varieties are easy to malt and no processing challenges were recorded in this study.
- Although all the tested varieties generated satisfactory results, some varietal differences in process performance and quality of the end products were recorded.

Conclusions

- Cerveza is bred specifically for the craft market, the all malt brewer; could this be the one that delivers the taste of Harrington?
- CDC Clear is a very interesting hulless variety, not only does its malt provides superior extract yield over AC Metcalfe and CDC Copeland, the malt showed soluble protein, FAN and enzymes comparable to hulled barley such as AC Metcalfe and CDC Copeland.
- These newer barley varieties showed good brewing performance and produced beers with quality comparable to AC Metcalfe and CDC Copeland.
- They will be the future barley varieties in Canada moving forward

Acknowledgements

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