

Q U A L I T Y I N N O V A T I O N S E R V I C E



Canadian Grain
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Improving fermentation: Low phytate barley malt

BMBRI Triennial Meeting
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Outline of presentation



- **Need for continuous yeast growth during fermentation**
- **Effects of reduced phytate malt on wort mineral levels**
- **Brewing performance of reduced phytate worts**
- **Testing fermentability of reduced phytate worts with a lab-scale, high-adjunct fermentation test**

Fermentability: Yeast growth and attenuation

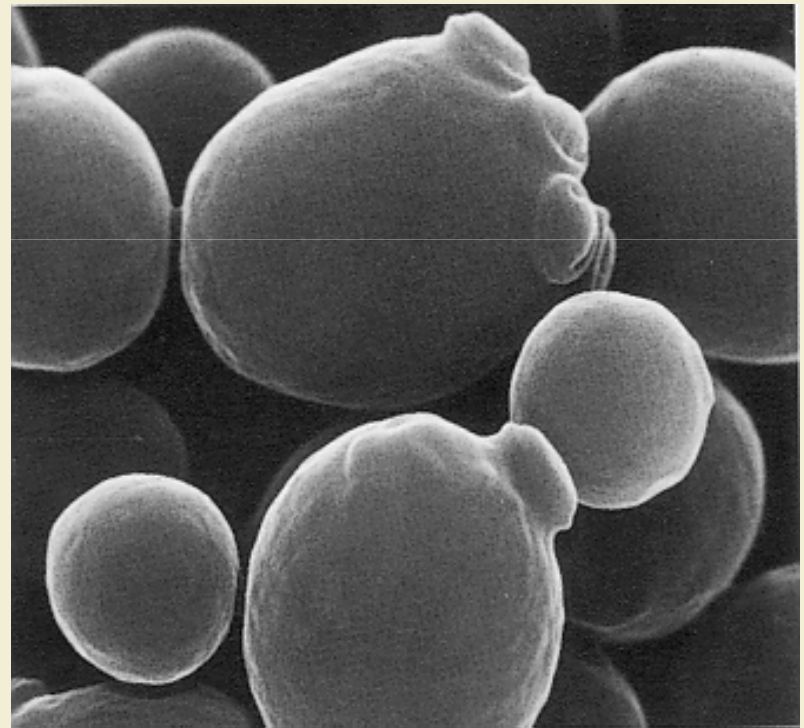


- **“Rate of fermentation dependant on rate and extent of yeast growth” - *Kirsop 1978***
- **“High gravity worts only ferment efficiently with increased yeast cell mass” - *Casey et al. 1984***
- **Yeast growth requires adequate supply of all essential nutrients**

Requirements for yeast growth and attenuation



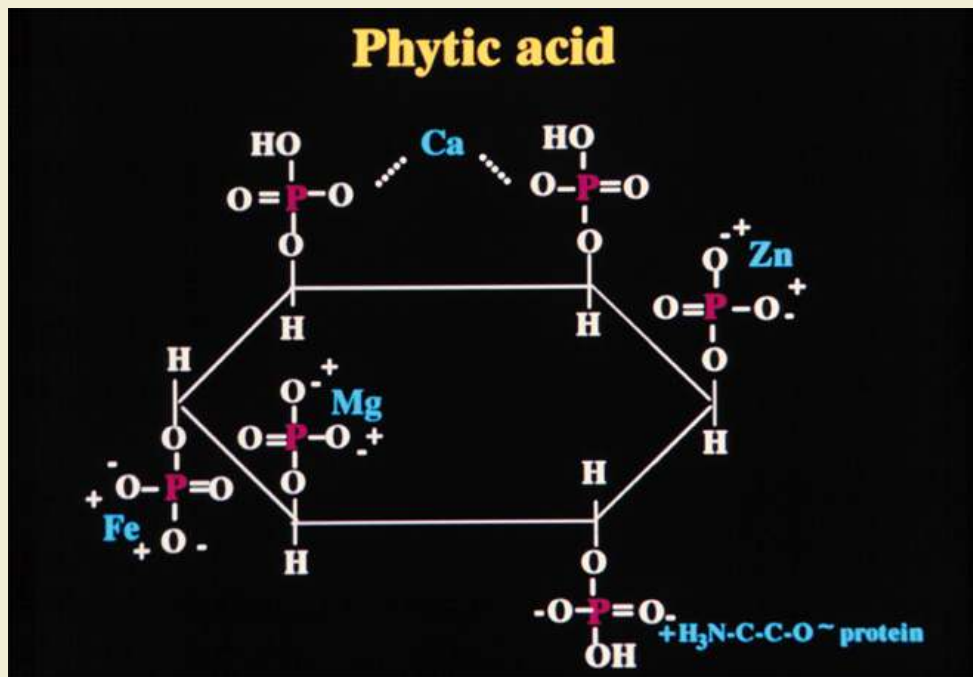
- **Yeast growth requires**
 - sterols or oxygen
 - nitrogen (amino acids)
 - micro nutrients (minerals)
 - energy (sugars)
- **Anaerobic fermentation**
 - ethanol production
 - dependent on supply of fermentable sugars



Effects of phytate on barley minerals



Phytic acid



- Phytic acid binds minerals other than Phosphorus
- Magnesium, Zinc, Calcium, etc.

Two groups of reduced phytate barley were investigated



Harrington Group

- **Harrington**
(normal phytate control)
- **LP 422**
(50% phytate reduction)

AC Metcalfe Group

- **AC Metcalfe**
(normal phytate)
- **Low phytate parent**
(50% phytate reduction)
- **Normal phytate bulk**
- **Reduced phytate bulk**

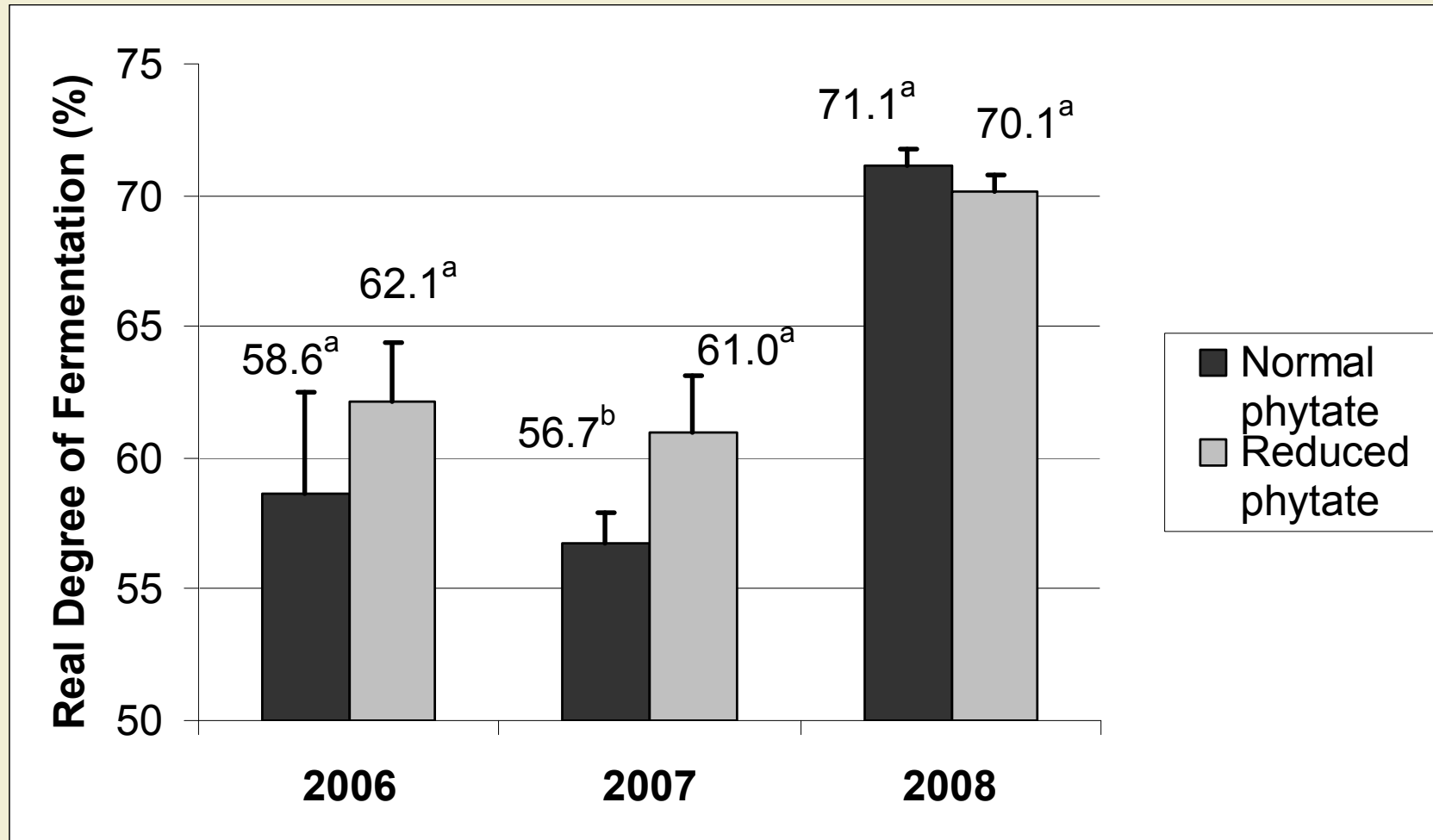
Zinc/magnesium levels: Normal vs. reduced phytate wort



	Wort Zinc (mg/L)	Wort Magnesium (mg/L)
Normal phytate	0.17 _± 0.13	119 _± 11
Reduced phytate	0.39 _± 0.16	144 _± 24
F-value	114.13 ^{***}	5.58 [*]

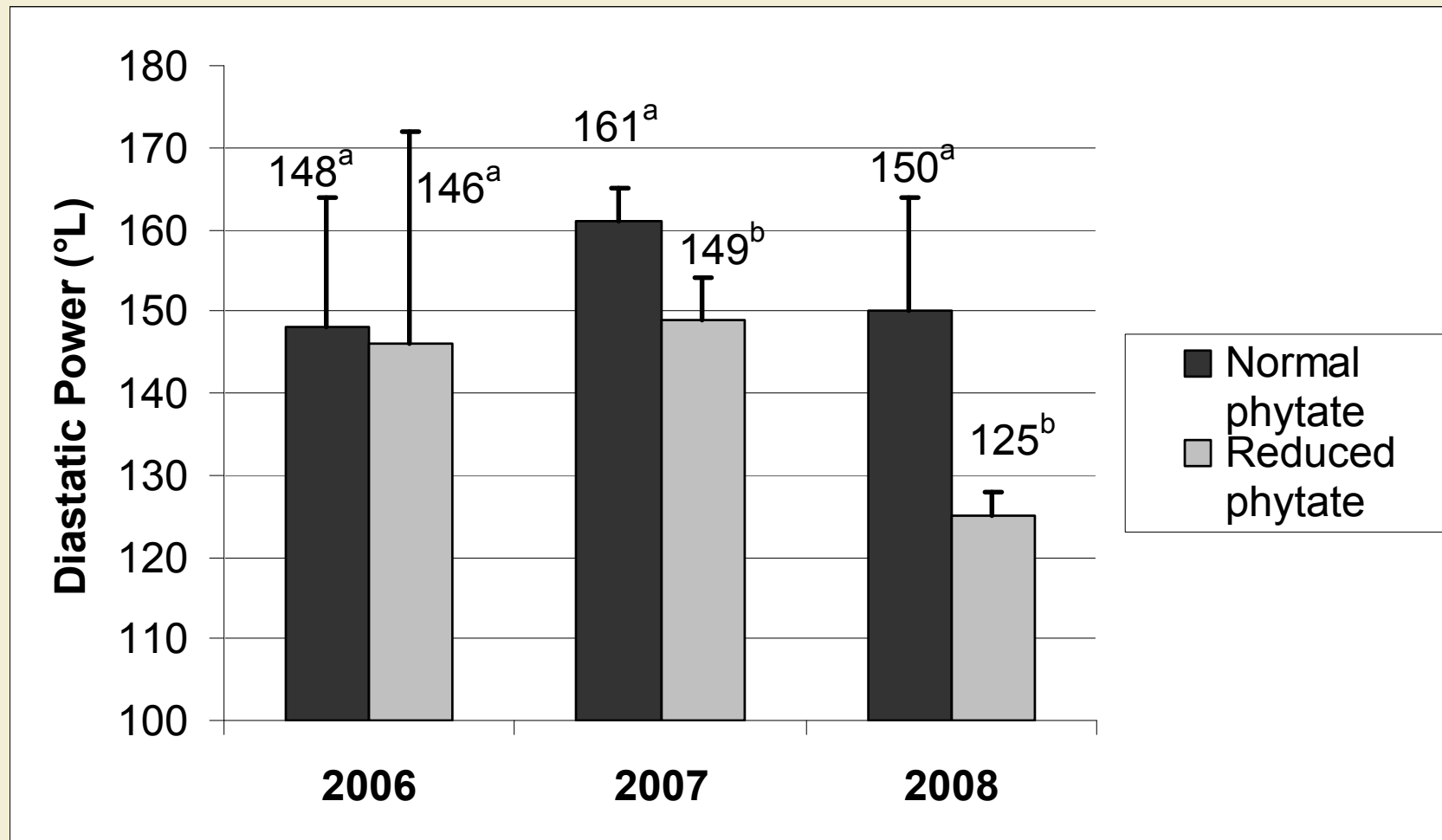
** , *** F-values significant at the $p < 0.10$ and $p < 0.01$, respectively*

Real Degree of Fermentation: Normal vs. reduced phytate worts



a,b pairs with different superscripts differ significantly ($p < 0.05$)

Diastatic power: Normal vs. reduced phytate malts



a,b pairs with different superscripts differ significantly ($p < 0.05$)

Conclusions: Advantages of reduced phytate malt



- **Low phytate barley malt delivers significantly higher levels of wort zinc and magnesium**
- **Advantage of increased minerals only apparent in the brewery when malt quality (enzymes) adequate**

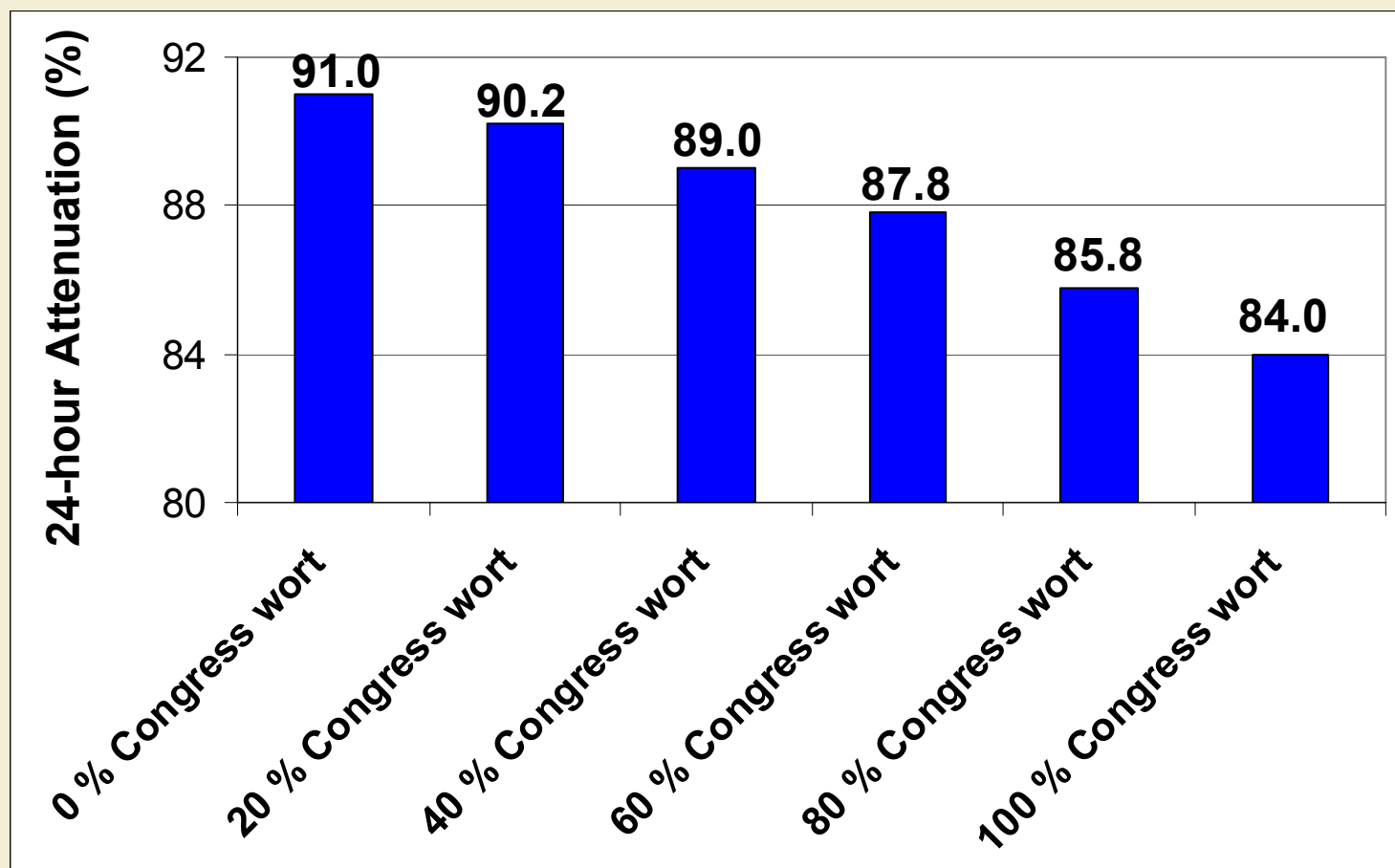
Predicting fermentability in the laboratory



- **Official EBC Apparent Attenuation Limit**
 - excess yeast with stirring (24 hours)
 - dependent on fermentable sugars
- **Miniature fermentation method (Lake et al 2008)**
 - commercial-like
 - small tube, no stirring (78 hours)
 - dependent on time of flocculation
 - predicts premature yeast flocculation

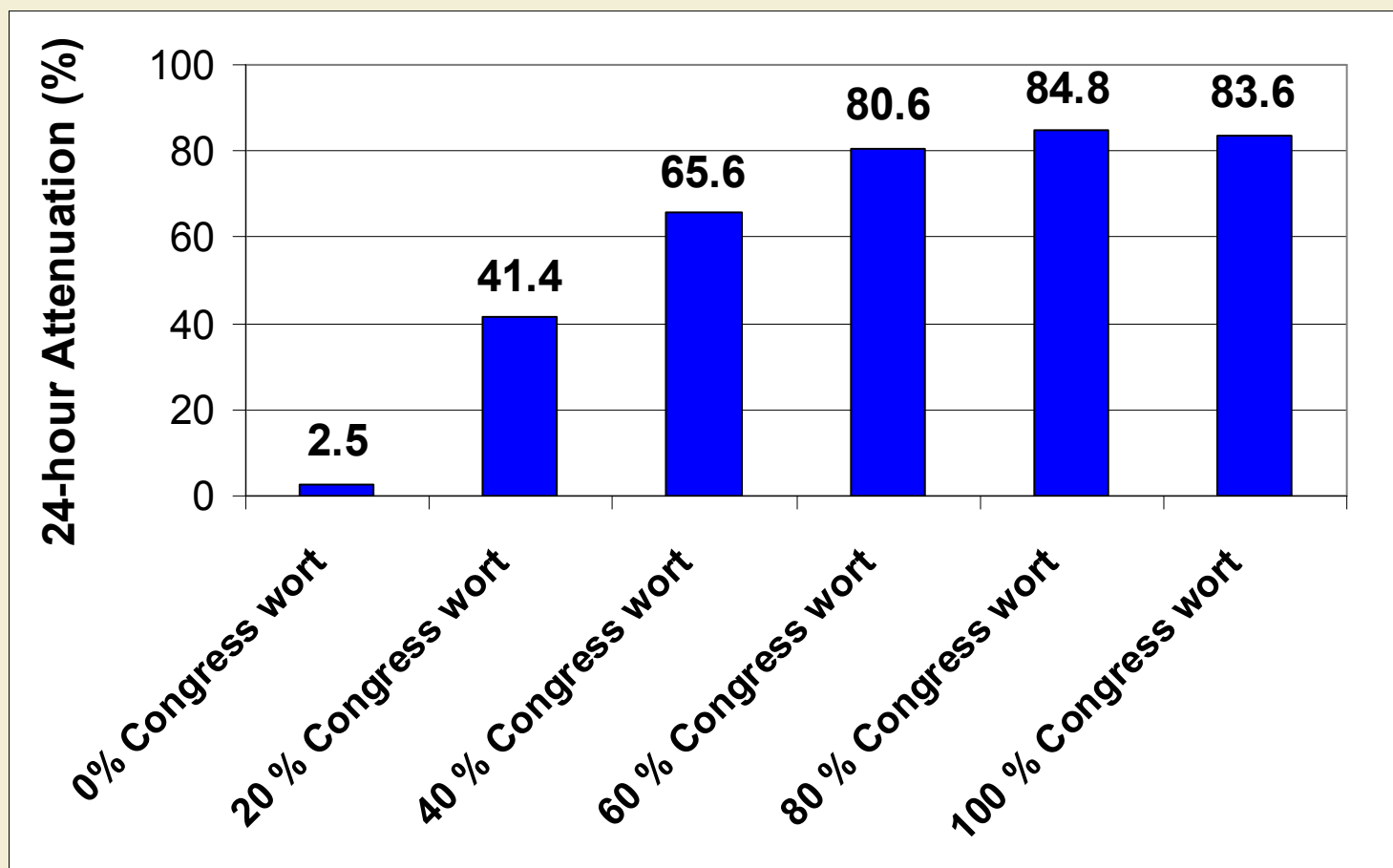


Attenuation loss in worts with varying levels of high maltose syrup (7.5 g rate)



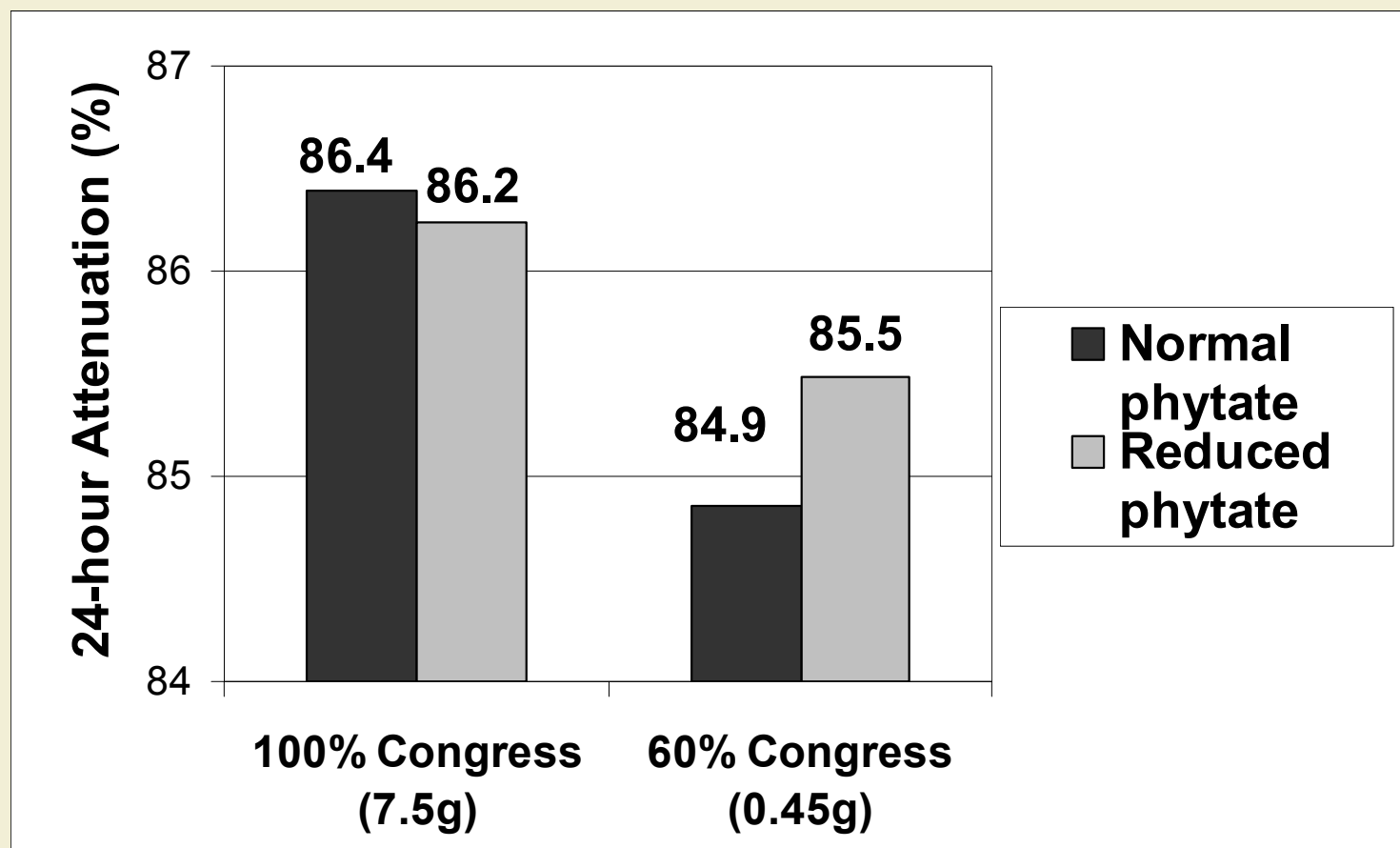
Gomez 2009

Attenuation loss in worts with varying levels of high maltose syrup (0.45g rate)



Gomez 2009

EBC official AAL vs. broth method: Normal vs. reduced phytate worts



Future direction



- **Continue breeding for better malt quality in combination with low phytate trait (low phytate line in 2010 Coop test)**
- **Submit a manuscript on advantages of low phytate barley malt for brewing**
- **Further investigate the broth fermentation method and ability to predict yeast growth potential of worts**



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