



Rahr Technical Center



Mill Setting Study for BSG Pre-ground Malt

Apr 26, 2019





Executive Summary

- ▶ The study was first carried out at the Rahr Technical Center (RTC) in both lab and brewery settings, and then in commercial brewery trials. The results indicate that a finer grind potentially provides more extract yield, but may not necessarily be beneficial to every brewery in overall terms.
- ▶ Brewery trials showed that tightening the mill settings from BSG's regular spec (34/32) to narrower openings (34/20) resulted in an increase of approx. 5-6% to brewhouse yield, but also extended the lautering time by more than 20 minutes per batch, which may be a consideration in production settings with multiple brews per day.
- ▶ Finer grist sizes could affect transfer from mash vessel to lauter vessel.
- ▶ The increase of extract yield is not necessarily all for fermentable sugars.
- ▶ No significant difference was observed in the triangle sensory test between brewery wort samples from the two different mill settings.
- ▶ Conclusion: Brewery lautering capacity and beer quality dictate the grist fineness.



Introduction

- ▶ Milling makes the malt endosperm accessible for solubilization and enzyme digestion. However, husk integrity must be maintained for efficient lautering and to prevent undesirable substances such as polyphenols, iron, and lipids from leaching out.
- ▶ Several other factors besides milling influence the extract yield and the quality of wort and beer in a brewery, including:
 - ▶ Lauter tun design
 - ▶ Mashing regime
 - ▶ Malt : water ratio
- ▶ BSG's regular spec (at 34/32 mill-setting) gives a medium-coarse grist that suits most craft brewery setups for trouble-free operations. The equipment in large-scale industrial breweries can handle finer grists.
- ▶ The current study begins with bench-scale tests, to 3 Hl brewery trials, to commercial operations. Relevant analyses were carried out at each stage.





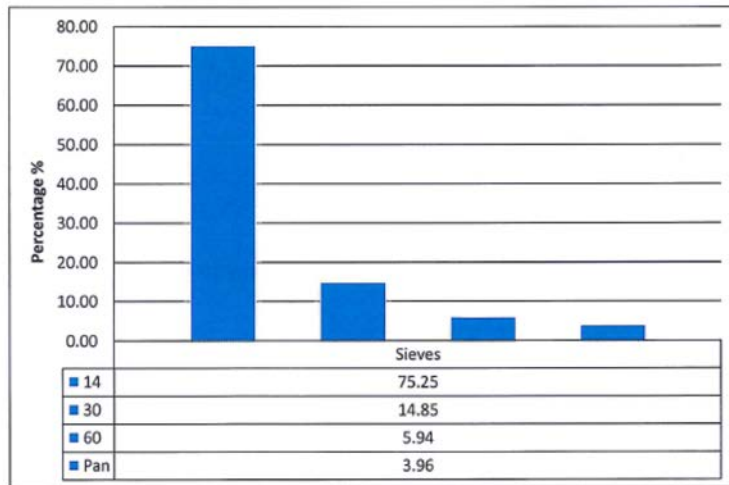
Grist analysis of pre-ground malt

- Regular BSG mill setting (34/32) vs finer grist (34/20)

Brew Analysis Datasheet

Sample Name: STANDARD 2ROW (MN) Date: 6/20/2018
Description: 2row Shakopee test RMS setting 34/32

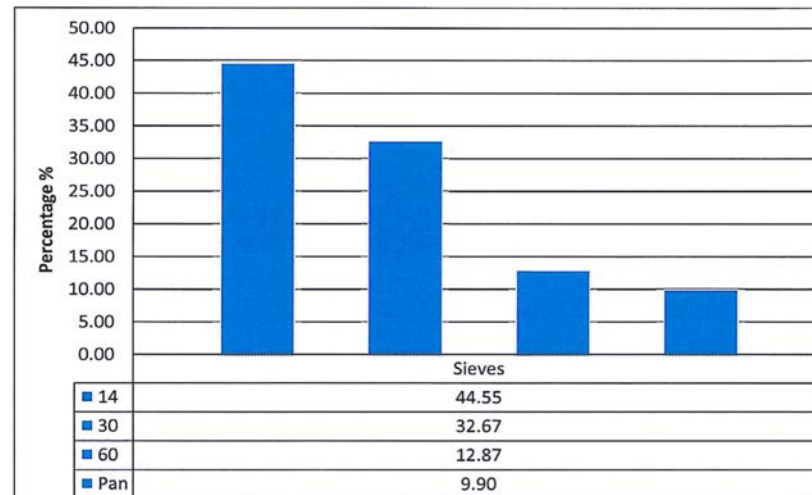
Screen	Gross	Tare	Net	%
14	800	420	380	75.25
30	455	380	75	14.85
60	360	330	30	5.94
Pan	390	370	20	3.96
Total			505	100



Brew Analysis Datasheet

Sample Name: STANDARD 2ROW (MN) Date: 6/18/2018
Description: 2row Shakopee test RMS setting 34/20

Screen	Gross	Tare	Net	%
14	645	420	225	44.55
30	545	380	165	32.67
60	395	330	65	12.87
Pan	420	370	50	9.90
Total			505	100



Sieve mesh # ...Opening
No 141.25mm
No 300.600mm
No 600.250mm

Pilot Brewing Trial at RTC





Pilot brewery (3 Hl) brewhouse observations

▶ 34/32 setting (Regular grist)

- ▶ 2 x 25 kg bags Rahr Std. 2 row-milled 34/32
- ▶ 1st wort gravity: 18.0 P
- ▶ Tailings gravity: 2 P
- ▶ Volume of wort lautered: 282 L
- ▶ Gravity of collected wort: 12 P
- ▶ Lauter time: 114'
- ▶ Notes: 1st wort was comparatively turbid (>10 EBC)

▶ 34/20 setting (Finer grist)

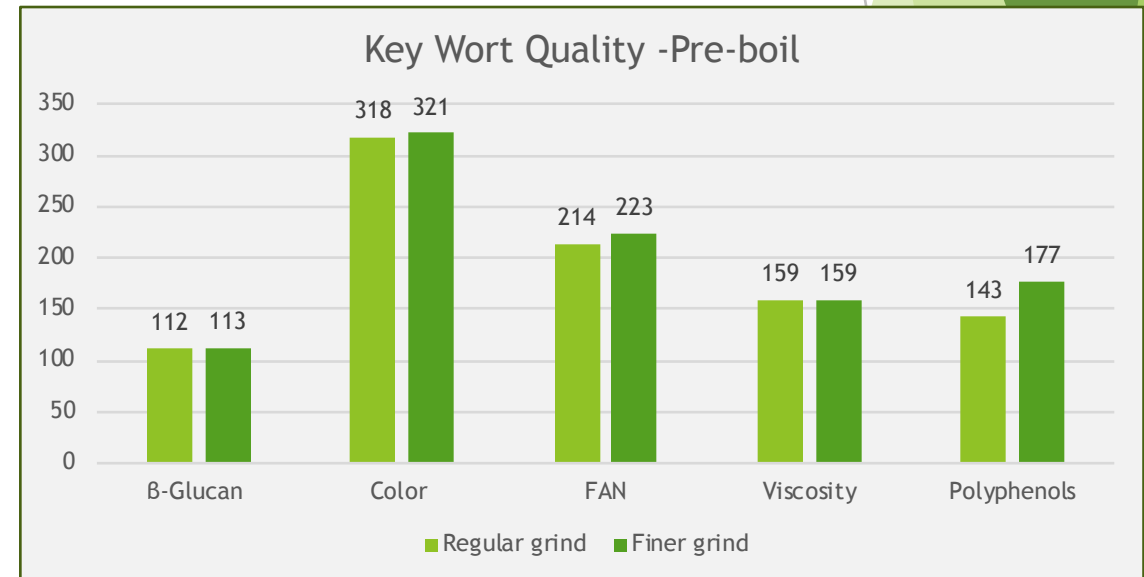
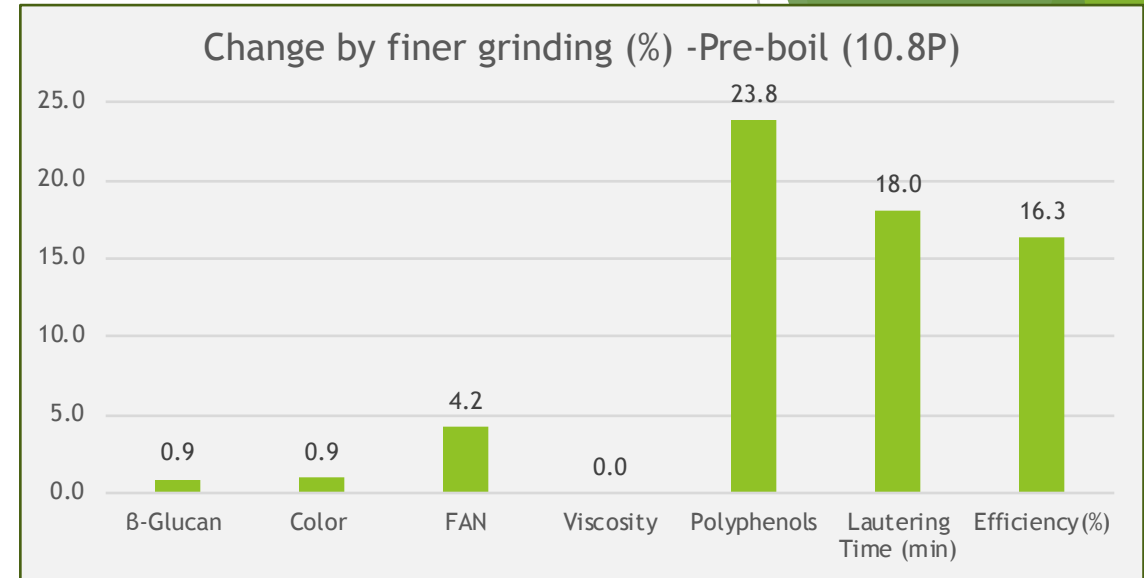
- ▶ 2 x 25 kg bags Rahr Std. 2 row-milled 34/20
- ▶ 1st wort gravity: 18.4 P
- ▶ Tailings gravity: 2 P
- ▶ Volume of wort lautered: 271 L
- ▶ Gravity of collected wort: 12.8 P
- ▶ Lauter time: 111'
- ▶ Notes: wort was of “normal” turbidity



Pilot brewhouse mashing comparison

-Pre-boil data

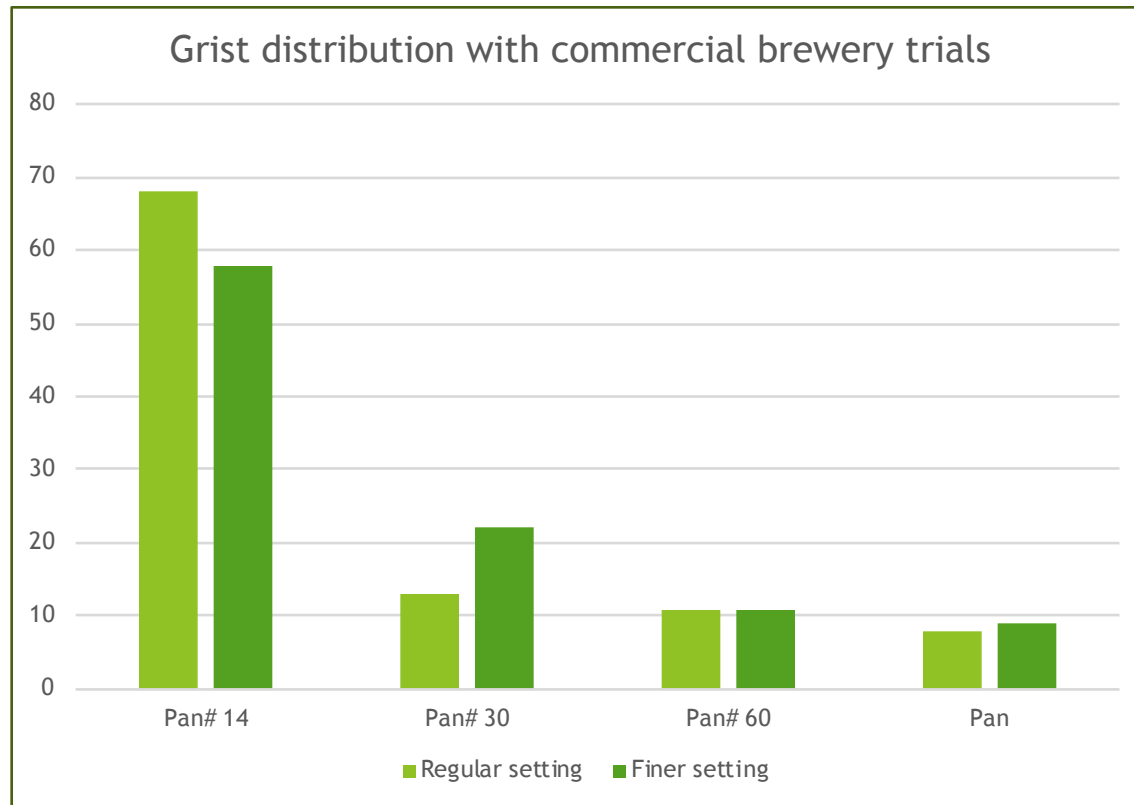
- The differences in brewhouse performance of the finer grind were noticeable.
- Higher extract efficiency would be an economic benefit while the longer lautering time (by 18%) could be an operational concern.
- At 10.8 Plato pre-boil, the diluted wort from finer grind had more polyphenols, which might have impact on beer colloidal stability and mouthfeel.



Commercial Brewery Trial



Change in grist distribution with commercial brewery trials



Shifting to finer setting of the commercial mill (from #7 to #3) resulted in 10% reduction of the fraction on top sieve #14 (1.25mm), most of which went to the medium fraction on #30 (0.6mm).

	Commercial Brewery	
	Regular setting	Finer setting
# 14	68	58
# 30	13	22
# 60	11	11
Pan	8	9



Lab wort analysis from grist samples

- Brewery-milled vs Congress fine grind

- ▶ Brewery-milled grist gave 0.8% less extract yield than the fine grind in the lab.
- ▶ Less enzymes are extracted with the brewery grind.
- ▶ Most parameters are in line with each other.

	Lab Milled- ASBC Congress	Milled at Brewery
Alpha Amylase	63.4	55.3
Beta Glucan	80	51
Color Skalar	1.94	2.07
NTU	8.0	14.5
Dias Power	126	104
Fine Grind	81.4	80.6
FAN	167	155
Moisture	4.21	4.15
pH	5.90	5.94
Sol Tot Pro Ratio	43.6	42.8
Soluble Protein	4.56	4.40
Total Protein (Leco)	10.47	10.27
Viscosity	1.49	1.47



Brewery wort analyses of commercial trials

- ▶ Finer mill setting generated wort with more extract level.
- ▶ All parameters were in alignment but finer setting showed better extraction in general.
- ▶ Forced fermentation test (AAL) indicated that the total alcohol yield of the finer grind was only 101% of the control, in comparison of the total extract yield of 106%. Therefore, not all the extract was contributing to alcohol production.

	Brewery Control	Brewery Trial (fine)
Beta Glucan	94	92
430nm	0.697	0.714
700nm	0.035	0.033
Color	8.41	8.65
Color Skalar	13.33	13.29
NTU	338	159
FG Plato	19.86	20.09
SGFgr	1.08237	1.08338
FAN	427	437
pH	5.56	5.61
Sol Pro As Is	11.22	11.35
Kinetic Viscosity	2.55	2.58
Viscosity	2.76	2.8

- Note: Control used 38 bags and Trial (fine) used 36 bags, by accident



Triangle sensory (Brewery first wort samples)

Panelist	A B C	Correct/Incorrect	Preference	Preference
1	C C T	1	C	Control had toasty/biscuity aroma. First impression was more apparent, more subdued on second taste. C was a but overwhelmingly sweet but simple. T - melon and slightly sweet.
2	T C C	0	-	-
3	C T C	0	-	-
4	T T C	1	C	C was slightly brighter or acidic. (Lucky guess)
5	C T T	0	-	-
6	T C T	1	C	Different aromas. Less sharp malt quality in Control. More rounded maltiness.
7	C C T	1	T	Strong wort.
8	T C C	0	-	-
9	C T C	0	-	-
10	T T C	0	-	-
11	C T T	1	C	Control was slightly less sweet, slight astringent.
12	T C T	0	-	-
13	C C T	0	-	-
14	T C C	0	-	-
15	C T C	1	C	Hint of bitterness in Control, more grainy.
16	T T C	1	T	T smelled more grassy, some caramel notes, more balanced.
17	C T T	0	-	-
18	T C T	0	-	-
19	C C T	0	-	-
20	T C C	1	C	Enjoyed the sweetness and aroma in Control.

Conclusion: No significant sensory difference in brewery wort samples from the two different mill settings!



Thank You!



