GLUTOPEAK TEST FOR PREDICTION OF WHEAT TECHNOLOGICAL QUALITY AND BAKING PERFORMANCE OF BRAZILIAN TROPICAL WHEAT SAMPLES

ICBC 2021 29-31 March — Lincoln University — ICC

Embrapa — BRAZIL

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Introduction

GlutoPeak method has been proposed as an alternative method for evaluating wheat and as a tool to predict the baking quality of flour, by measuring the gluten aggregation (rapid and flour saving). The wheat cultivated in the central Brazil region (tropical wheat), where the Cerrado biome is predominant, is characterized by its good performance for baking (high gluten strength and stability).

This work aims to investigate the relationship between GlutoPeak rheometer and traditional tests, used to evaluate the technological quality (physicochemical and rheological tests), and baking performance in Brazilian tropical wheat samples.
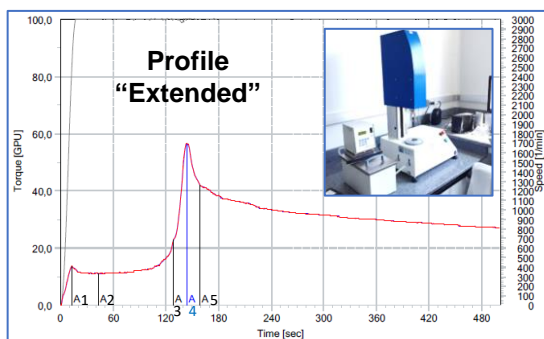
Material and Methods

Figure 1. GlutoPeak equipment and typical graph ("extended" profile – Figure example: PF 100368).

Four wheat genotypes of Embrapa (cultivars: BRS 264, BRS 394, BRS 404, and line: PF 100368) and two mixtures from BRS 264 with 30% and 50% of PF 100368. The gluten aggregation properties were measured in GlutoPeak (Brabender), according to "extended" profile using the following analysis conditions, tested by Embrapa (unpublished data): speed 3000 rpm (1/min), 8 g of flour (14% basis)/10 g of distilled water, 36ºC thermostat and 500 s of analysis time). The conventional tests (with parameters) performed according to AACC were: hectoliter weight, in kg/hL (Method 55-10.01); grain protein content (Method 46-13.01); grain falling number (Method 56-81.03); flour yield (Method 26-10.02 – samples conditioned to 14% moisture for 16-24h prior to milling in a Brabender Quadrumat Senior mill); gluten (Method 38-12.02); alveography (Method 54-30.02); and, farinography, using a 50 g bowl (Method 54-60.01). The other tests were: thousand kernel weight (Brasil, 2009), flour and bread crumb color (colorimeter Minolta, CR-410, D_{65} illuminant - Konica Minolta, 2013), and baking test (evaluated according to ORO, 2013). The result mean was submitted to Pearson correlation analysis at 5% level of significance (p< 0.05).

Results and Discussion

Table 1. The result mean of physicochemical and rheological analyses of the six wheat samples.

ANALYSIS / parameters	BRS 264	BRS 394	BRS 404	PF 100368	30% PF 100368	50% PF 100368
HW: hectoliter weight (kg/hL)	83.80	82.90	85.40	82.15	82.15	81.05
TKW: thousand kernel weight (g)	46.2	49.6	46.7	37.7	46.1	43.4
GHI: grain hardness index (SKCS)	57	62	63	81	65	71
GP: grain protein (%)	12.9	12.3	14.4	15.1	13.4	13.9
GFN: grain falling number (s)	438	272	434	367	463	403
FY: flour yield (%)	62.4	55.3	59.9	55.2	57.8	55.5
Flour color (Minolta)						
L*: lightness (0= dark, 100= white)	93.82	93.94	93.5	93.18	93.63	93.42
a* value (- 60= red, + 60= green)	-0.51	-0.40	-0.87	0.06	-0.29	-0.09
b* value (- 60= yellow, + 60= blue)	10.54	10.21	12.88	10.18	10.24	9.95
Gluten (Glutomatic)						
GI: gluten index	100	100	97	97	99	97
WG: wet gluten (%)	25.7	25.3	31.5	34.7	27.5	29.8
DG: dry gluten (%)	9.2	9.2	11.1	11.9	9.8	10.2
Alveography						
W: gluten strength (.10⁻⁴ J)	338	443	358	362	369	364
P: tenacity (mm)	87	132	94	75	93	91
L: extensibility (mm)	108	100	124	171	112	120
P/L ratio	0.81	1.32	0.76	0.44	0.83	0.76
SI: swelling index	23.1	22.3	24.8	29.1	23.6	24.4
EI: elasticity index (%)	65.2	60.1	57.9	57.1	64.6	62.3
Farinography						
WA: water absorption (%)	55.3	59.2	61	62.1	57.2	57.9
DDT: dough development time (min)	9.7	12.4	7.4	8.8	11.9	11.7
STB: stability (min)	17	29	9	9	26	24
MTI: mixture tolerance index (mm)	15	9	26	24	11	2
GlutoPeak (perfil "Extended")						
PMT: Peak maximum time (s)	498	337	171	138	495	327
BEM: maximum torque (BU)	12	39	37	57	12	39
PM: torque 15 s after the maximum	12	37	24	23	12	38
AM: torque 15 s before the maximum	-/-	37	36	42	-/-	37
A(0-1): AUC for 0 and 1 #	81	107	90	98	82	84
A(1-2): AUC for 1 and 2 #	999	970	463	306	997	861
A(2-3): AUC for 2 and 3 #	3275	2510	1052	1080	3274	2373
A(3-4): AUC for 3 and 4 #	181	565	505	603	184	568
A(4-5): AUC for 4 and 5 #	4534	558	541	739	4536	558

\# AUC: area under the curve for the different points of the grafic.

Figure 2. Bread and crumb images, followed by the table with baking test results of the six samples.

BRS 264 | BRS 394 | BRS 404 | PF 100368 | 50% PF 100368 | 30% PF 100368
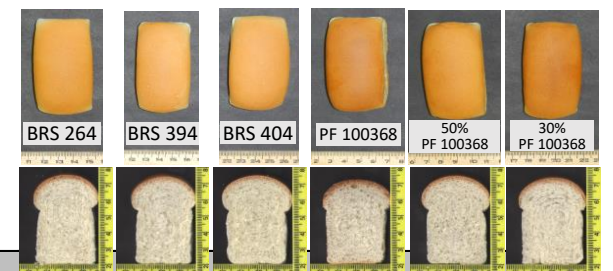
Bread crumb color	BRS 264	BRS 394	BRS 404	PF 100368	50% PF 100368	30% PF 100368
L* (lightness)	86.82	85.63	87.74	82.95	86.03	84.21
a* (red color)	-0.55	-0.26	-0.97	0.41	-0.09	0.31
b* (yellow color)	18.22	18.95	21.29	17.72	18.26	18.65
VE: specific volume (mL/g)	**3.76**	**3.54**	**3.87**	**4.19**	**4.52**	**4.85**
Bread evaluation						
VE (mL/g) x 3.33	12.52	11.78	13.21	12.79	12.98	14.02
ExtCh: External characteristics (points)	19	17	19	19	20	18
IntCh: Internal characteristics (points)	32	30	28	31	31	31
A&F: Aroma and Flavor (points)	23	21	21	23	24	22
Total of points	**87**	**80**	**80**	**85**	**86**	**85**

Table 2. Significant correlations (p< 0.5) from GlutoPeak (GTP) parameters with parameters of wheat quality conventional analyses and baking performance.

GTP	HW	GHI	GP	GFN	GI	WG	DG	W	L	SI	EI	WA	DDT	STB	MTI	VE	Ext-Ch	A&F
PMT	-0.77														-0.81	0.93		
BEM				0.77	-0.83	-0.87					0.96	-0.94						
PM	0.78										-0.86	0.83						
A(0-1)																	-0.87	
A(1-2)			-0.91			0.80		0.87										
A(2-3)	-0.88				-0.91	-0.96		-0.87	-0.87	0.95		-0.88	0.78	0.85				
A(3-4)	-0.78	0.76	-0.84	-0.89						-0.76	-0.93							
A(4-5)						0.76												0.76

GlutoPeak parameters showed high and significant correlations with some important parameters of wheat technological quality evaluation. Also, it can be very useful for differentiation of wheat genotypes, showing the contrast in gluten aggregation behavior.

References

AACC. **Approved Methods of Analysis**, 11th ed. Cereals & Grains Association, St Paul, USA.
BRASIL. MAPA (2009). **Regras para análise de sementes**. Brasília, DF. 398 p.
KONICA MINOLTA (2013). **instruction manual: c**hroma meter CR-400/410:. Tokyo. 156 p.
ORO, T. (2013). **Adaptation of methods for whole wheat flour technological quality assessment.** Thesis (Doctoral on Food Science) – Postgraduate Program in Food Science, Federal University of Santa Catarina, Florianópolis - SC. 195 p.