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Influence of harvesting on technological quality of wheat flour

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Abstract

Major changes occurred in the last decade on global food market indicates a growing interest in people's health and nutrition. Consumer concern for rational and healthy eating has led to increased consumption of cereal products, especially those with high fibre content and minimal energetic value. Cereals have been considered all along the time the most important group of plants for the human existenceTaking into consideration current trends in terms of healthy eating, through this paper did research on the quality of raw materials, essential condition for getting a quality product for sure in terms of the safety and high nutritional value. The researches aim was to have involved assessing the quality of cereal crops and the flours obtained over three years. This analysis allows us to have an idea of the variation in climatic conditions, and if the parameters are included in quality indicators established by the standards and laws. Samples were analyzed in order to highlight the quality of the physico-chemical, microbiological and sensory contaminant content of essential amino acids. The results were statistically analyzed by ANOVA modeling of experimental data. Statistical modeling of data and analysis of regression coefficients and correlation parameters estate, that the power W is the maximum (265, 97) to an ash content of 0.65% and wet gluten content of 26.1%, which characterize the flour white wheat harvest 650 of 2013. For flours with ash 1.25%, we obtained a maximum energy W 150 to 2013, wet gluten this year being 23.9%.

Keywords: rheological parameters**,** deformation, protein content**,** dough extensibility

1. Introduction

The great interests for using cereal products in human nutrition is due, on the one hand the fact that they meet in a small volume of large quantities of nutrients (proteins, carbohydrates, minerals, vitamins), and it provides a greater number of calories (~ 50% from daily calorie intake) and, on the other hand, that these presents economic advantages related to short vegetation period, the ease of transport and storing them. [1]

The competitiveness of a product expresses its ability to sell and market is necessary given that it fully meets customer requirements. For bakery products to be competitive, quality characteristics have seen the whole chain from "farm to fork" namely from wheat to bread even if the importance to manufacturers of bakery products has flour quality and for consumers the end product quality [3]. The flour is an intermediate product between wheat and finished products (bread and bakery products, pasta, biscuits, waffles, pastries, etc.), with has a direct influence on the quality of finished products. Issues, valence or quality attributes and finally determining the competitiveness of a product can be divided conventionally into several categories as lawful;

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nutritional quality; quality hygienic - sanitary (innocuous); technological quality; sensory quality; aesthetic quality. The nutritional value of the flour is closely related to its chemical composition. The chemical composition of flour depends on a number of factors, among which mainly occupies a chemical composition of wheat grain and the degree of extraction. Flour proteins besides are important in calculating the nutritional value, have an important role in technological [2]. The power of flour characterizes the ability of flour to form dough and the dough has after fermentation and leavening certain rheological properties (consistency, stability, flexibility, softening point). Technological importance of the power of flour is to influence the amount of water needed to obtain dough consistency, changes in rheological properties of dough during fermentation and behavior of the leavening and baking. The power of flour determines maintainer of shape and gas retention in dough and that it influences the shape and volume of the product. [4] This feature is the basis for flour mixes flour and setting the parameters of the technological process.

2. Materials and methods

Harvests wheat mill and flour mill 650 source was S.C. MP Moara - Baneasa S.A. It were performed monthly by 3 determinations for each feature and then calculated the annual average

The analytical flours quality was determined according to the international standard methods (ash content – ICC104/1, wet gluten – ICC105/2, protein content – ICC106/2, hydration capacity with Pharinograph - ICC115/1). The moisture content of the wheat flour and bran were determined by oven drying at 1300C for 1 hour.

Also, it was made determination of technological and rheological properties through Alveographic curves, in order to make recommendation for different usages. A Chopin Alveoconsistograph was used for determination of resistance of deformation (tenacity) P, dough extensibility, L, the value of P/L, and the mixing energy W according with the international standard SR ISO 5530 – 4.

The data obtained was statistically processed by multifactor method ANOVA. The validation of optimal mixture was made through compare with reference values for bakeries flour.The analyzes were performed in the S.C. MP Moara - Baneasa S.A and in the research laboratory of Stefan cel Mare University of Suceava, Faculty of Food Engineering. [5]

3.Results and discussion

*3.1 Evaluation of wheat quality***.** First of all, it was determined the physical-chemical indicators of quality for wheat crops during 2010-2013 years (table 1).

Analyzing the physico-chemical parameters compared to reference values established in the technical specification, it is noted that throughout the period studied, the average values were variations of about 0.5% compared to the reference value. If moisture in the 2011 exceeds 1.5%, in other years the humidity does not vary by more than 0.5%. Acidity is below 4 degrees, ash is above the limit set. If wet gluten is observed that for the years studied, the value was below the reference, except 2013. The experimental indicate that at least the last three years; the deformation index was below 5 mm, which required practical use improvers based cysteine relaxation.

The percentage of protein and ash content were within the limits imposed by the reference value. In all years, if we refer to the average annual rate of fall was above the limit of 250 seconds, which basically meant that production use of α-amylase intake.

From the analysis of rheological parameters (table 2) and comparison with reference values, we observe that, throughout the period under review, the average values are above the minimum hydration capacity of 60%. By CH's correction of 14% flour moisture obtain a deviation from the practical results of maximum + / - 0.5%.

From rheological point of view flours used were P / L above 1, which correlated with the deformation, confirms that gluten flours were resistant, less stretch. The fact that P and W values were large and small L, it follows that starchy flours damaged. This may explain CH values large enough to standard.

Table 1. Physico-chemical characteristics, average annual wheat crop during 2011-2013

Year /Reference value	Humidity %	Acidity, grade	Wet gluten, %	Deformation , mm	Ash, %su	Proteins %su	Falling Number, sec
	14,5	**4**	**24**	**5**	**1,25**	**10**	**200**
2011	15,5	2,9	23,5	3,5	1,23	11,9	320
2012	15,2	3,4	22,9	3,5	1,26	12,1	310
2013	14,8	2,4	24,2	3,5	1,24	11,1	280

Table 2. Rheological characteristics, average annual wheat crop during 2011-2013

Year /Reference value	Humidity %	Hydration Capacity %	CH	P, mmH_2O	L, mm	W, 10 E - 4J	P/L
	14,5	**60**	**Correction to 14%**	**75**	**130**	**200**	**0,65**
2011	15,5	62,4	63,5	26	31	29	0.87
2012	15,2	65,2	66,12	27	32	34	0.85
2013	14,8	63,8	64,4	30	29	36	1.05

Table 3. Physico-chemical characteristics of 650 wheat flour, average annual value during 2011-2013

Year / Reference value	Humidity %	Acidity, grade	Wet gluten, %	Deformation mm	Ash, %su	Proteins %su	Falling Number, sec
	14,5	**2,8**	**26**	**5**	**0,65**	**9,5**	**250**
2011	14,8	2,0	23,9	3,0	0,65	10,00	292
2012	14,5	2,5	23,8	3,7	0,65	10,26	279
2013	13,9	2,1	25,1	4,0	0,62	10,1	265

Table 4. Rheological characteristics from 650 wheat flour, average during 2011-2013

Year /Reference value	Humidity%	Hydration Capacity %	CH	P, mmH2O	L, mm	W, 10 E -4J	P/L
	14,5	**60**	**Correction to 14%**	**75**	**130**	**200**	**0,65**
2011	15,5	62,4	63,5	26	31	29	0.87
2012	15,2	65,2	66,12	27	32	34	0.85
2013	14,8	63,8	64,4	30	29	36	1.05

Table 5. Influence of harvesting and type of flour on physico-chemical and rheological characteristics by ANOVA method

Prameters	**Year**			**Fischer report**	**Ash**			**Fischer report**	**Year x ash**
	2011	2012	2013		0.65	0.9	0.95		
Physico-chemical properrties									
Humidity, %	14.83^{b}	14.39^{d}	14.49^{c}	205.21***	14.36^{d}	14.51^{c}	14.57^{b}	41,76***	4.06***
Acidity, grade	2.86^{a}	2.33^{d}	2.53^{c}	128.22***	2.16^{e}	2.41^{d}	2.49^{c}	159.45***	8.27***
Wet gluten, %	24.55^{c}	23.50^{f}	25.96^{a}	254.35***	26.11^{a}	24.68^{b}	24.61^{b}	75.29***	5.66***
Deformation, mm	3.58^{b}	3.66^{a}	3.44^{c}	28.54***	3.38^{c}	$3.43b^{c}$	3.48^{ab}	5.17***	7.56***
Protein content, %	11.20^{c}	10.59^{e}	12.01^{a}	201.34***	10.44^{e}	11.07^{d}	11.36^{c}	489.50***	2.11**
Falling number, sec	298.54^{e}	276.30^{f}	387.54^{a}	408.83***	299.16^{e}	307.46^{d}	309.92^{bc}	21.47***	0.57ns

Rheological properties									
Hudration capacity, %	61.17^b	60.56^c	62.06^a	18.35***	56.87^e	59.71d	60.42c	271.58***	0.86ns
P, mm H2O	73.66c	76.48b	76.81b	103.70***	121.88a	84.48b	75.07c	4467.16***	2.89***
L, mm	48.36bc	46.17d	49.44ab	18.67***	69.16a	52.57b	48.42c	1596.28***	19.18***
W, E	156.56b	161.95a	138.25d	93.81***	265.97a	172.13b	148.61c	4328.62***	5.54***
P/L	1.36c	1.49b	1.55a	80.94***	1.79a	1.51b	1.42c	414.73***	15.42**

3.2 Evaluation of flour quality. Analyzing the physico-chemical parameters (table 3) compared to reference values established in the technical specification, it is noted that throughout the period studied, the average values were variations of about 0.5% compared to the reference value

Thus, moisture does not exceed by more than 2% of the reference value, the acidity is less than the limit of 2.8 degrees, ash is not more than the set limit. If wet gluten is observed that for the years studied, the value was below the reference was found that at least the last four years, the deformation index was below 5 mm, which required the use of enhancers based practice cysteine for relaxation. The percentage of protein and ash content were within the limits imposed by the reference value. In all years, if we refer to the average annual rate of fall was above the limit of 250 seconds, which resulted in the practical production, the need for intake of α-amylase.

To have an overview of the technical quality of the flour 650 were made in parallel on rheological measurements relevant to the production behavior (table 4). Rheological characteristics indicating all protein quality were assessed with Alveograph Chopin.

We determined the capacity CH of the hydration which has been adjusted to a value of 14.0% of the moisture of the flour and the power (energy) W, W resistance, the extensibility of the dough L, and the ratio L/L. Were performed monthly by 3 determinations for each year and then calculated an average feature which overall was compared with reference values.From the analysis of rheological parameters and comparison with reference values, we observe that, throughout the period under review, the average values are above the minimum hydration capacity of 60%. By CH's correction of 14% flour moisture obtain a deviation from the practical results of maximum + / - 0.5%.

From rheological point of view flours used were P / L above 1, which correlated with the deformation, confirms that gluten flours were resistant, less stretch. The fact that P and W values were large and small L, it follows that starchy flours damaged. This may explain CH values large enough to standard. In all years, if we refer to the annual average, the overall picture shows that the corrections process or through appropriate improvements (addition of L cysteine) flour can be processed without obtaining non-compliant products.

3.3. Study of the influence of harvesting and type of flour on physico-chemical and rheological characteristics by ANOVA method

In order to confirm the influence on the collection of physicochemical and rheological characteristics of flour studies, data obtained was analyzed with statistical method ANOVA variance in order to verify the deviations shown in the table 5.

Deviations related outcomes checking method (ANOVA), it appears that ash (flour type) and the year of harvest had a significant ($P < 0.05$) for the following physico-chemical parameters: moisture, acidity, wet gluten, deformation index and content protein. In hydration capacity and Falling number the influence was insignificant.

From the point of view of rheological data using statistical modeling and analysis of the linear regression coefficients and correlation parameters, it is clear that the energy W is the maximum (265.97) 0.65% ash content, i.e. containing flour 650 and 26.1% wet gluten, flour characterizing 650 from

2013. As shown in 2013, 650 flour quality had characteristics most relevant from technological point of view

3.4. Validation of rheological properties of 650 wheat flour

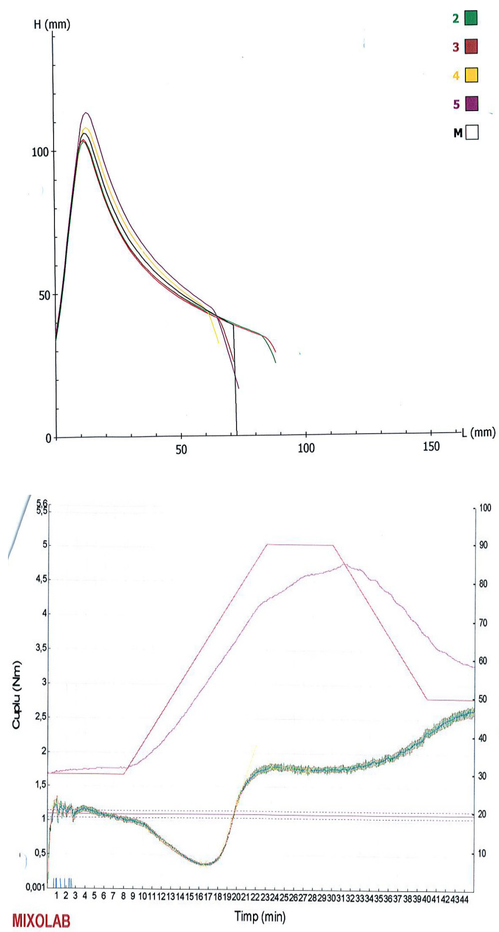

Figura 1. Alveographic and mixographic curves for 650 flours

The P/L report is above the reference value of 0.55, which indicates that the analyzed flours are durable and require attention during processing. Also, the resulting development time was 3 min, 6.5 min and the stability was degree of softening was 82 UF to 77 UF. The mixogram obtained give us information about the behavior of the flour in the technological. It is noted that among energy W and time distortion C2 proteins are correlations.

4. Conclusion

As bakery products remain basic nutrition to manufacture quality products and reliable in terms of harmlessness must trace the flour to finished product. After the experimental determinations, it could be drawn the following conclusions:

- Wet gluten content was above the reference value of 3% in 2013, the rest of the periods studied was below the limit max 8% in 2010
- Protein content in all years and all months was above the reference value, the highest value recorded in 2013, with over 16%.
- Ash content was within the legal limits, with small exceeding (up to 3%)
- The analysis showed that the rheological characteristics of flours were analyzed damage starch, gluten short and strong, requiring corrections in both the process and the improvement (adding L-cysteine)
- Extensibility L, was for all years below the benchmark, the lowest recorded in 2010 (60% lower than the reference value)
- Energy W had values above the reference value, the highest being in 2013 (48%)
- Values of P / L were located in all the years more than the recommended amount for bread flours with up to 3.6 times higher in 2013
- The statistical data modeling and analysis of regression coefficients and correlation parameters estate, that is the maximum power W (265, 97) to an ash content of 0.65% and containing 26.1% wet gluten, flour, and characterizing 650 white wheat harvest 2011. 1.25% for flours with ash that characterizes wheat flour in 1250, obtained a maximum energy W, 150 for 2011, this year being wet gluten 23.9%

Compliance with Ethics Requirements: Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human and/or animal subjects (if exists) respect the specific regulations and standards.

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