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Evaluation of wheat quality using modern methods

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Abstract

Cereal gradation constitutes in fact an identification and separation of cereals in accordance with appearance and physical properties or taking into consideration one of cereals' specific characteristics (chemical or technological). This new system gave the opportunity to establish the real quality of stored cereals. The most important operation in gradation process is to obtain a representative sample. The aim of this paper was to establish the real quality of wheat species cultivated in the Suceava County. Also, it was made determination of technological properties through Alveograph curves, in order to make recommendation for different usages. Four wheat species were evaluated (Dropia, Flamura 85, Fundulea 4, Local type named SV1). The most qualitative were Dropia and Falmura 85 which had very good rheological properties and could provide superior flours. Fundulea 4 belongs to A2 class according to its rheological properties, and could provide good flours. The local type SV1 was the worst species analyzed and the flour obtained could be used only to make biscuits, cakes or liquid doughs.

Keywords: rheological properties, humidity, wet gluten, Alveograph curve

1. Introduction

The number of methods for analyzing technological characteristics of wheat flour is growing because of the more pronounced need to anticipate as early as possible their technological behavior. The technological behavior of flour is the result of subtle and highly complex interactions that need to be usually judged based on very specific quality parameters: protein content, wet gluten content, "strength" of gluten, Zeleny index, fall/decrease index, extensibility and resistance. Reality has shown that at least for the classical parameters of the quality of flour (protein content, gluten index, wet gluten content, fall/decrease index) the values enshrined in the literature do not always ensure optimal technology and behavior. The explanation lies in the multitude of factors underlying the behavior of the flour and technology and in many ways they can interact.

A number of studies have attempted to explore how flour quality parameters depend on each other and hence how some values could be expected, with an error of course acceptable, due to other values. In 2002, Anne and Reine Ingver of Koppel Plant Breeding Institute at Jogeva (Estonia) showed that for wheat flour derived from cultivation in Estonia during 1999 to 2003, there are interesting correlations between physical - chemical parameters, extensographs, farinographs and loaf volume [4]. Thus, protein content correlated with wet gluten content to a level comparable to that recorded for Romanian flour and flour hydration capacity increased similarly with increasing protein content and wet gluten. Flours containing higher protein and gluten content respectively generated more stable doughs with higher developing times. Another study, conducted by several researchers in the U.S., which aimed to assess comparative analysis of the main

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methods of gluten strength revealed some interesting details about the predictability of dough behavior according to a series of physical parameters and classic physical-chemical characteristics [1]. Gaines et al. analyzed 33 samples of wheat varieties grown in a number of US states [2]. They found that three of the parameters used in the analysis of wheat and flour quality can be considered superior in terms of their technological characteristics predictability: alveographic mechanical work (W), peak height mixographic's and solvent retention capacity (Solvent Retention Capacity, AACC Method 56-11) to gluten index and SDS sedimentation index. The aim of this paper was to establish the real quality of wheat species cultivated in the Suceava County. Also, it was made determination of technological properties through Alveograph curves, in order to make recommendation for different usages. Four wheat species were evaluated (Dropia, Flamura 85, Fundulea 4, Local type named SV 1) [3].

2.Material and Method

In order to obtain some available experimental data, four wheat species were evaluated: Dropia, Flamura 85, Fundulea 4 and a local type named SV 1. The samples have 1000g and were analyzed from the point of view of sensorial and physical-chemical quality parameters like: humidity, impurities content, hectolitric weight, grain glassines, infestation and wet gluten.

All the wheat samples were classified in accord with quality determination (table 1).In order to establish the corelation between the grain physical-chemical quality parameters and the rheological behavior, the wheat samples were grounded in by laboratory mill Chopin CD 1. The analytical flours' obtained quality (table 2) was determined in accordance with 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.

Table 1. Quality of wheat samples

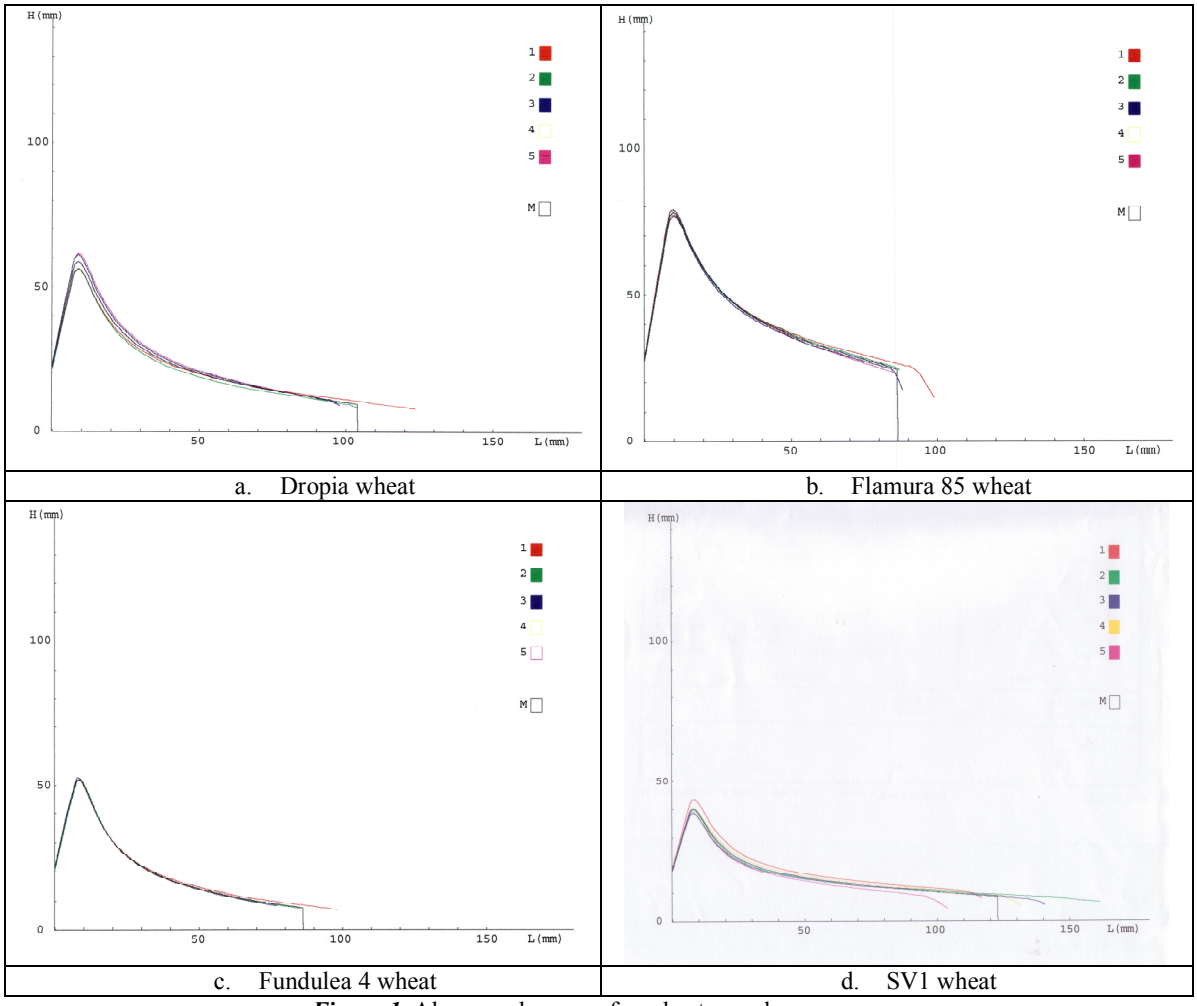
Wheat sample	Sensorial parameters	Hectolitric wheight, Kg/hl	Humidity, %	Impurities %	Allocate grade
Dropia	Healthy grain	76.5	14.2	4.5	Grau, Ro, Nr.2, A1
Falmura 85	Healthy grain	80.3	13.2	1.8	Grau, Ro, Nr.1, A1
Fundulea 4	Healthy grain	78	16.2	6.3	Grau, Ro ,A2
SV 1	Healthy grain	83.2	14.4	4.8	Grau, Ro, Nr.1, B

Table 2. Quality of flours samples

Flour sample	Moisture content, %	Ash, %	Wet gluten %	Hydration capacity %	Protein content, %
Dropia	14.2	0.67	30.08	60.75	12.86
Falmura 85	13.2	0.68	31.10	62.62	13,30
Fundulea 4	14.2	0.69	28.42	57.74	12.15
SV 1	14.4	0.75	24.12	50.76	10.31

Table 3. Characterizations of wheat samples from physical-chemical and rheological point of view

Flour sample	Dropia	Flamura 85	Fundulea 4	SV1
Moisture content,%	14.2	13.2	14.2	14.4
Ash, %	0.67	0.68	0.69	0.75
Wet gluten, %	30.08	31.1	28.42	24.12
Hydration capacity, %	60.75	62.62	57.74	50.76
Protein content, %	12.86	13.30	12.15	10.31
Resistance of deformation (tenacity) P, mm	65	86	57	44
Dough extensibility, L, mm	104	87	87	123
Value of P/L	0.62	0.99	0.66	0.36
Mixing energy W	165	241	118	136



a. Dropia wheat | b. Flamura 85 wheat

c. Fundulea 4 wheat | d. SV1 wheat

Figure 1. Alveograph curves for wheat samples

Also, it was made determination of technological properties through Alveograph 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 experiments are made in the research laboratory of "Ştefan cel Mare" University of Suceava, Faculty of Food Engineering.

3. Result and discussions

For trace possible correlations between the physical-chemical characteristics of wheat varieties and the technological behaviour of the obtained flours, we studied the rheological parameters of the four samples obtained by grinding the wheat samples. The obtained results are shown in Table 3 and in the alveograph curves in Figure 1.

As seen in table 3, the wheat of Dropia si Flamura 85 varieties, which have the best content of protein and wet gluten, have superior rheological parameters than the other varieties.

With the SV local variety, it is observed that it has the greatest extensibility, but correlating this with its low resistance will determine poor rheological behavior, making the corresponding flour and bakery products unfit for high quality. This variety can only be used for making cakes and cake tops from fluid dough. This is highlighted by the alveograph curve (Figure 1, d) which clearly shows that the index has zero extensibility. This rheological behavior is influenced by chemical and physical parameters of the variety, especially the wet gluten content and low moisture capacity. Taking into account variety Fundulea 4, we can say that it belongs to a middle

class according to its grading, and the obtained doughs had a relatively stable behavior, due to the good correlation between strength and elasticity. However, the energy of mixing is relatively small and will require low kneading times at slow speeds.

The flour obtained could be used in the manufacture of products which do not require a strong gluten skeleton, especially sugary biscuits or donuts.

For the Dropia variety, it is obvious that because of good wet gluten content and optimum hydration capacity, it will lead to stable doughs. However, as is seen in the alveograph curves (Figure 1, a), dough strength is not at a very high level, so it will not be able to stand the burdens of additives meant to improve gluten structure. The flour obtained can be used to make bread and common loaf products.

Variety Flamura 85, is from a rheological point of view, the one that will provide flours that can be used for baked goods and products incorporating more materials (fat, sugar, milk), especially puffs. This is possible because it has a very good protein content, and also a good dough strength, which correlated with high kneading energy (241) makes it the best dough that withstands additions.

4. Conclusions

Research showed that between physic-chemical parameters of flour and dough alveographic parameters a number of significant correlations are established, suggesting that achieving a predictive model of alveographic characteristics based on physics-chemical properties of flour is possible.

Dropia wheat samples and Flamura 85 belong to grade 1 class A have very good rheological properties : a W (kneading energy) between 123-241, which results in obtaining high quality flour, with very good tenacity and extensibility. The flour obtained from this grade1 wheat can be used to manufacture puffs.

Fundulea wheat sample 4 which belongs to the class A2 has good rheological properties (with a W like118-136) which leads to obtaining good quality flour with a wide range of manufacturing options.

SV local wheat sample belongs to the class B with weaker rheological properties. The flour resulting from this wheat can be used only for simple biscuits or cakes and cake tops (fluid doughs).

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