The influence of climatic conditions of the harvest year on the wheat quality

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SUMMARY

Technological potential of wheat bread depends on the variety, manner and type of fertilizer, irrigation conditions and climatic conditions in their absence. This study was done on two varieties of wheat grown in Bihor county in a place with identical fertilization conditions, for two different years: year 2014 can be characterized by a greater quantity of rainfall during the wheat vegetation period and the year 2015 can be characterized by a drought during the growing wheat on the subject of the study. In the study was examined whether climatic conditions have any influence on the technological potential of wheat, not taking into account the data on quantity produced per hectare in the years studied.

Keywords: *technological potential, climatic conditions, viscoelastic properties*

INTRODUCTION

Technological potential of wheat bread is given by gas forming capacity of dough during fermentation in presence of yeast, which is influenced by the activity of amylolitic enzymes that are contained and added to flour and gas retention capacity of dough which is influenced by the content and quality of gluten and its viscoelastic properties. These viscoelastic properties depend on the interaction of gluten flour proteins and the activity of proteolytic enzymes in the flour. Depending on the viscoelastic properties of gluten, wheat products will be obtained or quality and will require their correction by the addition of various improvers.

MATERIAL AND METHODS

The study was based on two types of wheat: Dropia and Alex, what were cultivated by agricultural units in the same location in western Romania, in identical fertilization conditions in two years with different climatic conditions. Year 2014 can be characterized as an optimal period on climate conditions during the development of wheat while 2015 can be characterized by a period of drought on wheat development. The determination of technological potential was performed by laboratory tests that were analyzed in gas retention capacity and fermentation capacity to retain them. Wheat varieties studied were those that are most prevalent in the area, namely Dropia and Alex. The varieties of wheat taken into experiment are autumn varieties which grown mainly in the plains. They have large production capacity, high adaptability to the environment (tolerance to frost and drought), tolerance and resistance to the cryptogamic diseases (Ruska and Iancu 2014). They are seen as varieties with good and very good baking properties.

The *Table 1* shows the rainfall conditions during the vegetation period of wheat in 2014, respectively 2015 extracted from NMA (Administrația Națională de Meteorologie) (Net1, Net2).

The samples of wheat were labeled as follows: Sample of wheat Alex from 2014 was labeled with A14, of the wheat Dropia from 2014 with D14, of the wheat Alex from 2015 with A15 and the sample of wheat Dropia from 2015 was labeled with D15. In the *Table 2* the determined parameters of wheat can be seen using Agri Check (humidity, protein content, Zeleny sedimentation index). The determination of ashcontent was done according to SR 90/2007. The falling number was determined according to SR ISO 3093/1997 (Banu 1999).

Table 1.

The rainfall conditions during the vegetation period of wheat in 2014, 2015 (l m^{-2})

	2014	2015
April	60	45
May	85	58
June	115	77

Table 2.

The characteristics of wheat

Characteristic	A14	D14	A15	D15
Humidity (%)	12.32	13.53	11.25	12.21
Ash (%)	1.09	0.81	1.58	1.18
Protein content (%)	14.93	13.74	15.33	15.78
Zeleny sedimentation index (ml)	52	48	56	58
Falling Number	305	332	434	483

After processing from the wheat samples mentioned above flour samples were taken and have been performed to the following determinations: determination of wet gluten according to ISO 21415-2 SR/2007 determination of gluten deformation according to SR 90/2007. With Chopin were determined energy (W*10^{-4} J), maximum steam pressure (P) (mm), extensibility index (G), extensibility (L) (mm) and P/L. With Farinograph were determined capacity hydration (%), development (min) and stability (min). By Zimotachygraf was determined the total volume of gases (V) (cm^3) *(Table 3)*.

After the laboratory test the baking was made according to the operational following schedule:

– preparing the ingredients (flour, water, yeast, salt);
– weighing: 500 g flour, water depending on the (CH), yeast 10 g, salt 10 g;

– dissolving the salt: take some water measured according to CH and the salt is dissolved;
– yeast suspension: take the amount of remaining water and dissolve in it the quantity of yeast weighed and mixed to obtain a homogeneous suspension;
– dosage: first add water in the yeast suspension, and then add flour;
– blending;
– add the solution in which the salt was dissolved;
– kneading (Bordei 2004).

Table 3.

The characteristics of flour

Characteristic	FA14	FD14	FA15	FD15
Wet gluten (%)	27.60	26.30	29.20	29.80
Deformation wet gluten (mm)	10.50	11.50	6.50	7.00
		Chopin		
Energy (W*10^{-4} J)	68.00	94.00	110.00	107.00
Maximum steam pressure (P) (mm)	96.00	85.00	95.00	88.00
Extensibility index (G)	8.60	11.60	11.90	12.20
Extensibility (L) (mm)	15.00	27.00	29.00	30.00
P/L	6.46	3.12	3.34	2.94
		Farinograph		
Capacity hydration (%)	60.20	58.30	64.30	64.80
Development (min.)	3.50	4.00	5.20	5.50
Stability (min.)	2.00	2.50	4.50	7.50
		Zimotachygraph		
Total volume of gases (V) (cm^3)	1406.10	1484.40	1147.60	1087.50

On dough preparation the temperature of flour was measured and the water that entering the dough was heated according to this. Dough temperature after kneading must be between 26 and 28 °C. Baking was done in shapes (steel pan) and between the dough and form it will put baking paper to avoid sticking the product after baking. The baking was carried out in a laboratory furnace. The analysis methods of bread are as SR 91/2007: Appreciation organoleptic. Volume (Fornet device). Porosity. Elasticity. Acidity. The wheat samples studied differ between them by the protein content. ranging from 12.74 to 14.93%. a good to very good content or the wet gluten content that ranges from 26.3 to 29.8%, and the quality of protein and gluten which deformation ranging from 6.5 to 11.5 min. which puts them in the category with good potential for bread grain (Antes and Wieser 2001). This is confirmed by the farinograph curve characteristics, training time (3.5–5 min) and stability of dough (2–7.5 min). All samples present a high P/L alveograph form report (2.94 to 6.46). largely due to a lower extensibility (15–30 mm). The samples of wheat suffers from a shortage of α-amylase content. as shown in the figure dropping (305–483 s) whose value is superior in all cases of optimal value (280 s).

Comparing the Alex variety wheat (A15) from harvest 2015 – dry year – with the same variety (A14) from the crop of 2014 year with higher humidity is observed that in the case of wheat A15 compared to wheat A14 the protein content increases from 14.93% to 15.33%. but their quality does not keep the same trend and gluten deformation is 10.5 mm for A14 and 6.5 mm for A15. At the same time the falling number increased from 305s to 434s which shows a significant decrease of α-amylase activity. From the viewpoint of viscoelastic properties of dough made from these flours we find that those derived from A14 grains respectively D14 grains have viscoelastic properties higher than those obtained from the grain of 2015. This is a decrease of P/L in flours obtained from grains of a dry year – which shows that in dry years flours are harder with a higher resistance to mechanical work – with smaller elasticity and lower extensibility (Belton 1999). To confirm the data obtained from measurements made on flour. baking test has been carried out and we obtained the following results *(Table 4)*.

Table 4.

The characteristics of bread

Characteristic	FA14	FD14	FA15	FD15
Specific volume (cmc/100 g)	380	370	355	340
Porosity (%)	78	76	72	74
Elasticity (%)	98	98	94	92
Acidity degrees	2.6	2.6	2.6	2.6

In terms of the results obtained from measurements made on bread. it can be seen that the volume of breads obtained from samples of flour FA14 respectively FD14 have a larger volume. porosity and elasticity of the core is better than bread made from samples of flour FA15 respectively FD15. confirming the data obtained in the determinations made in flour.

RESULTS AND DISCUSSION

After analyzing the data obtained both the wheat, flour and bread derived therefrom. may be seen the influence of climatic conditions on the technological potential of flour. so in a dry period although the gluten is higher. the viscoelastic properties are weak. which can be seen on the characteristics of bread (Bordei 2011). The breads obtained from these types of flour grow harder. have a smaller volume and a lighter color of the shell due to a lower activity of amylolytic enzymes (Rodica et al. 2005).

CONCLUSIONS

As a conclusion, we can say that to get quality products similar to products from flour in normal years. The flour obtained from grain in dry years have to be corrected by adding enhancers with an amylolitic enzymes activity (Lásztity 2006). Using additional quantities of yeast, extending the process of obtaining the bread and increasing the work done during the kneading dough by kneading prolongation (Rodica et al. 2006).

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