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INFLUENCE OF RESTING TIME AFTER WETTING THE DURUM WHEAT BEFORE GRINDING ON THE FLOUR BAKING PROPERTY

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Abstract
The penetration of water into the core of the wheat grain during the rest after wetting leads to a decrease in the mechanical damage of the components in its core, thus reducing overheating during grinding that protects gluten proteins and also obtaining a lower percentage of damaged starch. By determining the fall index and rheological properties with Chopin Alveograph in samples taken at different rest time intervals after wetting, it was found that for a durum wheat the optimal rest time is 20 hours because after exceeding this time the rheological properties and the fall index has not changed significantly.

Key words: time, properties

INTRODUCTION

Wheat wetting is one of the stages of the technological flow of baking wheat milling. In the past, this stage consisted even in the effective washing of the wheat, followed by centrifugation and introduction into the rest bunker. This method was abandoned due to the residues resulting from the washing process because they were a factor of biological pollution. After wetting, rest before grinding. During the rest of the wheat grains, the water penetrates the grain and improves the yield at the mill and reduces the amount of damaged starch resulting from the mechanical work by which the wheat grains and by-products are crushed between the rollers. The rest time varies greatly depending on the hardness or glassiness of the wheat grains to be ground. If we are dealing with a durum wheat, the rest time is indicated to be much longer, even double that of a soft wheat used in obtaining baking flour.

Following the determinations made, it was highlighted that by prolonging the rest time for durum wheat, very good results were obtained on the rheological properties of the dough. The enzymatic attackability of starch characterizes the ease with which the starch granule is hydrolyzed by enzymes. It is influenced by the degree of damage to the starch granules. Of the two amylolytic enzymes alpha amylase and beta amylase, only the enzyme beta amylase hydrolyzes the mechanically damaged starch granules. Beta amylase hydrolyzes only damaged starch granules, the rest of the starch being deteriorable only for amylase.

Therefore, the ability of flour to form fermentable carbohydrates depends mainly on the degree of damage to the starch granules. Flour obtained from glassy durum wheat consists mostly of whole cells and fragments of endosperm cells, along with small amounts of starch and free protein particles. The strong bond between starch and the proteins inside the endosperm cell causes it to remain largely intact. Deterioration of the starch granule during grinding is accidental and inevitable. Due to the high degree of damage of starch granules in flours from hard grains with high glassiness, they have a high capacity to form fragile carbohydrates.

MATERIAL AND METHOD

The study was conducted at the mill in Bicaci, Bihor County in Romania in its own laboratory. A batch of durum wheat with a high glassiness was introduced into the mill. The respective lot had 22 tons, which meant grinding in 6 hours, given the mill's grinding capacity. After introduction into the grinding process, the wheat batch was left to rest for 16 hours after wetting. Samples of flour were collected at the entrance to the flour hopper at an interval of 30 minutes, obtaining 12 samples: at 16 and a half hours, 17 hours, etc. up to 22 hours of wheat rest before grinding.

The analysis methods were those from the Romanian Standard for the following determinations: determination of the fall index SR ISO 3093/1997, the fall index method uses as substrate the starch contained in the sample.

It is based on the rapid gelatinization of the flour suspension in a hot water bath, and the measurement of gel liquefaction under the action of amylolytic enzymes. Wet gluten according to SR ISO 7495-2001. For the determination of wet gluten, the protein substances in the form of gluten are separated, by washing with sodium chloride solution of the dough prepared from the sample to be analyzed and the gluten obtained. Determination of the rheological characteristics of the dough using the chopin alveograph according to the SR ISO 5530-4: 2002 Standard.

The alveographic method is based on the tensile strength of a sheet of dough subjected to air pressure, which swells in the form of a bubble growing to rupture. The Chopin alveograph is used to determine certain rheological properties, especially the maximum overpressure P, the swelling index G, the average abscissa at rupture I and the deformation energy W.

Baking test according to SR 90-1998. The baking properties of the flour are assessed based on the characteristics of the dough and of the bread resulting from the baking test performed under established conditions, applying the single-phase process. For this test, larger quantities of flour (200 kg) were taken in order to be able to test the properties in our own bakery in working conditions within a mechanized flow for obtaining bread.

RESULTS AND DISSCUSIONS

Following the laboratory determinations, the following results were obtained as can be seen in the tables below:

Table 1

The value of the fall index according to SR ISO 3093/1997

Fall index value (sec)	276	282	288	290	294	296	299	302	304	306	308	306	308
Rest time (hours)	16.5	17	17.5	18	18.5	19	19.5	20	20.5	21	21.5	22	22.5

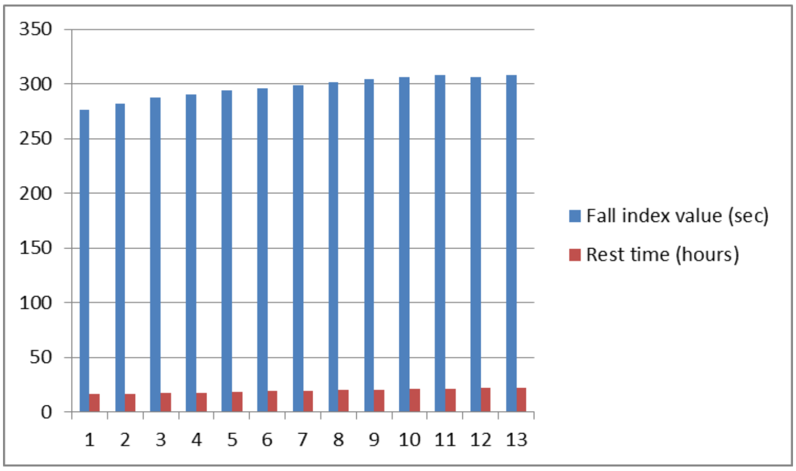

Fig 1. The value of the fall index according to SR ISO 3093/1997

Table 2

Wet gluten value according to SR ISO 7495-2001

Amount of wet gluten (%)	32.6	32.4	32.4	3.5	32.2	32.3	32.5	32.4	32.2	32.6	32.4	32.8	32.2
Rest time (hours)	16.5	17	17.5	18	18.5	19	19.5	20	20.5	21	21.5	22	22.5

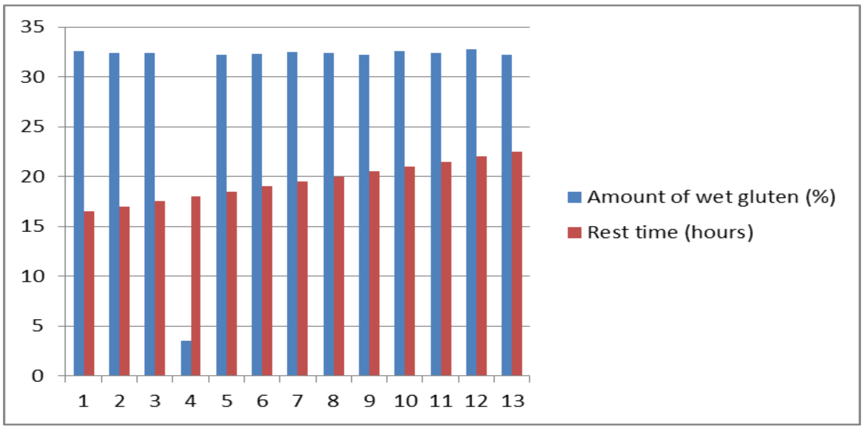

Fig 2. Wet gluten value according to SR ISO 7495-2001

Table 3

Value Maximum pressure Chopin alveograph according to SR ISO 5530-4: 2002

Maximum pressure (mm)	110	110	114	118	122	122	128	130	130	134	134	134	132
Rest time (hours)	16.5	17	17.5	18	18.5	19	19.5	20	20.5	21	21.5	22	22.5

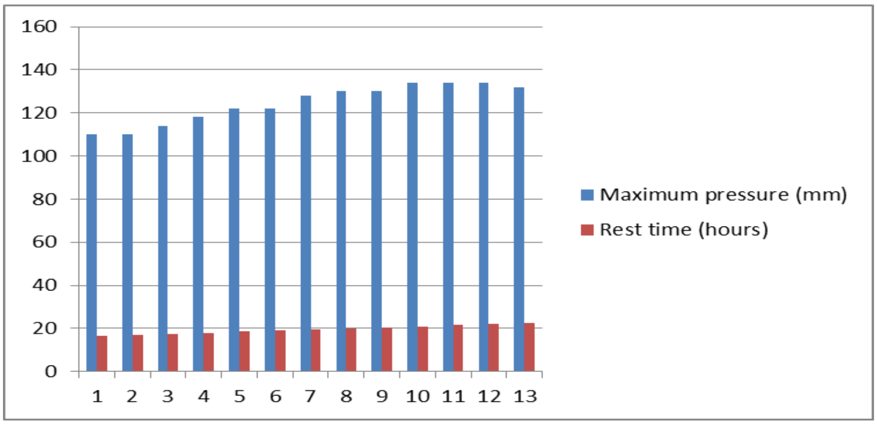

Fig 3. Value Maximum pressure Chopin alveograph according to SR ISO 5530-4: 2002

Table 4

Elasticity value Chopin alveograph according to SR ISO 5530-4: 2002 Standard

Elasticity (mm)	126	126	124	120	118	118	114	114	110	110	108	108	108
Rest time (hours)	16.5	17	17.5	18	18.5	19	19.5	20	20.5	21	21.5	22	22.5

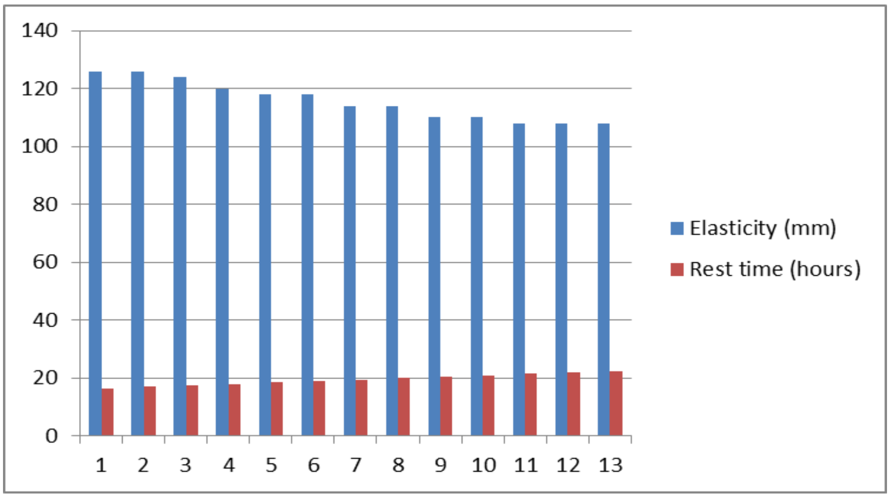

Fig 4. Elasticity value Chopin alveograph according to SR ISO 5530-4: 2002 Standard

Table 5

P / L ratio Chopin alveograph according to SR Standard ISO 5530-4: 2002

P/L ratio	0.87	0.87	0.92	0.98	1.03	1.08	1.14	1.14	1.22	1.22	1.24	1.24	1.22
Rest time (hours)	16.5	17	17.5	18	18.5	19	19.5	20	20.5	21	21.5	22	22.5

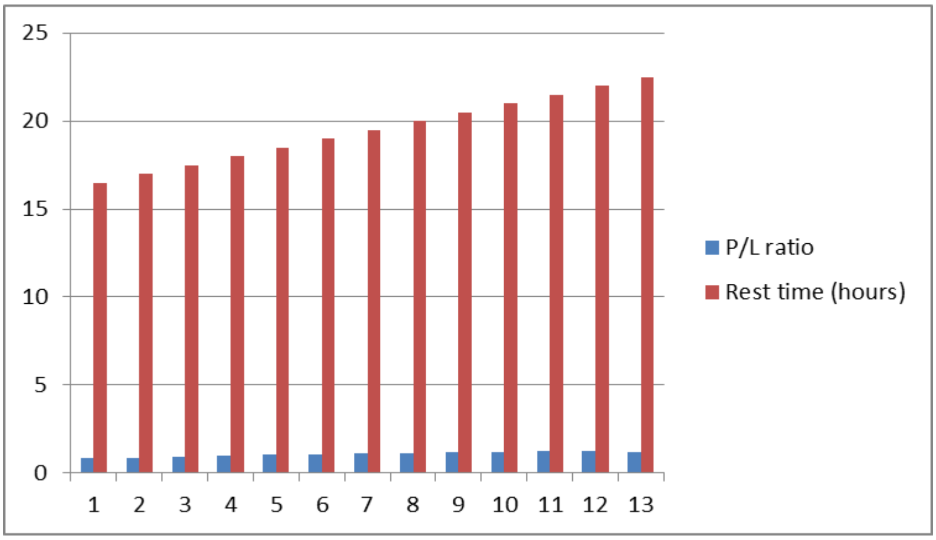

Fig 5. P / L ratio Chopin alveograph according to SR Standard ISO 5530-4: 2002

After processing the flour in our own bakery, the following were observed: for the flour batches that were taken at a rest time of 16-18 hours, the dough soon (10-12 minutes) after division began to become sticky and presented as if "sweating". The mechanized processing was quite difficult due to the stickiness of the dough requiring more interventions on the modeling flow.

As the rest time progressed, this phenomenon was diluted and at a rest time of 20 hours it did not manifest itself, behaving like a normal dough. On the other hand, after baking, the volume of products obtained from flours with less rest was visibly higher compared to those obtained from flours with higher rest. In the latter, there were no processing difficulties during the technological flow.

CONCLUSIONS

Following the determinations made on the dough as well as on the products obtained from them, it was found that the rest time before grinding has a significant influence on durum wheat. Thus, as the rest time increases, the rheological properties of the dough improve. This is due to the higher amount of damaged starch in flours obtained from ground grains with less rest.

According to the determinations, it turned out that the optimal time for a durum wheat with a high glassiness is at least 20 hours, exceeding this time no longer having an influence on the rheological properties. On the other hand, the opposite was found for the volume of products. The products obtained from grain flours whose rest was lower, was visibly higher than those with a longer rest. This is due to the ease with which starch damaged by amylolytic enzymes is hydrolyzed, thus obtaining a much higher amount of mono and diglucide, which intensifies the activity of baking yeast and increases the amount of fermentation gases obtained.

As a recommendation we can say that in the units where the dough processing is mechanized, the rest time in case of grinding durum wheat must be extended by at least 20-30%, otherwise the interventions during the technological flow of obtaining of the products will be difficult, there will be many rejections. In the case of bakery units that have a technological flow of processing the dough mainly manula, there the flours resulting from the grains that have a shorter rest time even lead to obtaining products with a higher volume.

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