Scientific Papers. Series A. Agronomy, Vol. LXII, No. 1, 2019
ISSN 2285-5785; ISSN CD-ROM 2285-5793; ISSN Online 2285-5807; ISSN-L 2285-5785

SOME ASPECTS OF BAKERY INDUSTRY QUALITY FOR ORGANIC AND CONVENTIONAL WHEAT

Maria TOADER[1], Emil GEORGESCU[2], Paula Ionela NĂSTASE[1], Alina Maria IONESCU[1]

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, District 1, 011464, Bucharest, Romania
[2]National Agriculture of Research and Development Institute Fundulea, 1 Nicolae Titulescu Street, Calarasi County, Romania

Corresponding author email: mirelatoadervali@yahoo.com

Abstract

The objective of these researches was to analyze the quality for bakery industry of some organic and conventional wheat samples on the agricultural market in Romania. Analysis was performed on grains, flour and bread of the organic wheat by comparison with the conventional wheat. For wheat grains we tested: moisture, gluten, starch, proteins, Zeleny index, ash and fiber. For integral wheat flour we performed the following: organoleptic examination; wet gluten content; the index of gluten deformation; gluten index; Falling Number. For bread, we analysed: organoleptic examination; the ratio height/diameter; crumb porosity; crumb elasticity. The chemical composition of organic wheat grains was: 10.73% moisture; 13.25% proteins; 66.27% starch; 1.53% fibre; 1.87 ashes; 35 Zeleny Index. By comparison, for conventional wheat grains were: 11.52% moisture; 12.96% proteins; 67.12% starch; 2.31% fibre; 1.62 ash; 32 Zeleny Index. The results of integral wheat flour include: specific color of wheat milled grist, with smell pleasant, not specific smell of mold, hot or other special smell; the taste was normal, slightly sweet, not bitter or sour, with no mineral impurities; the wet gluten content varied between 30.74% for organic flour and 27.12% for conventional; deformation index was between 5 for organic flour and 3 for conventional flour; 56.43 gluten index was for organic flour and 50.07 for conventional; Falling Number was 247 seconds for organic flour and 234 seconds for conventional flour. Another aspect that was highlighted by determinations organoleptic bread quality assessment where it obtained 23 points for conventional bread and 30 points for organic bread. Thus, the bread obtained good fall into the category (18.1 ... 24 points) for conventional bread and very good, especially in terms of smell and taste for organic bread.

Key words*: wheat, bakery industry, organic agriculture, yields quality, chemical composition.*

INTRODUCTION

Bread is a commonly consumed grain product in numerous countries and societies. Nowadays, there is a great variety of organic and "natural" breads, along with conventional ones. Can choose from white bread, wheat, whole or sprouted wheat, multi-grain, and gluten-free (Kucińska, 2012).

A clear understanding of the relationships between farming systems and crop nutritional quality is very important for designing agricultural management strategies which enhance environmental quality and sustainability while improving consumer's health.

Agricultural production systems may differ greatly in terms of amount and sources of fertilisers, crop protection strategies and crop rotation. As such, a relationship between food quality and farming systems could be expected (Mazzoncini et al., 2007).

Introduction European policy to promote quality food products is an important component of the current Common Agricultural Policy (CAP). By this policy, European Union encourages farmers in order to obtain the agricultural products with superior quality. Currently, while the initial goal was achieved (in many agricultural products European Union provides the use of domestic over 100%), CAP was shifted to the qualitative aspect of food products, rather than to the quantity (Toader, 2008).

Grain quality at the mill is the result of the interaction of genotype with environmental conditions from sowing to delivery to the mill, and this interaction is potentially different for

each aspect of grain quality (Cauvain, 2003). The baking potential of wheat flours is influenced by many factors, most notably protein content (MacRitchie, 1987). Protein content is in turn influenced mainly by nitrogen fertilization, while the protein quality is determined primarily by the wheat genotype (Samaan et al., 2006). On the other hand, both the quality and the content of the wheat protein are affected by the climatic conditions during wheat maturation (Huebner, 1999). Vitreousness is considered to be related to the endosperm microstructure whereas hardness is suggested to influence the adhesion forces between starch granules and protein matrix (Greffeuille et al., 2006).

EU quality policy on the products obtained in the organic farming system is part of wider agricultural product quality policy. This policy meets the demand for specific products, increasingly stronger European consumers towards standardization in the development of conventional products. Producers are allowed if their products meet the conditions imposed by European regulation, to engage in a quality approach to enable better marketing. In order to qualify, depending on the geographical area will be enhanced, two indications: protected designation of origin and protected geographical indication. There is also the possibility that products produced using traditional methods to obtain certification of specificity (under endorsement traditional specialty guaranteed) (www.organic-europe.net).

This means that modern organic products, are not only fresh, delivered straight from the farm, but they also cover products every day involving sophisticated methods of processing products including wine, beer, pasta, yoghurt, prepared meals, cheeses etc. Like their counterparts from conventional agriculture, organic farmers and processors monitor trends in food consumption to ensure their products keep up with any changes in consumer tastes or demand, with the guarantee system certification on these products.

As a result of fewer irrigation practices and no synthetic fertilizers and pesticides being used in crops' growth, a higher amount of significant health-promoting nutrients, minerals, vitamins, and antioxidants can be found in organic grains. Eating organic bread can also lower your exposure to pesticides. Organic farming is significantly reflected not only in quality and safety of grain and grain-based products; it also has a great impact on our environment.

Furthermore, wheat is the most important cultivated plant, which is obtained mainly bread, staple food for about 40% of world population. The wheat flour is used for the preparation of various bakery products and manufacturing of pasta, etc. The grains of wheat are included in mixtures for breakfast cereals. Wheat grains are used in animal feed as such or ground, for the production of starch, gluten, alcohol, spirits (vodka, whiskey) beer, biofuel (ethanol). Straw have multiple uses, such as raw material in the pulp and paper industry; bedding; roughage; organic fertilizer into the soil after harvest incorporation or composting; producing energy by burning ends in fiery heat recovery.

In Romania there are favorable conditions for wheat cultivation and its role in food security strategy is determined by the possibilities of conservation inexpensively compared to other foods, cold chains unnecessary or costly installation (Roman et al., 2012).

MATERIALS AND METHODS

The main objective of this research was to determine the chemical composition and yield quality for organic and conventional wheat from the market of agricultural products in Romania. At the same time, there were tested samples of wheat flour for bakery industry quality. The material includes 20 of wheat samples, 10 for each type, organic and conventional. For results we present the average results.

Chemical analyses were performed to Yield Quality Laboratory of Crops Sciences Department of the Faculty of Agriculture, University of Agronomic Sciences and Veterinary Medicine of Bucharest, in 2017.

The devices used for analyses of wheat grains was spectrophotometer infrared NIR Inframatic 9200 Product Instalab-Analizer (Figure 1). For wheat grains we tested: moisture, gluten, starch, proteins, Zeleny index, ash and fibre.

For integral wheat flour performed according the STAS Methods (SR 877-95-Wheat Flour),

the following: organoleptic examination; wet gluten content; the index of gluten deformation; gluten index; Falling Number (Figure 2).
For bread, we analysed: organoleptic examination; the ratio height/diameter; crumb porosity; crumb elasticity (Table 1, Figure 3).

Figure 1. NIR Inframatic 9200 Product Instalab-Analizer (Yield Quality Laboratory of Crops Sciences Department)

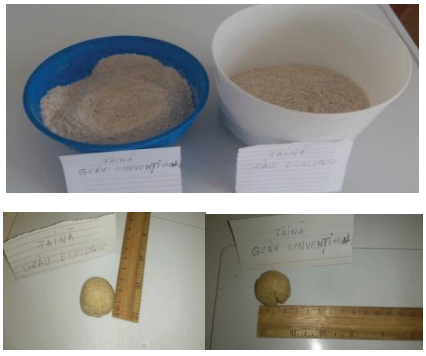

Figure 2. Aspects of gluten index deformation analysis (Yield Quality Laboratory of Crops Sciences Department)

Figure 3. Aspects of bread analysis (Yield Quality Laboratory of Crops Sciences Department)

Table 1. Descriptive vocabulary and definitions used by assessors to evaluate bread

Attribute	Definition
Appearance	
Crust colour	Degree of colour darkness in the crust ranging from pale to dark brown
Crumb colour	Degree of colour darkness in the crumb ranging from creamy to white
Crumb appearance	Degree of porosity and its uniformity from non uniform to uniform
Odour	
Yeasty	Odour associated with aromatic exchange from yeast fermentation
Grainy	An aromatic impression of cereal derived products like wheat, barley and corn
Texture	
Manual	Force required snapping sample by hand
Oral	Force required biting completely through sample placed between the molars
Flavour	
Sweet	Fundamental taste sensation of which sucrose is typical
Salt	Fundamental taste sensation elicited by sodium chloride
Sour	Fundamental taste sensation evoked by acids

RESULTS AND DISCUSSIONS

Results of wheat grains chemical compositon. Knowing, the moisture content plays an important role in storage of wheat grains. Moisture percentage is very important in the practice of obtaining and preserving agricultural products, as increased moisture favors grains firing and infestation. In Romania, the STAS moisture for wheat seeds is 14% (SR ISO 13548:2013).
According to the moisture content, a higher amount of dry matter was obtained from organic wheat, about 90% compared with conventional wheat which had a value of about 88% (Table 2).

Table 2. Comparative analysis on chemical composition of conventional and organic wheat seeds

Compounds (%)	Conventional wheat	Organic wheat
Moisture	11.52	10.73
Dry matter	88.38	89.27
Proteins	12.96	13.25
Starch	67.12	66.27
Fibre	2.31	1.53
Ash	1.62	1.87
Zeleny index (number)	32	35

Regarding the biochemical content of other components, one can highlight content slightly higher in proteins, over 13% for organic wheat, compared with conventional wheat samples.

Because minerals are distributed mainly to the periphery of the grain, the degree of extraction of the flour is higher, the higher ash content and flour is darker but richer in minerals, fibre and enzymes. Ash content for organic wheat flour had a value of 1.87%. For conventional wheat flour ash content was 1.62%. The starch was higher of conventional wheat, respectively 67.12%, by comparison with organic wheat.

Results on flour (whole meal). Organoleptic examination of the flour was: appearance (colour), smell and taste of flour for bakery.

Both types of flour (organic and conventional) had the characteristics of healthy product. After infestation determination, it was observed that after about an hour, the cone made with a funnel did not collapse, and there were no signs indicating the presence of mites or other insects on the surface for any of the analyzed samples.

The obtained results showed an ash content falling standards for integral flours in Romania for both types of sample. The wet gluten and proteins contents have the main role in the production of bread from wheat flour. Sufficiently flexible and extensible gluten ensures well-developed, smooth, uniform porosity with thin walls. In our experiments, wet gluten content varied between 30.74% for organic wheat and 27.12% for conventional wheat (Table 3). Thus, the obtained values frame the organic wheat and the conventional wheat in the Romanian standards (22-32%) for high quality flour for bakery. It highlights the wheat flour made from organic wheat, where gluten was over 30%.

The deformation of gluten index indicates the proteolytic activity of the flour. The deformation of the gluten is high if it exceeds 15 mm. If gluten deformation is below 5 mm, proteolytic activity is very low, gluten is highly elastic, and flour requires amelioration with proteolytic or reducing enzymes. For baking flours Standards, gluten deformation index ranges from 3 to 25 mm. In this experiment it was obtained 3 mm for conventional wheat flour and 5 mm of organic wheat flour.

Gluten index calculated for the two types of flour ranged between 50.07 in the case of conventional wheat flour and 56.43 respectively for organic wheat flour. The standards gluten index ranges oscillated between 40 and 50.

The nutritional content of breads is related to the chemical composition of the bread, hence protein content and starch composition are of importance when considering the dietary impact of breads.

Table 3. Comparative analysis on flour of conventional and organic wheat

Compounds	Conventional wheat	Organic wheat	Standards Values
Organoleptic examination	Product specific healthy	Product specific healthy	Product specific healthy
Wet gluten (%)	27.12	30.74	22
Deformation index (mm)	3	5	3-15
Gluten index	50.07	56.43	40-50

Falling Number test was determined in laboratory by Falling Number device, according to standard ISO 3093-2005. In these circumstances it was 228 seconds organic flour and conventional flour was 247 seconds (Table 4). This index measuring amylase activity involved in starch degradation, which can be excessive in the presence of germinating seeds or emerging germination. The method is widely used commercially to measure the germination of grain. The results show the two types of flour are suitable to use in bakery industry.

Table 4. Falling Number of conventional and organic wheat flour

Values			Quality of flour
Conventional wheat flour	Organic wheat flour	Standards Values	
-	-	< 120 seconds	Unusable
-	-	120- 180 seconds	Satisfactorily
228	247	180- 260 seconds	Suitable
-	-	>260 seconds	Usable with the addition of enhancers

Results on bread. Organoleptic characteristics after 4 hours of rest from cooking were following:

- Type of product: bread analyzed has regular shape at both flour types, and volume was sufficiently developed and flattened to any of the samples.

• Bark:
  - Appearance: shell surface was matt (has cracks on upper and side shell surface over 1 cm long, the skin is crispy, slightly soft to hear a sound hitting its open, clean).
  - Color: nice browned crust was yellowish-gold coloration is uniform and attractive.
• Core:
  - Sectional appearance: the product was sufficiently ripe, fairly uniform crumb porosity, cracks vertical, lateral or horizontal core.
  - Colour: crumb feature was the assortment of bread.
  - Consistency: pressing with the finger slowly enough bread crumb returns to its original state and cutting the slice of bread, knife remains clean, it is not crumbles core was wet and tacky to the touch, and elastic.
  - Smell: the product was especially pronounced flavor of organic wheat flour.
  - Taste: product has a satisfactory taste.
  - The total number of points by scoring method (Table 5) was 23 points for the conventional bread by comparison with organic bread (30).

Quality bread falling in the good category (18.1-24 points) for conventional bread and very good for organic bread, especially in terms of smell and taste.

Table 5. Organoleptic quality assessment by method points of bread

Organoleptic characteristics	Maximum points for conventional bread	Maximum points for organic bread
Product form	4	5
Crust:		
aspect	3	3
colour	3	3
Crumb:		
sectional appearance	3	3
colour	3	3
consistency	3	3
Smell	2	5
Taste	3	5
Total score	23 points	30 points

Besides other issues as determined by organoleptic examination, little can comment on defects in, namely:
- Cracks in the shell, even if they were not large, were determined through gas outlet fermentation of the dough, giving it specifies that poor aesthetics and a low volume, so once the output of these gases fermentation were lost and some the flavour substances of bread.
- The core was wet, probably due to elastic baking at elevated temperature, a short time.

The evolution of the core and shell after 24 hours storage. Bread immediately after cooling began to aging, the first signs appeared after 10-12 hours. Bark has become matt, it was first soaked, then it became hard core was brittle. Flavor and aroma of fresh bread disappeared, replaced by a bland taste, especially stale bread from conventional wheat. The core brittle occurred due to insufficient gelatinisation of starch. Taste of the core and shell fad after 24 hours of storage arose due to insufficient fermentation and leaven dough.
To remember is that not all defects importance for the quality of bread. Very important are: ripeness, volume, porosity, taste and smell. They can decide the acceptability of bread as the final product.

CONCLUSIONS

The concept of organic farming is aimed to produce food with the taste, texture and authentic qualities and attractive corresponding to culinary preferences and skills of the modern consumer.
The production of certified organic wheat allowed to maintain a premium price compared with the conventional market.
Consumers are increasingly aware of social issues and the environment related to food production as evidenced by the significant increase in sales of food certificates, both in stores and in natural food supermarket chains.
All these values are exponent climatic conditions and culture technology applied for the two types of wheat analyzed and reveal their importance on the chemical composition or the quality of the harvest.

ACKNOWLEDGEMENTS

This article was financed by the Faculty of Agriculture, University of Agronomic Sciences and Veterinary Medicine of Bucharest.

REFERENCES

Cauvain, S.P. (2003). *Bread making. Improving quality*. Woodhead Publishing Limited. Cambridge. England.

Greffeuille, V., Abecassis, J., Rousset, M., Oury, F., Faye, A., Lullien-Pellerin, A. (2006). Grain characterization and milling behavior of near-isogenic lines differing by hardness. *Theor. Appl. Genet*., *114*, 1–12.

Huebner, F.R., Bietz, J.A., Nelson, T., Bains, S.G., Finney, P.L. (1999). Soft wheat quality as related to protein composition. *Cereal Chem*., *76*, 650–655.

Kucińska, M. (2012). Organic bread versus natural and convetional bread. Archive at https://planet save. com/2012/09/20/organic-read-versus-natural-and-conventional-bread/.

MacRitchie, F. (1987). Evaluations of contributions from wheat protein fractions to dough mixing and bread making. *J. Cereal Sci*., *6*, 259–268.

Mazzoncini, M., Belloni, P., Risaliti, R., Antichi D. (2012). Organic Vs Conventional Winter Wheat Quality and Organoleptic Bread Test. Archived at http://orgprints.org/view/projects/int_conf_qlif2007.html

Roman, Gh.V., Duda, M., Imbrea, F., Matei, Gh., Timar, A.V. (2012). *Conditioning and preserving agricultural products.* Bucharest, RO: University Publishing House.

Samaan, J., El-Khayat, G.H., Manthey, F., Fuller, M., Brennan, C.S. (2006). Durum wheat quality: II The relationship of kernel physicochemical composition to semolina quality and end product utilisation. *Int. J. Food Sci. Technol*., *41*, 47–55.

Toader, M. (2008). Research on chemical composition and quality of the harvest of grain and pseudocereales species under the influence of natural and technological factors. PhD Thesis, USAMV Bucharest.

http://ISO Standards of wheat: http://old.madr.ro/pages/proiecte_interne2012/ordin-manual-gradare-seminte-consum.pdf.

http://www.organic-europe.net.