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Breadmaking Quality Parameters of Different Varieties of Triticale Cultivars

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Abstract: The aim of this research is to investigate the quality of different triticale cultivars (Ingen 35, Ingen 33, Ingen 93, Ingen 54, Ingen 40, Fanica and Costel) cultivated in the Republic of Moldova from the point of view of the flour, dough, and bread quality characteristics. This research may be of great importance for producers and consumers due to the high production capacity, wide adaptability, economic significance in human foods and nutritional value of triticale cultivars. The triticale flours were analyzed for moisture, ash, protein, wet gluten, fat, carbohydrates, acidity and color parameters (L*, a* and b* values). According to the chemical values, the triticale flours were suitable for breadmaking. The moisture content was less than 14% for all triticale varieties, indicating a long shelf life during its storage and the lowest protein content of 13.1%. The mixing, pasting and fermentation characteristics of triticale dough were analyzed using Mixolab, falling number, dynamic rheometer, alveograph and rheofermentometer devices. All triticale flours presented high levels of α-amylase, with falling number values being less than 70 s. The bread quality characteristics analyzed were the loaf volume, porosity, acidity, and sensory characteristics, and the textural parameters examined were the hardness, gumminess, chewiness, cohesiveness, and resilience. Our data showed large differences in breadmaking quality parameters. However, according to the sensory data, all the bread samples except those obtained from the Costel variety were of a very good quality, being within a total sensory range of 25.26–29.85 points. According to the relationships between flour, dough and bread characteristics obtained through principal component analysis, it may be concluded that the triticale varieties Costel, Ingen 33, Ingen 93 and Fanica, and Ingen 35 were more closely associated with each other. Significant differences were found between the triticale variety samples Ingen 40, Fanica, and Ingen 35 and between Ingen 54, Ingen 33, Costel, and Ingen 93.

Keywords: bread quality; dough rheological properties; principal component analysis; triticale flour

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1. Introduction

Triticale is a hybrid grain created by crossing species of rye (Secale) and wheat (Triticum), which presents the properties of both cereals [1]. According to the information provided by FAOSTAT, from the beginning of the 1990s to the beginning of the 21st century, the cultivated areas of triticale have been continuously increasing [2]. Nowadays, triticale production is around 13 million tons worldwide, and Europe is the major triticale-producing region with almost 90% of the global triticale production and a tendency to expand into areas with soils and climate unfavorable to wheat and rye [2,3]. It is a cereal with a high yield potential; resistance to winter, drought and diseases; tolerance to the toxicity of salts; and high adaptation to the environment (high yields are obtained on slopes, soils, clayey, sandy soils with poor soil) [4,5]. Triticale can easily adapt to different growing conditions, and in this way, it may be a reliable crop for food production. Due to its characteristics, triticale, according to experts, will become one of the leading grain crops in the future [6,7]. Even if it is mostly used as an animal feed, the interest of using it for food production has been increased due to its valuable nutritional composition [8] and health effects [3,6]. Triticale presents a high fiber content (11.7–13.6 g/100 g) and a high amino acid–lysine content (0.31–0.71 g/100 g), which is deficient in wheat grains [6,9]. Compared to wheat, triticale has a higher content of nutrients. Triticale has a comparable starch content (63.3–68.8 g/100 g dry) to rye and wheat [9]. It can produce high levels of α-amylase, which can make the starch more digestible [10]. However, the ratio of amylopectin to amylose can vary considerably. For example, in the case of triticale, the amylose content is very variable, from 12.8 to 35.1 g/100 g of total starch, compared to the amylose content found in wheat, which may vary from 26.9 to 42.8 g/100 g. Regarding the non-starch polysaccharide content, triticale has values much closer to wheat than rye [9,11,12]. The protein content (14–15 g/100 g) may be like those of wheat and rye, but it presents a different amino acid composition. According to Mosse et al. [13], triticale presents intermediate values for serine, leucine, asparagine and aspartate and higher values for arginine and alanine compared to those of parental species. Regarding the content of essential amino acids, triticale is richer in lysine, threonine, tyrosine, tryptophan, methionine and cysteine than wheat and rye [13]. Due to its high nutritional content and the possibility to cultivate it even in difficult conditions, triticale use in breadmaking is of high interest. However, the resistance of triticale to *Fusarium* head blight (FHB) is not well known [14]. According to different authors, it seems that triticale is less resistant to FHB than rye and more resistant than wheat [15,16].

Few studies have been conducted to formulate triticale-based bread in recent years [3,17–19]. This may be due to the fact that triticale has a low amount of gluten of poor quality, high α-amylase activity, and a lower dough development time and stability than wheat [18,19]. Among the great variety of triticale grain genotypes, only some are sustainable for bread production. The seven cultivars selected for this study may be part of this group. These are Republic of Moldova cultivars, namely Ingen 35, Ingen 33, Ingen 93, Ingen 54, Ingen 40, Fanica and Costel.

Given the economic significance of triticale in human foods, due to its high production capacity, wide adaptability, nutritional value, and considerable agricultural potential, this study aims to formulate bread products only from triticale flour. For this propose, different rheological, textural and physical–chemical studies have been made. To our knowledge, this is the first study in which triticale dough technological behavior was completely analyzed during mixing, extension, pasting and the fermentation process. Moreover, the significance of the revealed triticale cultivar diversity from the Republic of Moldova is discussed, analyzing their impact for the breadmaking industry. Exploring the possibility of using triticale flour as the main ingredient in breadmaking could increase consumer interest, leading them to seek out bakery products made from other cereal grains than common wheat ones. Indeed, some studies have presented bread formulations using triticale flour, but most of them have used this cultivar as a different percentage addition to wheat flour [3,18,19]. Moreover, dough technological behavior has been partially presented. In this study, to better explore the suitability of triticale in bread, different cultivars have been tested in terms of technological and physico-chemical attributes.

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