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INVESTIGATION OF BAKING PROPERTIES OF FLOUR PRODUCED FROM WHEAT OF DIFFERENT HARVEST YEARS

Abstract

The article presents the results of a study on the influence of wheat harvest year on the baking properties of wheat flour of premium, first, and second grades. Two types of milling blends were used: 100% wheat from the 2024 harvest and a 50:50 mixture of wheat from the 2023 and 2024 harvests. The rheological and technological properties of the flour were evaluated using a Farinograph (Brabender) and a AlveoLab (Chopin Technologies) in accordance with ISO 5530-1 and ISO 27971. The analyzed parameters included water absorption, dough development time, dough stability, degree of softening, farinograph quality number (FQN), as well as dough tenacity (P), extensibility (L), strength (W), P/L ratio, and elasticity (Ie) and extensibility (G) indexes. It was established that the use of wheat blends from different harvest years (2023 and 2024) has a positive effect on flour baking properties. In premium-grade flour (Sample 1), the degree of dough softening decreased by 25 FU compared to flour made from 100% 2024 wheat (Sample 2), while dough stability increased (11 vs. 10 minutes) along with the farinograph quality number (43 vs. 42 FU). For first-grade flour (Samples 3 and 4), the mixed wheat sample showed a 15 FU lower softening, a higher farinograph quality number (53 vs. 46 FU), and a longer dough development time (3.5 vs. 2.5 minutes), indicating more structured and stable gluten formation. In second-grade flour (Samples 5 and 6), although the 100% new crop wheat sample had higher dough stability (7.5 vs. 5.0 minutes) and farinograph quality number (54 vs. 50 FU), both samples showed a high degree of softening, which reduces the predictability of processing properties. Overall, combining wheat from different harvest years provides a better balance of dough extensibility, stability, and resistance to mechanical stress—key factors in producing high-quality bakery products. The results confirm the feasibility of forming milling blends from multi-year wheat crops to improve flour quality and ensure stable technological performance in bakery manufacturing. These findings are particularly relevant for milling enterprises facing variability in raw material quality due to climatic conditions or storage duration. The proposed approach to combining wheat from different harvest years can serve as a practical tool for stabilizing flour functionality and improving the efficiency of production processes in the baking industry.

Keywords: milling blend, wheat flour, rheological properties, farinograph, alveolab.

Introduction

The quality of wheat flour is one of the key factors determining the technological and sensory properties of final bakery products. Flour quality largely depends on the characteristics of the wheat used in its production. Wheat harvested in different years may vary significantly in protein content and enzymatic activity, which in turn can alter the rheological behavior of dough and its baking performance [1].

In industrial milling practice, it is often necessary to combine wheat from different origins, regions, or harvest years. While such blending is common, the effects of combining wheat from different harvest years on the technological properties of the resulting flour remain insufficiently studied. Given the increasing variability in wheat quality caused by climatic fluctuations and storage conditions, further investigation is warranted.

A critical stage in flour production is the formation of the milling batch, which involves the purposeful combination of wheat varieties or lots differing in quality indicators, class, region, or harvest year [2]. This practice aims to mitigate natural variability in raw material quality, which arises due to agro-climatic conditions, cultivation practices, post-harvest handling, and storage logistics.

Proper formulation of milling batches enables producers to: stabilize flour quality; meet regulatory requirements for key quality indicators (e.g., protein, gluten, ash); and optimize milling and baking processes.

For example, blending wheat with high baking strength with lower-quality lots allows the final product's quality to be evened out while increasing the efficiency of raw material usage [3].

In the current context of limited access to premium wheat and the growing need to utilize carry-over grain from previous seasons, rational milling batch design has become increasingly important. It has a direct influence on the baking value of flour, its suitability for specific end-use applications, and the consistency of technological processes at industrial bakeries.

In this regard, evaluating flour obtained from such blended milling batches using modern rheological instruments — particularly the Farinograph and Alveolab (AlveoConsistograph) — is essential. These instruments provide reliable data on dough behavior during mixing, fermentation, and deformation, thus enabling more precise control of product quality and formulation efficiency [4].

Literary review

The stability of wheat flour quality is a subject of continuous interest among both researchers and milling industry professionals. One of the core elements influencing flour quality is the composition and condition of the raw material — wheat grain. Numerous studies have demonstrated that the protein characteristics of wheat, especially the quantity and quality of gluten, are decisive for the formation of dough rheological behavior and, consequently, baking performance [5].

Wheat harvested in different years may differ significantly in its physicochemical and biochemical composition, particularly in enzymatic activity, protein content, ash level, and moisture content, all of which affect the final flour's functional properties. Long-term storage of grain may result in the deactivation of enzymes, partial protein degradation, and structural changes in the endosperm, which can lead to a decline in dough stability, reduced water absorption capacity, and other negative effects on flour performance [6].

In modern milling practice, the formulation of milling batches is an essential technological operation aimed at stabilizing the quality of finished flour. This process involves blending wheat that differs in variety, class, origin, or harvest year to achieve target quality parameters. The variability in raw material quality is influenced by agroclimatic conditions, growing technologies, post-harvest maturation, and storage and transportation conditions [7].

Grain from new harvests often shows higher moisture content, lower endosperm strength, and less stable gluten formation, which can complicate processing and negatively impact rheological parameters. In contrast, grain from previous harvests tends to display greater uniformity due to the completion of post-harvest biochemical stabilization and adjusted enzyme activities, especially amylase and protease balance.

Several studies have suggested that blending wheat from different harvest years can be an effective strategy to: equalize protein quality and gluten formation capacity across the milling batch; stabilize the rheological and technological properties of flour regardless of raw material variability; optimize the use of available wheat stocks and reduce milling costs; minimize the risks associated with low-stability or high-moisture grain from new harvests.

From both technological and economic perspectives, such blending strategies help improve overall milling efficiency and ensure that flour meets the quality requirements of diverse bakery products [8].

Recent advances in milling process control emphasize the importance of objective grain quality assessment during batch formulation. The application of modern analytical instruments — particularly the Farinograph and AlveoConsistograph — provides comprehensive insight into water absorption, dough development, and extensibility, supporting informed decision-making in the blending and production of flour with consistent performance characteristics [9].

Modern analytical instruments — such as AlveoLab (AlveoConsistograph), Farinograph, Amylograph, and devices for determining of damaged starch, protein content, and Falling Number — offer precise measurement of critical parameters that influence dough behavior during mixing, fermentation, and baking. These instruments allow for accurate assessment of key flour and dough characteristics, including: the content and quality of gluten; water absorption capacity; amylolytic and proteolytic activity; the degree of starch damage; and overall rheological properties of dough.

The integration of data obtained through these technologies enables a more advanced approach to milling batch formulation, taking into account not only the basic quality indicators of grain but also their interactions during processing. This is especially important when blending wheat from different batches or harvest years, as it ensures technological compatibility and predictable flour performance.

Consequently, the effective use of modern instrumentation allows for: improved accuracy in selecting components for milling batches; reduced variability in technological indicators of finished flour; increased standardization and process predictability; minimized losses and technological deviations; and adaptation of flour properties to the requirements of specific end products (bread, pasta, confectionery, etc.).

The implementation of innovative approaches to raw material quality control is essential for improving the efficiency of modern milling enterprises and for producing high-quality flour that meets both consumer expectations and international standards [9].

Despite the extensive body of research available, limited attention has been given to the study of mixed milling batches, particularly those involving the combination of wheat from different harvest years — a practice that is increasingly common due to constraints in grain supply. Such combinations may result in both beneficial and adverse effects on flour quality, depending on the physicochemical compatibility of the blended wheat.

Therefore, it is timely and relevant to conduct a focused study on how wheat blending across harvest years influences the technological properties of flour, as determined by Farinograph and AlveoConsistograph analysis. Such research will contribute to the optimization of milling batch design and support the production of flour with stable and predictable quality characteristics.

Formulation of the problem

Despite the considerable number of studies in the field, insufficient attention has been paid to the potential of forming milling batches from wheat harvested in different years and assessing the rheological properties of such mixtures.

Therefore, in light of the above, it is relevant to conduct a study aimed at evaluating the influence of combining wheat from different harvest years on the technological properties of flour, as determined by Farinograph and AlveoConsistograph measurements. Such research will help optimize the milling batch formulation process and ensure consistent quality of the final product.

Purpose and objectives of the study

The aim of this study is to determine the impact of using wheat from different harvest years on the quality of premium-, first-, and second-grade flour based on parameters measured by the Farinograph and AlveoConsistograph instruments.

The objectives of the study are as follows:

- To investigate the rheological properties of different flour grades produced from two milling batches of wheat;
- To compare the quality parameters of premium-, first-, and second-grade flours obtained using the Alveograph and Farinograph;
- To provide recommendations for the effective formulation of milling batches.

Materials and methods

To investigate the rheological properties of wheat flour obtained from milling batches composed of grain harvested in different years, two instruments were used: the Farinograph (Brabender) and the Alveolab (Chopin Technologies). The tests were performed in accordance with international standards ISO 5530-1 and ISO 27971, adapted to the laboratory conditions.

The Farinograph (Brabender) was employed to determine the flour's water absorption capacity and to evaluate dough development and stability. The method is based on measuring the resistance of dough during mixing.

The tests were carried out using flour sifted through a 250 µm sieve. The sample mass was adjusted according to its moisture content, following the instrument's calibration. The flour was loaded into the mixer, and water was added gradually until the dough reached a consistency of 500 Farinograph Units (FU).

The following parameters were evaluated:

- Water absorption WAC (%) — the amount of water required to reach a dough consistency of 500 FU;
- Dough development time DDT (min) — the time taken to reach maximum consistency;
- Dough stability ST (min) — the time the dough remains at maximum consistency;
- Dough breakdown time DBT (min) — the time from maximum resistance to a decrease of 30 FU;
- Degree of dough softening DDS (FU) — the difference between maximum and minimum consistency values.
- Farinograph Quality Number FQN (FU) — the length along the time axis from the start of mixing to the point where the centre line of the curve falls 30 FU below the peak; a higher FQN indicates a stronger, more tolerant dough.

The alveographic analysis was conducted using the AlveoLab instrument (Chopin Technologies), which enables simultaneous evaluation of dough rheological properties under controlled pressure, deformation, and consistency.

Dough samples were prepared automatically using a standard flour mass (250 g) and the amount of water determined either by Farinograph results or prior alveographic calibration.

Dough shaping and fermentation: Dough was formed into spherical pieces and fermented under controlled temperature and humidity conditions (typically 20–25 minutes at +25 °C). Each dough piece was inflated with air until rupture, while pressure and extensibility were recorded on the curve.

The following parameters were analyzed:

- Maximum over-pressure P (mm H_2O) — the peak pressure needed to inflate the dough bubble to rupture; indicating dough strength (resistance to inflation);
- Curve length L (mm) — the horizontal length of the pressure–time curve up to rupture; reflecting dough extensibility;
- Strength-to-extensibility ratio P/L (dimensionless) — balance between resistance and stretch; higher values indicate strong, less extensible dough, lower values a weak, very extensible dough;
- Energy of deformation (W, 10^{-4} J) — the area under the curve; the total mechanical energy the dough can absorb, used as an overall indicator of baking quality;
- Swelling index G (mL) — the volume of air injected up to rupture ($G = 2.226\sqrt{L}$); reflects the bubble's ability to expand without tearing;
- Elasticity index (Ie, %) — $(P_{200} / P) \times 100$, where P_{200} is the pressure after 200 mL of injected air; quantifies how well the dough maintains resistance during deformation, i.e., its elasticity.

The study was conducted on six wheat flour samples from two milling batches: Batch I – a blend of wheat from the 2023 and 2024 harvests in a 50:50 ratio; Batch II – 100% wheat from the 2024 harvest.

Sample descriptions: Sample 1 – premium-grade flour from Batch I; Sample 2 – premium-grade flour from Batch II; Sample 3 – first-grade flour from Batch I; Sample 4 – first-grade flour from Batch II; Sample 5 – second-grade flour from Batch I; Sample 6 – second-grade flour from Batch II.

Results of the study and their discussion

A comparative analysis of the farinograph indicators for Sample 1 and Sample 2 revealed noticeable differences in dough behavior. Both samples demonstrated nearly identical levels of water absorption (54.2% and 54.0%), indicating similar hydration characteristics. However, Sample 1 exhibited a significantly shorter dough development time (1.0 mins) compared to Sample 2 (2.5) — which may indicate faster gluten network formation possibly due to the lower enzymatic activity of the grain from the previous harvest year. Moreover, Sample 1 showed slightly higher dough stability (by 1 minute) and a significantly lower degree of softening (by 25 FU), suggesting better resistance of the dough to mechanical stress and stronger gluten structure. The farinograph quality numbers of both samples were practically identical. These results indicate that blending wheat from different harvest years (Sample 1) can have a positive effect on dough structure by reducing enzymatic softening and providing a more stable and consistent flour quality.

Sample 3 exhibited a water absorption capacity of 53.6%, which is 2.8% lower than that of Sample 4 (56.4%). This difference is attributed to a less organized protein structure and higher enzymatic activity in the freshly harvested grain, necessitating increased water for optimal hydration.

In contrast, Sample 3 was characterized by a longer dough development time (3.5 min) versus 2.5 min for Sample 4, which may indicate slower but more structured gluten formation. This is likely a result of the combination of protein fractions from both fresh and stored grain. Both samples demonstrated identical dough stability (16.5 min), suggesting a high resistance of the protein complex to mechanical stress during mixing.

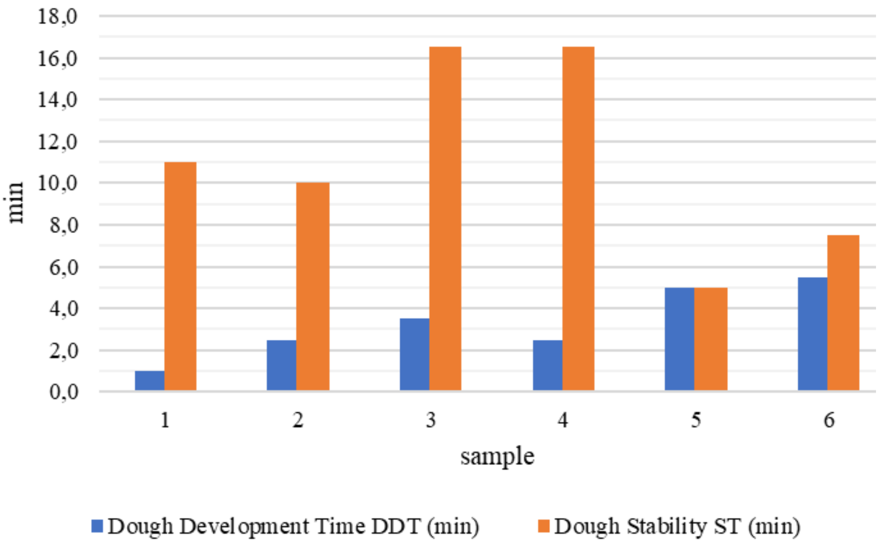

Fig. 1. Dough development time DDT and Dough Stability of flour samples

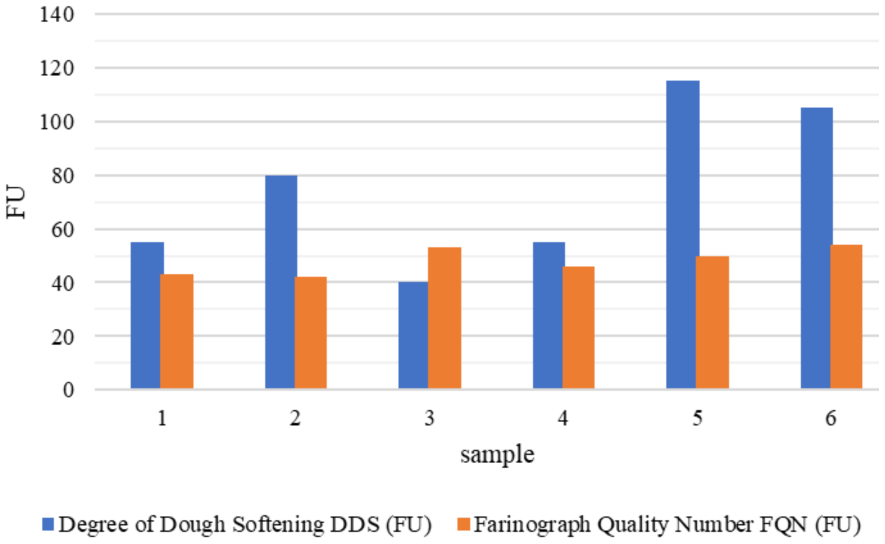

Fig. 2. Degree of Dough Softening DDS and Farinograph Quality Number FQN of flour samples

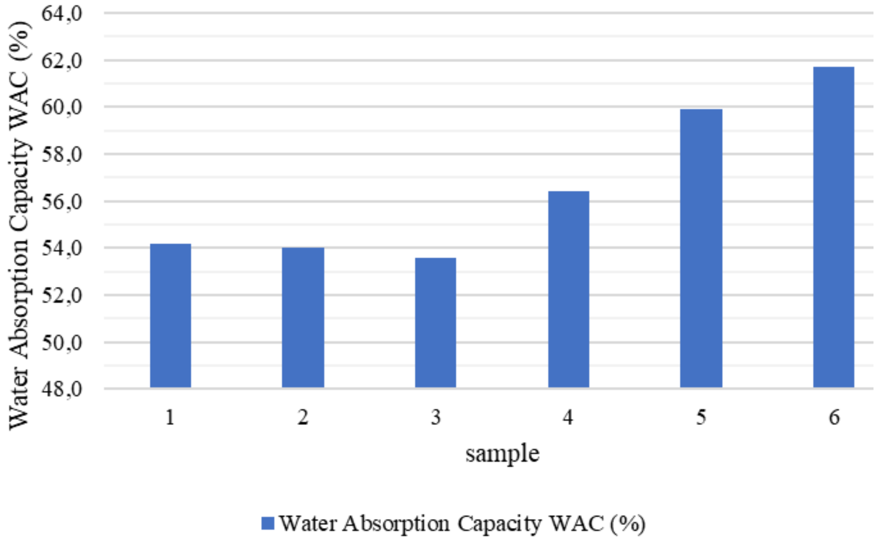

Fig. 3. Water Absorption Capacity WAC of flour samples

A significant difference was observed in the degree of dough softening, which was markedly lower in Sample 3 by 15 FU compared to Sample 4. This indicates a stronger gluten network and better dough tolerance to prolonged mixing. In addition, Sample 3 achieved a higher farinograph quality number (53 FU vs. 46 FU in Sample 4), confirming its superior overall dough quality.

Overall, the obtained results suggest that the inclusion of wheat from the previous harvest in the milling batch (Sample 3) contributes to enhanced dough strength and stability. This supports the feasibility of using milling blends composed of wheat from different harvest years to optimize the functional properties of flour, particularly under conditions of variable raw material quality.

In Sample 5, water absorption was 1.8 % lower than in Sample 6, indicating a lower damaged starch content or reduced enzymatic activity in the older-harvest grain. Furthermore, the dough development time for Sample 5 was shorter than the 5.5 min observed for Sample 6, suggesting that less intensive mixing is required to achieve the desired consistency.

In Sample 5, dough stability was 2.5 minutes lower than in Sample 6, indicating reduced resistance to mechanical stress. Although both samples exhibited a high degree of softening, Sample 5's softening was 10 FU higher, reflecting a slightly weaker dough structure. Additionally, the farinograph quality number for Sample 5 was 50 FU compared to 54 FU for Sample 6, confirming the overall improvement in the dough's rheological properties in Sample 6.

Alveographic analysis of the two wheat flour samples revealed noticeable differences in their rheological behavior, which are critical for assessing baking quality. Sample 1 exhibited superior breadmaking characteristics when compared to Sample 2.

Specifically, Sample 1 demonstrated higher dough tenacity (P = 74 mm) and greater extensibility (L = 120 mm) than Sample 2 (P = 68 mm, L = 111 mm). The balance between resistance and extensibility, as expressed by the P/L ratio (0.62), was identical in both samples, suggesting similar dough deformation behavior under stress.

However, the flour strength (W) was markedly higher in Sample 1 (298 ×10⁻⁴ J) compared to Sample 2 (282 ×10⁻⁴ J), indicating better gas retention capacity and overall baking potential. Although Sample 2 had a slightly higher elasticity index (Ie = 67.2%) than Sample 1 (Ie = 62.1%), this was not sufficient to compensate for the lower tenacity and energy values.

Therefore, based on the alveographic parameters, Sample 1 is more suitable for breadmaking applications, particularly for products requiring a strong and extensible gluten network. These findings are consistent with previous studies highlighting the importance of high W values and balanced P/L ratios in predicting baking performance.

The comparison of alveograph results between Sample 3 (a 50/50 blend of 2023 and 2024 wheat) and Sample 4 (100% 2024 wheat) provides insight into the influence of harvest year on dough properties and flour strength.

Sample 3 showed a lower dough tenacity (P = 52 mm) compared to Sample 4 (P = 63 mm), indicating a softer dough structure with less resistance to deformation. However, Sample 3 had slightly higher extensibility (L = 154 mm) than Sample 4 (L = 146 mm), which may benefit gas retention and oven spring.

In Sample 3, the P/L ratio was 0.34 - 0.09 lower than in Sample 4 (0.43), indicating a less balanced combination of dough strength and extensibility. An even more pronounced difference was observed in flour strength (W): Sample 3 reached 249 × 10⁻⁴ J, whereas Sample 4 measured 302 × 10⁻⁴ J, a critical factor for loaf volume and gluten network development.

The elasticity index (Ie) and swelling index (G) were relatively close between samples (Ie: 61.1% vs. 62.9%, G: 27.6 mm vs. 26.9 mm), indicating similar resilience and stretch capacity under stress.

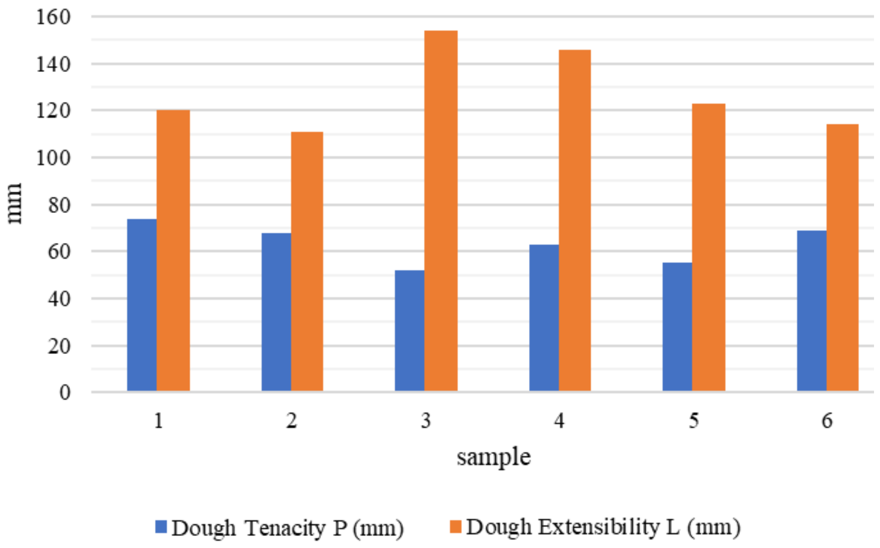

Fig. 4. Dough tenacity P and extensibility L of flour samples

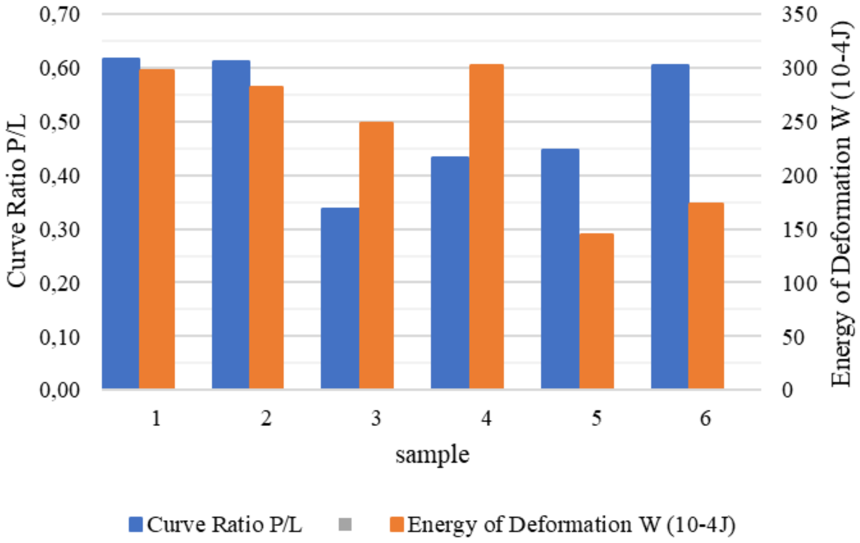

Fig. 5. Curve ratio P/L and Energy of Deformation W of flour samples

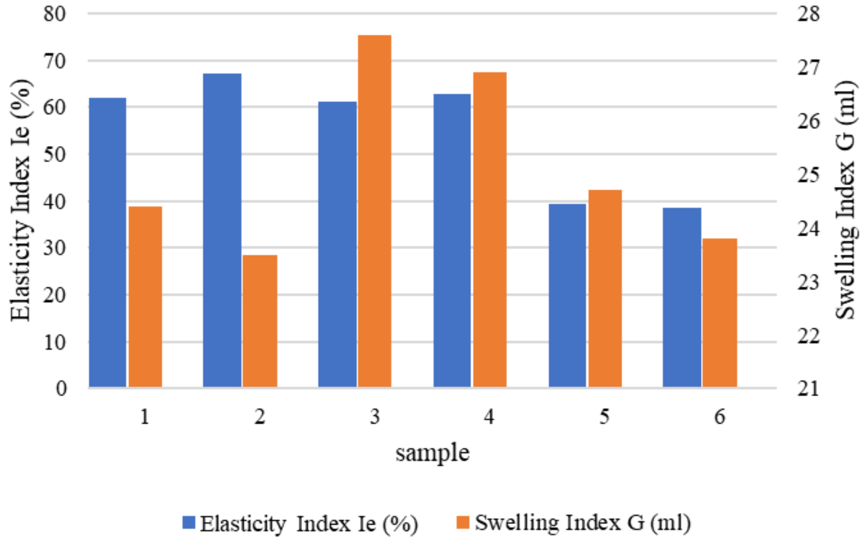

Fig. 6. Elasticity Index Ie and Swelling Index G of flour samples

In conclusion, Sample 3, prepared from a blend of previous and current harvest wheat, exhibited slightly reduced dough tenacity (P) and strength (W), while showing increased extensibility (L) and moderate stability. These findings suggest that using milling blends composed of grain from different harvest years can achieve an optimal balance between dough tenacity and extensibility, which is crucial for flexibly tailoring flour properties in breadmaking

In Sample 5, dough tenacity (P) was 55 mm - 14 mm lower than in Sample 6 (69 mm), indicating a weaker gluten network and reduced resistance to deformation. Conversely, extensibility (L) in Sample 5 was higher (123 mm vs. 114 mm in Sample 6), suggesting a greater capacity for elongation and gas retention. The P/L ratio for Sample 5 was 0.5, compared to 0.6 for Sample 6, reflecting a less balanced combination of dough strength and extensibility in the former.

The flour strength (W) of Sample 5 was 145×10^{-4} J, compared to 173×10^{-4} J for Sample 6, underscoring Sample 6's superior gas retention capacity and greater potential loaf volume. The elasticity index (Ie) was slightly higher in Sample 5 (39.4% vs. 38.6%), as was the swelling index (G) - 24.7 mm versus 23.8 mm in Sample 6 - indicating marginally better dough resilience and protein complex stability in Sample 5.

Thus, Sample 5 exhibited superior extensibility (123 mm vs. 114 mm in Sample 6), a higher elasticity index (39.4 % vs. 38.6 %), and a greater swelling index (24.7 mm vs. 23.8 mm in Sample 6). This makes Sample 5 particularly well suited for products requiring enhanced dough stretchability and uniform gas retention during shaping and baking.

The comparative assessment of alveograph parameters for wheat flour of three different grades (premium, first, and second) produced from various milling batches – namely, 100% wheat of the 2024 harvest, a 50:50 blend of wheat from 2023 and 2024, and partially 50% of wheat from 2024 – revealed that the milling batch composed entirely of 2024 wheat exhibited the most favorable baking properties.

Flours obtained from 100% 2024 wheat consistently demonstrated higher dough tenacity (P), better balanced P/L ratios, and the greatest energy of deformation (W), across all grades. These characteristics are essential for forming a stable gluten network, effective gas retention, and desirable dough development during breadmaking.

In contrast, the 50:50 blended milling batch showed comparatively strong performance only in premium-grade flour. This effect can be attributed to the selective milling of central endosperm fractions, which contain higher-quality proteins that are less affected by the storage-induced degradation observed in older wheat. However, for first and second-grade flours, which incorporate larger proportions of peripheral grain tissues (rich in bran, enzymes, and lower-quality gluten), the mixed batch resulted in decreased dough strength and reduced baking potential.

Conclusions

1. The rheological properties of wheat flour depend not only on the flour grade but also on the harvest year of the grain. Flour produced from 100% new crop wheat (2024) showed higher dough stability but also a higher degree of dough softening, which may be due to increased enzymatic activity and less structured proteins.

2. Using milling blends composed of wheat from different harvest years (50% 2023 + 50% 2024) helps to optimize the technological performance of the flour. This combination reduced dough softening (by 15–25 FU), improved gluten network structure, and increased the farinograph quality number (by 5–7 FU).

3. The best balance of quality parameters was observed in first-grade flour made from the mixed grain blend. Sample 3 demonstrated both high dough stability, a longer dough development time, and the highest farinograph quality number among all samples, confirming the effectiveness of grain blending in improving flour functionality.

4. The results confirm the feasibility of widely applying the strategy of mixing grains from different harvest years in milling practice. This approach enhances flour quality stability, mitigates the risks associated with the variability of new crop wheat, and enables greater flexibility in adjusting milling processes to meet consumer demands.

REFERENCE

1. Moradi V., Mousavi Khaneghah A. M., Fallah A. & Akbarirad H. Rheological properties of wheat flour with different extraction rate (64 %, 82 % i 90 %) investigating Alveograph, Extensograph i Farinograph. *International Food Research Journal*, 2016. 23(3), 1056–1061
2. Dobraszczyk B.J. & Morgenstern M.P. (2023). Wheat flour quality assessment by fundamental non-linear rheological methods: linking empirical indices (Farinograph, Alveograph) to functional baking performance. *Journal of Cereal Science*, review article, 2020. 11, 451-458.
3. Collar C., Bollaín C., Rosell C.M. Rheological behaviour of formulated bread doughs during mixing and heating. Food Sci. Technol. Int., 2007. 13. 99–107. https://doi.org/10.1177/1082013207078341
4. Dobraszczyk B.J., Morgenstern M.P. Rheology and the breadmaking process. J. Cereal Sci, 2003. 38. 229–245. https://doi.org/10.1016/S0733-5210(03)00059-6
5. Thanhaeuser, S. M., Wieser, H., & Koehler, P. Correlation of quality parameters with the baking performance of wheat flours. Cereal Chemistry, 2014. 91(4), 333–341. https://doi.org/10.1094/CCHEM-09-13-0194-CESI
6. Zhygunov D.O., Kovalova V.P., Zhyronkina D.S. Analiz yakosti boroshna z riznykh rehioniv Ukrainy // Nauk. pr. / Odes. nats. akad. kharch. tekhnolohii. Odesa. 2017. T.81, №.2. P. 35-43.
7. Toporash I., Chervonis M., Voloshenko O. The problem of assessing the baking quality of wheat with genetically different alleles of storage proteins. Grain Products and Mixed Fodder's, 2022; 22 (4, 88): 7-11. https://doi.org/10.15673/gpmf.v22i4.2531
8. Selga, L., Johansson, E., Andersson, R. Prediction models to evaluate baking quality instruments for commercial wheat flour. Cereal Chemistry, 2024. 101, 681–691. https://doi.org/10.1002/cche.10772
9. Marion, D., & Saulnier, L. Minor components and wheat quality: Perspectives on climate changes. Journal of Cereal Science, 2020. 94, 103001. https://doi.org/10.1016/j.jcs.2020.103001

10. Selga, L., Andersson, A. A. M., Moldin, A., & Andersson, R. Determining levels of water-extractable and water- unextractable arabinoxylan in commercial Swedish wheat flours by a high-throughput method. Journal of Cereal Science, 2023. 109, 103608. https://doi.org/10.1016/j.jcs.2022.10360

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ДОСЛІДЖЕННЯ ХЛІБОПЕКАРСЬКИХ ВЛАСТИВОСТЕЙ БОРОШНА, ВИРОБЛЕНОГО З ЗЕРНА РІЗНОГО РОКУ ВРОЖАЮ

Анотація

У статті представлено результати дослідження впливу року врожаю пшениці на хлібопекарські властивості пшеничного борошна вищого, першого та другого сортів. Для формування помельних партій використано зерно: 100 % пшениці врожаю 2024 року та суміш у співвідношенні 50:50 зерна врожаю 2023 та 2024 років. Реологічні та технологічні властивості борошна оцінювали за допомогою приладів Farinograph (Brabender) та AlveoLab (Chopin Technologies) згідно зі стандартами ISO 5530-1 і ISO 27971. Проаналізовано показники водопоглинання, часу утворення та стабільності тіста, ступеня його розрідження, числа якості за фаринографом, а також пружності (P), розтяжності (L), сили борошна (W), співвідношення P/L та індексів еластичності й розтяжності. Встановлено, що використання суміші зерна різних років врожаю (2023 р. і 2024 р.) позитивно впливає на хлібопекарські властивості борошна. У зразках борошна вищого сорту (Зразок 1) спостерігалося зменшення ступеня розрідження тіста на 25 од. фар. порівняно з борошном, виготовленим лише з зерна 2024 року (Зразок 2), а також підвищення стабільності тіста (11 хв проти 10 хв) і числа якості за фаринографом (43 проти 42 од. фар.). Для першого сорту борошна (Зразки 3 і 4) суміш зерна забезпечила зниження розрідження на 15 од. фар., вище число якості за фаринографом (53 проти 46 од. фар.) та довший час утворення тіста (3,5 хв проти 2,5 хв), що свідчить про формування більш структурованого та стійкого тіста. У борошні другого сорту (Зразки 5 і 6), хоча 100 % зерно нового врожаю мало перевагу за стабільністю тіста (7,5 хв проти 5,0 хв) та за числа якості за фаринографом (54 проти 50 од. фар.), обидва зразки мали високий ступінь розрідження тіста, що знижує передбачуваність технологічних властивостей. Загалом, поєднання зерна нового й попереднього врожаю дозволяє досягти кращої збалансованості між розтяжністю, стабільністю та опором тіста до механічного навантаження – критичних параметрів для виробництва якісної хлібобулочної продукції. Результати підтверджують доцільність формування помельних партій зерна різного року врожаю для покращення якості борошна та забезпечення стабільних технологічних властивостей у хлібопекарському виробництві. Отримані результати є особливо актуальними для борошномельних підприємств, які працюють в умовах варіативної якості сировини, зумовленої кліматичними чинниками або тривалим зберіганням. Запропонований підхід до поєднання зерна різних років врожаю може бути ефективним інструментом стабілізації властивостей борошна та підвищення ефективності виробничих процесів у галузі хлібопечення.

Ключові слова: помельна партія, пшеничне борошно, реологічні властивості, фаринограф, альвеолаб.

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