

Integrated analysis of wheat storage parameters in uncontrolled environments: case study of Valea Seacă, Bacău county

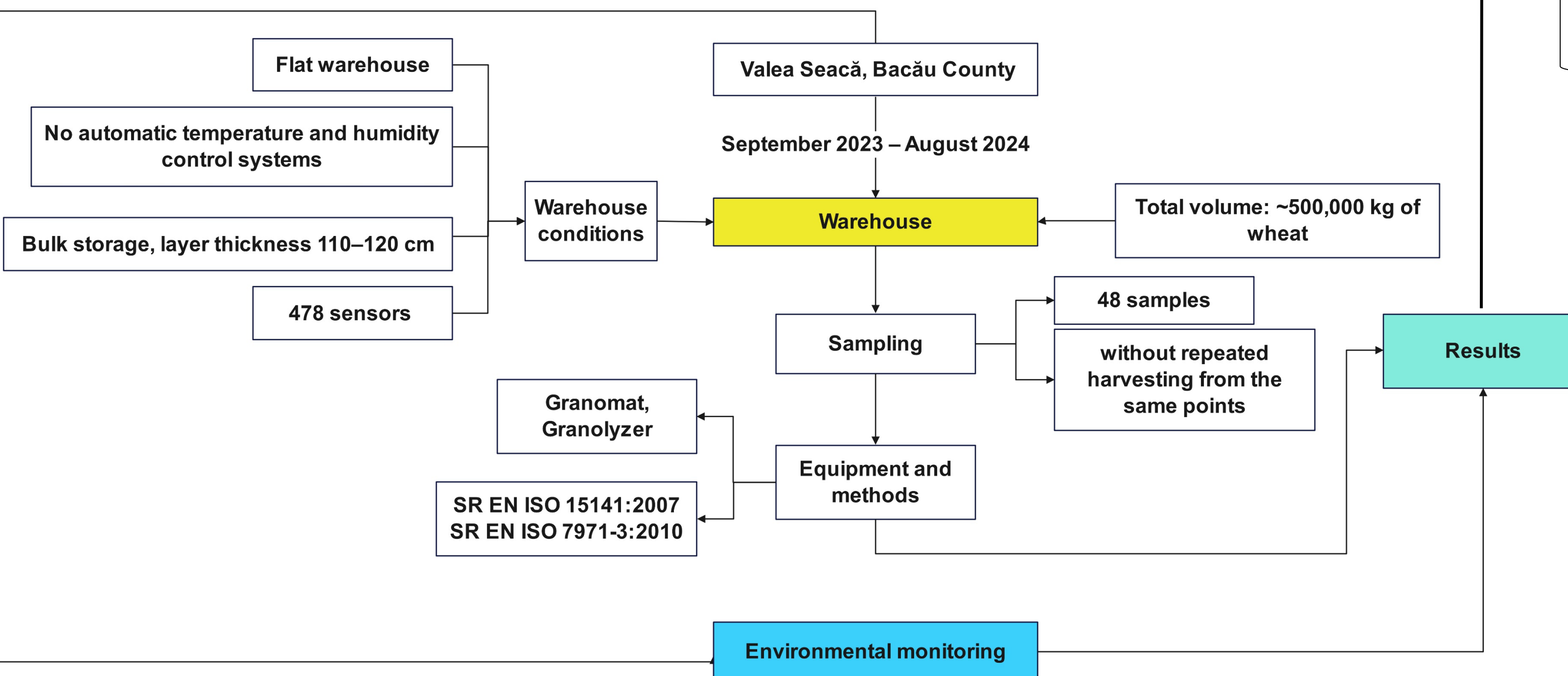
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GOAL OF THE STUDY

Storing wheat (RO1 variety) under uncontrolled conditions, in flat warehouses lacking automated microclimate control systems, can lead to the degradation of product quality. This issue is particularly exacerbated by seasonal fluctuations in atmospheric temperature and humidity, which directly affect the wheat's physicochemical parameters—such as moisture content, temperature, gluten and protein levels, and hectolitre weight. The study monitored and analyzed the physicochemical behavior of RO1 wheat over the course of a calendar year (September 2023 to August 2024) under uncontrolled storage conditions. It also assessed the influence of environmental factors—specifically temperature and atmospheric humidity—on wheat quality throughout the monitored period.

METHODOLOGY OF THE INVESTIGATION



MAIN RESULTS FROM THE STUDY

Following the analysis of the experimental results corresponding to the physicochemical parameters of the product under investigation, a series of graphical representations were generated. Figures 1 and 2 show the results obtained.

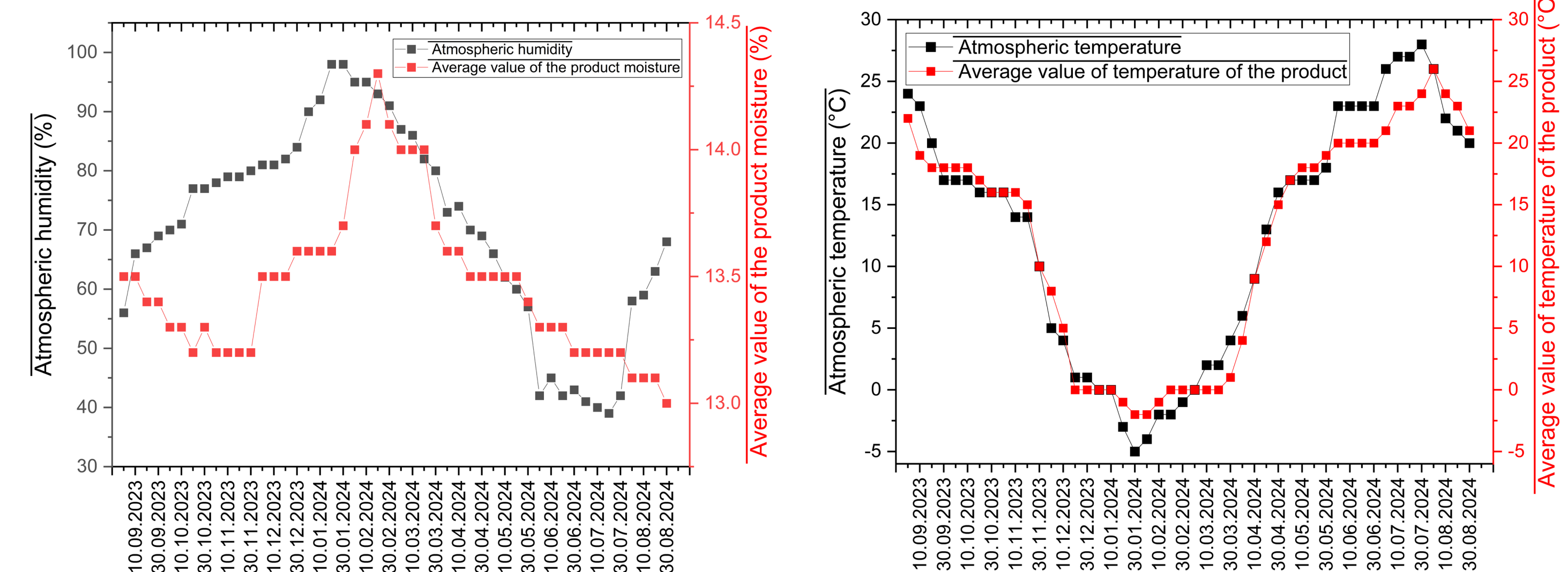


Fig. 1. Variation of (a) atmospheric humidity and the average variation of the humidity of the analyzed product and (b) atmospheric temperature and the average variation of the temperature of the analyzed product

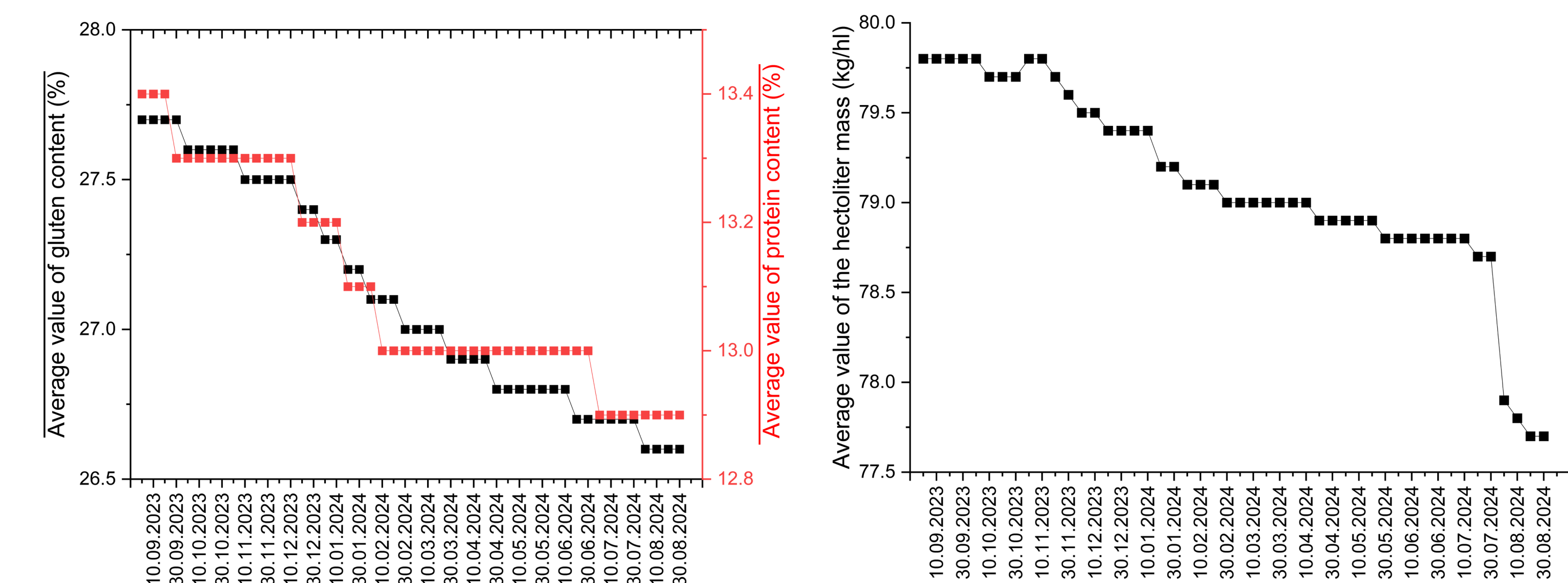


Fig. 2. Average variation of (a) gluten and protein content in the analyzed product and (b) hectoliter mass in the analyzed product

CONCLUSIONS

The study at the Valea Seacă-Bacău grain facility highlights the behavior of RO1 bread wheat under uncontrolled storage in flat warehouses. This variety is important for national food security due to its adaptability and baking suitability. While cost-effective, this storage method poses risks without microclimatic control. The absence of ventilation and monitoring systems leads to "hot spots" that favor mold and insect growth. Initial wheat parameters (13.5% moisture, 23°C, 79.8 kg·hl⁻¹, 27.7% gluten, 13.4% protein) declined over one year, indicating degradation influenced by climate fluctuations. Forty-eight samples were collected from 500,000 kg of wheat, ensuring broad coverage. Certified equipment and standardized methods confirmed changes in quality. Monitoring showed a link between atmospheric humidity and product moisture, with thermal inertia contributing to heat buildup. Temperature followed seasonal patterns, and gluten and protein content dropped slightly, reflecting biochemical degradation. Hectoliter weight also decreased, mainly due to moisture loss. The findings confirm that uncontrolled storage leads to gradual quality loss. Future work should focus on low-cost automated systems and predictive models to manage risks. Longer-term studies are needed to assess cumulative effects and improve post-harvest strategies.