EFFECT OF INCREASING NITROGEN AND PHOSPHORUS FERTILIZATION RATES ON THE MICRO- AND MACRONUTRIENT CONTENTS IN WHEAT GRAIN GROWN ON ACIDIC SOIL

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INTRODUCTION

The nutritional value of wheat grain is strongly influenced by its macro- and micronutrient composition, which depends on soil fertility status and fertilizer inputs.
Acidic soils, however, restrict the availability of phosphorus and several micronutrients, reducing their uptake and translocation within the plant (Fageria & Moreira, 2011).
Long-term fertilization experiments are essential for understanding how continuous applications of nitrogen (N) and phosphorus (P) modify soil chemical properties, nutrient cycling, and the nutrient composition of wheat grain over time.

MATERIAL AND METHOD

The soil at the experimental site is classified as Luvic Brown soil.
A 5P × 5N bifactorial design was applied to evaluate the response of winter wheat to increasing fertilization rates. Phosphorus (P) was applied at five doses: 0, 40, 80, 120, and 160 kg P/ha, and nitrogen (N) was applied at the same doses, resulting in 25 treatment combinations.
The results were subjected to analysis of variance (ANOVA), and differences among treatment means were evaluated using Tukey's multiple comparison test (Ceapoiu, 1968). For all graphical representations, means followed by the same letter do not differ significantly at the 5% level ($P < 0.05$), as determined by Tukey's HSD test.

RESULTS AND DISCUSSIONS

Fertilization with 120 and 160 kg N/ha led to statistically significant increases in grain nitrogen content.
Under phosphorus fertilization, slight decreases in grain nitrogen content were observed (Figure 1). This trend has also been reported in other studies and is commonly attributed to a relative dilution of nitrogen (Mehdi et al., 2025).

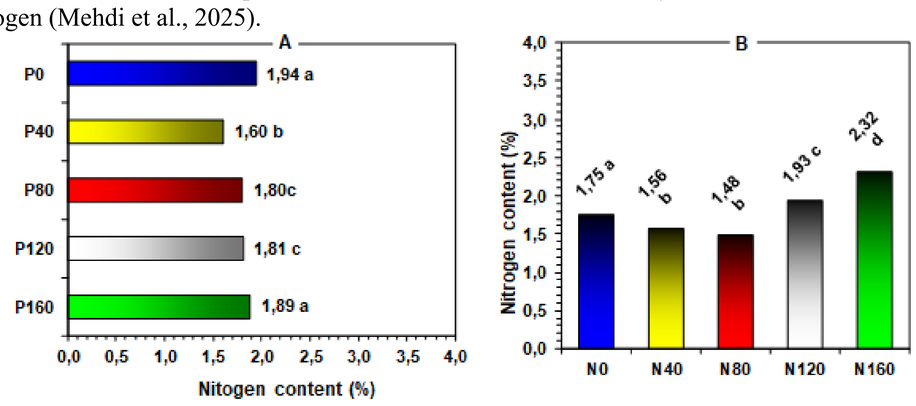

Figure 1. Effects of Phosphorus (A) and Nitrogen (B) Fertilization on Nitrogen Content in Wheat Grains

The higher nitrogen accumulation in the grain at these application levels translated into correspondingly higher protein content, confirming the strong positive relationship between nitrogen availability, grain nitrogen concentration, and protein synthesis in wheat (Figure2).

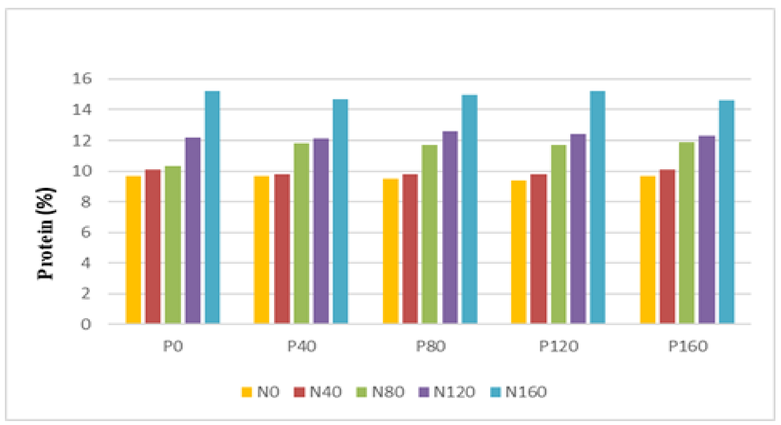

Figure 2. Effects of Phosphorus and Nitrogen Fertilization on Protein Content in Wheat Grains (adapted from Kurtinecz & Banateanu, 2020)

From Figure 3, it can be observed that there is a statistically significant decrease in copper content in wheat grains as phosphorus fertilization doses increase, which can be attributed to the antagonistic interaction between phosphorus and copper ..

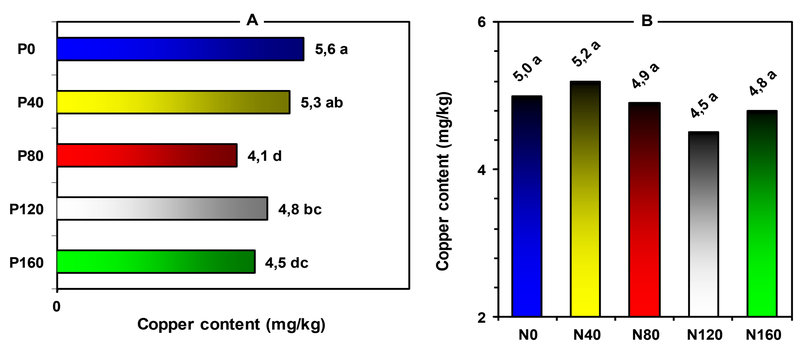

Figure 3. Effects of Phosphorus (A) and Nitrogen (B) Fertilization on Copper Content in Wheat Grains

Figure 4 demonstrates a reciprocal synergistic effect of prolonged fertilization with progressively increasing nitrogen and phosphorus rates, particularly at elevated doses, indicating potential yield enhancement through nutrient interactions.

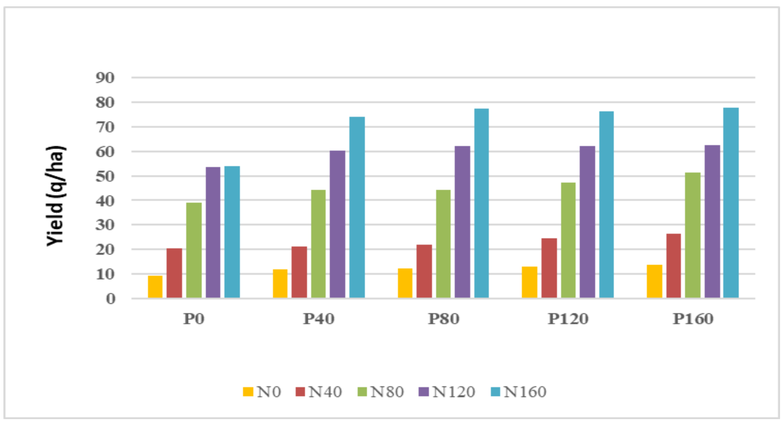

Figure 4. Effect of Progressive Nitrogen and Phosphorus Fertilization Rates on Wheat Yield (adapted from Kurtinecz & Banateanu, 2020).

CONCLUSIONS

❖ The results showed that nitrogen fertilization significantly increased grain nitrogen content and protein concentration, highlighting its crucial role in improving wheat nutritional value.
❖ The highest wheat yields were recorded with higher nitrogen and phosphorus application rates, phosphorus playing a major role due to the phosphorus reserves already accumulated in the soil.

ACKNOWLEDGEMENTS

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