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## Abstract

A two year field experiment was conducted in Moldova to study the effect of mineral fertilizers (Control – No fertilizers, N90K60, P90K60, N90P90, N90P90K60, N90P90K90, N90P120K60, N90P180K60, N120P90K60, and N180P90K60) on irrigated winter wheat (cv. Kavkaz 1) yield and grain protein composition. The soil at the experimental site was a chernozem, containing humus 3.73 %, total nitrogen 0.2%, plant-available P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O 10.8 and 25 mg/100 g respectively, extractable cations Ca<sup>2+</sup> and Mg<sup>2+</sup> 27.2 and 2.4 meq/100 g respectively, with pH<sub>H2O</sub> value of 7.2 at the 0-10 cm soil depth. The results revealed that mineral fertilizers significantly increased winter wheat grain yield compared to the control. The highest wheat grain yield gain, 1.44 t ha<sup>-1</sup> (p=0.00027, at α=.05, by LSD), was achieved when the plants were fertilized with N120P90K60 kg ha<sup>-1</sup>, but not all the grain yield values were significantly different between the fertilizer treatments. The grain yield did not significantly respond to increasing rates of nitrogen or phosphorus at the 90 to 180 kg ha<sup>-1</sup> treatment. The ranges of grain protein value were 10.6–14.4% and its concentration increased linearly with the nitrogen fertilizer rate. The non-gluten proteins albumins and globulins content ranged from 2.74–3.19% and were influenced slightly, whereas amounts of gluten proteins gliadins and glutenins were 3.42–5.53% and 3.31–4.90% and increased on average by 2.11 and 1.22% respectively in the wholemeal flour treatment (N180P90K60) compared to the control. Similarly, the gliadins to glutenins ratio increased from 0.93 to 1.13. Wet gluten comprised 20–25% of the wholemeal flour and increased on average by 11.5 % (N180P90K60) compared to the control. There was not a large difference in the amount of residue proteins in the wheat wholemeal flour, which ranged from 0.54 to 0.63%. Hence, the use of mineral fertilizers is essential to increasing irrigated winter wheat grain yield and grain storage protein content on chernozem soil.

## Introduction

The most important components of winter wheat grain are proteins. The protein content and composition determines the flour baking quality of wheat. Their variability is affected by genotype (Dua et al., 2009), and environmental growing conditions (Dupont et al., 2006). Mineral nutrition of winter wheat has great effects on wheat flour quality. However, there is a little information on production of high yield and quality of irrigated winter wheat. Therefore, the objective of this field experiment was to determine the effects of mineral fertilizers on irrigated winter wheat protein content and composition.

## Materials and Methods

Field experiments were conducted during the 1974-1976 growing seasons at the Moldova State University, Tiraspol Unit of South Experiment Station. The soil at the experimental field was a chernozem. Winter wheat variety Kavkaz 1 was used as planting material. The experiment was laid out in a completely randomized design with four replications. The treatments included nitrogen and phosphorus at four levels each (0, 90, 120, 180 kg ha<sup>-1</sup>) and potassium at three levels (0, 60 and 90 kg ha<sup>-1</sup>). Grain yield were determined for each plots and a 14% moisture basis was used for comparisons. The wheat grain was ground to provide wholemeal flour in a laboratory mill and albumins, globulins, gliadins and glutenins were isolated by the Osborne extraction procedure to determine their content.

## Results and Discussion

The results revealed (Fig. 1) that mineral fertilizers (N120P90K60) significantly increased irrigated winter wheat grain yields by 1.44 t ha<sup>-1</sup>. However, not all the grain yield was significantly different between the fertilizer treatments. The grain protein and wet gluten content (Fig. 2) linearly increased with increasing N rates. The non-gluten proteins albumins and globulins content (Fig. 3) were influenced slightly, whereas amount of gluten proteins gliadins and glutenins increased on average by 2.11 and 1.22% respectively in the whole meal flour treatment by increasing the rate of nitrogen from 90 to 180 kg ha<sup>-1</sup> compared to the control.

Fig. 1. Grain yield at different rates of mineral fertilizers.

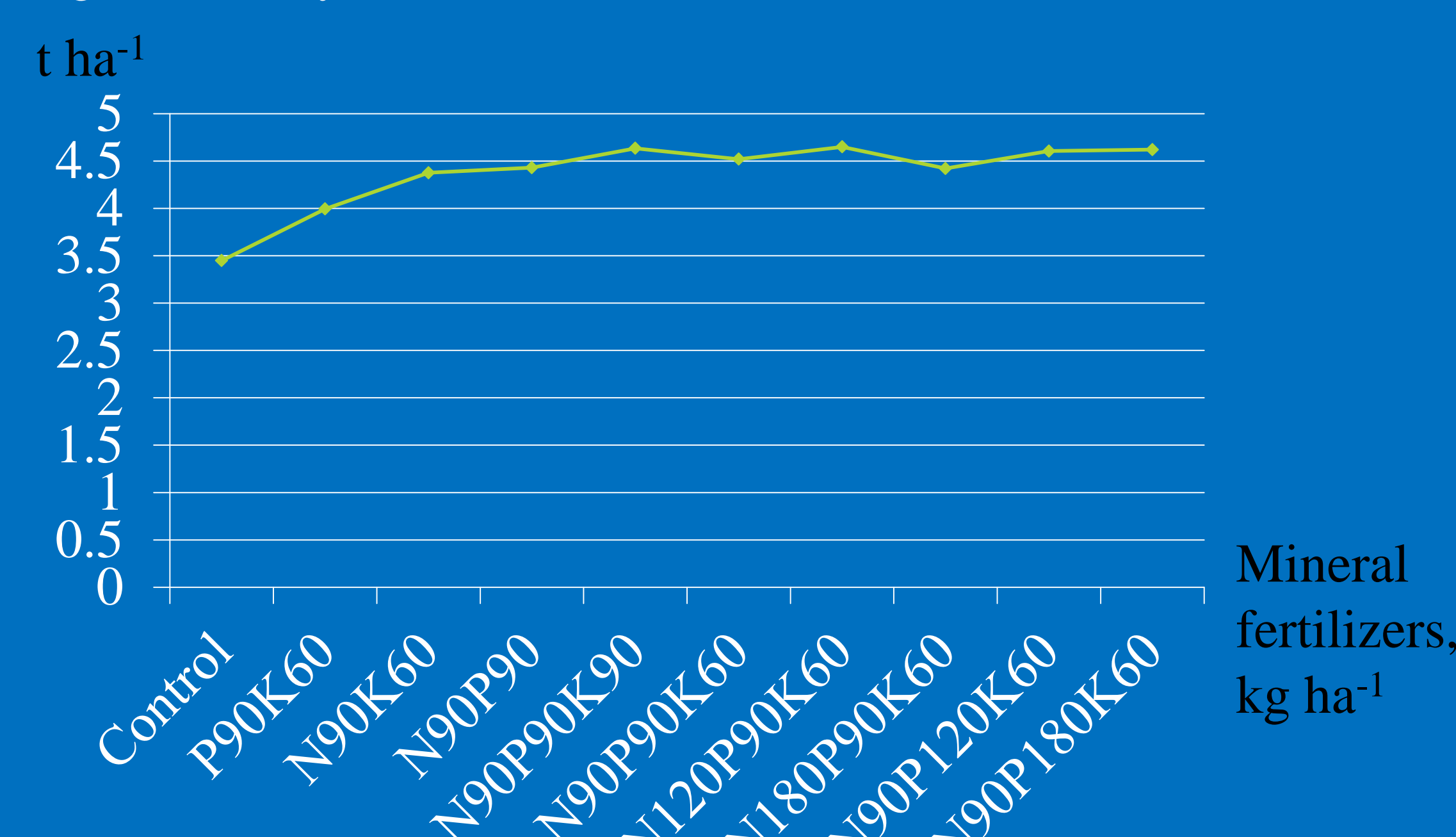


Fig. 2. The effects of mineral fertilizers on wet gluten and grain protein content.

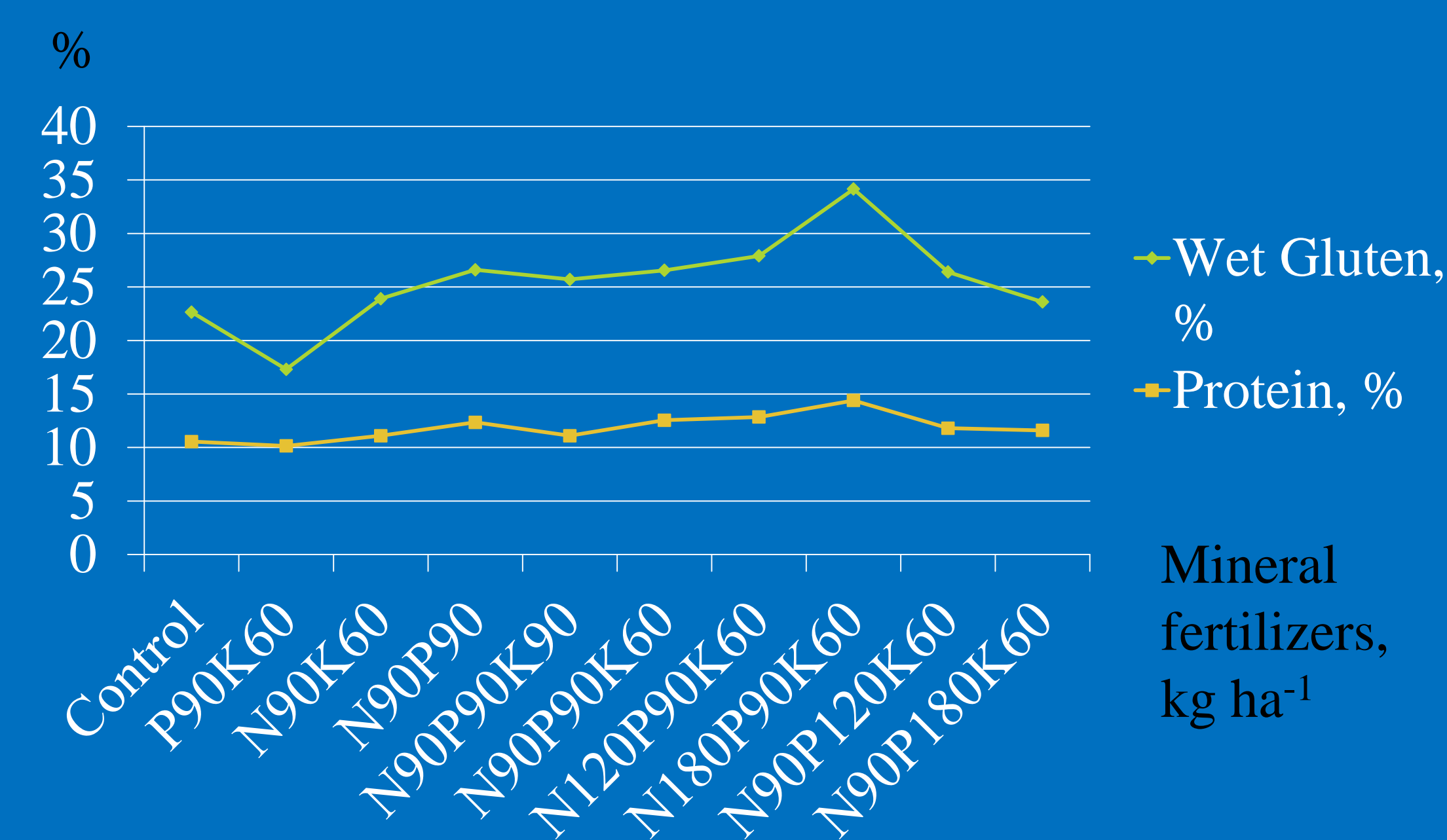
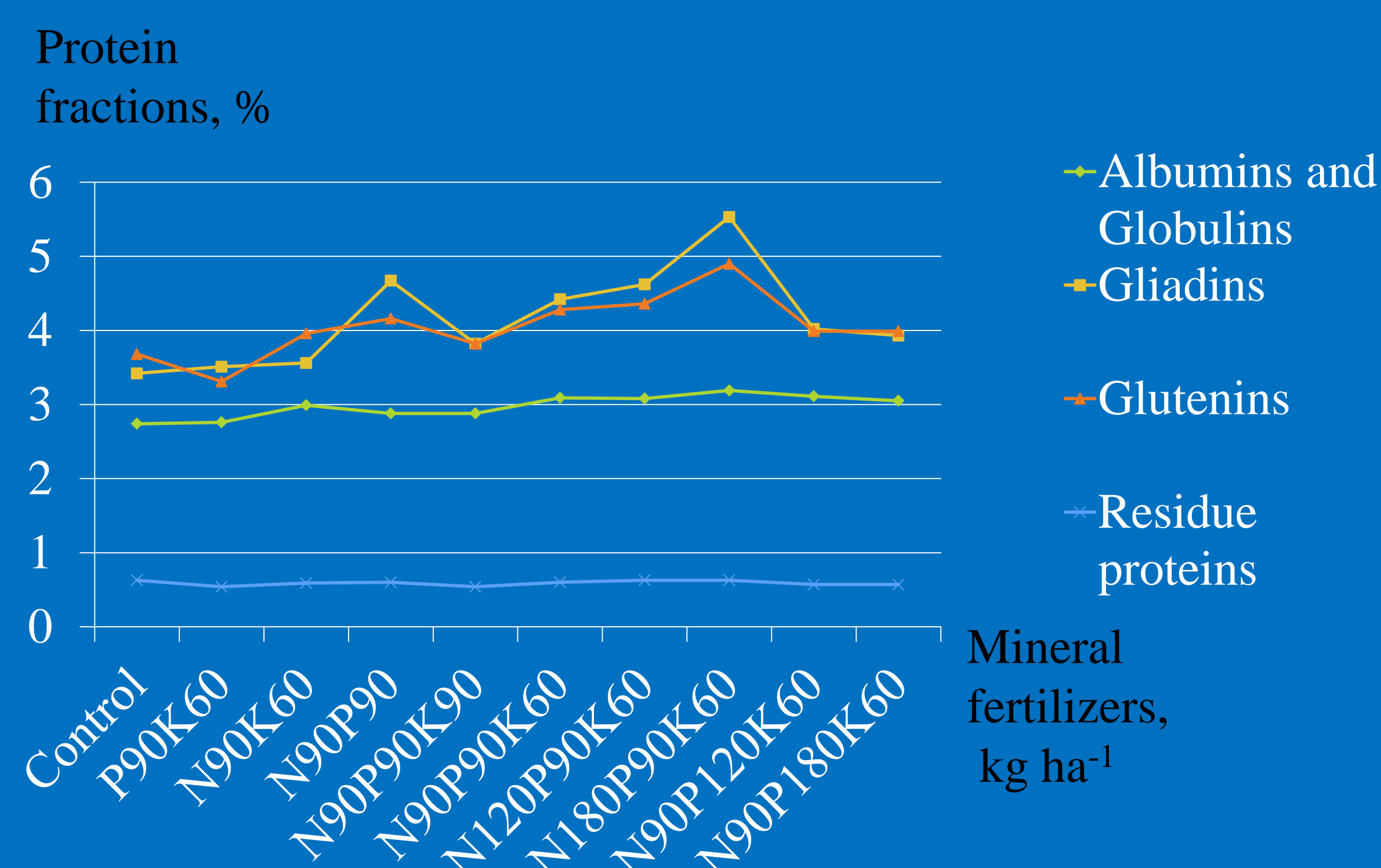


Fig. 3. Albumins-Globulins, Gliadins and Glutenins responses to mineral fertilizers.



Albumins and globulins of irrigated winter wheat grain represent 23.3% to 27.2%, whereas gliadins and glutenins 67.1% to 72.4% (Fig. 4). High positive linear correlations were observed between increasing N rates and either gliadins content (Fig. 5) or glutenins content (Fig. 6).

## Conclusion

The results of the investigation conclude that the use of mineral fertilizers are essential to increase irrigated winter wheat grain yield and to improve the grain quality on chernozem soil. The total grain protein content increased mainly by increasing N rates application. Furthermore, storage proteins gliadins and glutenins increased more than structural proteins albumins and globulins. The results also demonstrate that mineral fertilizer rates for irrigated winter wheat should be targeted for both grain yield as well as protein content.

Fig. 5. Positive linear correlation between increasing N fertilizer rates and Gliadins content in irrigated winter wheat (R<sup>2</sup> = 0.97).

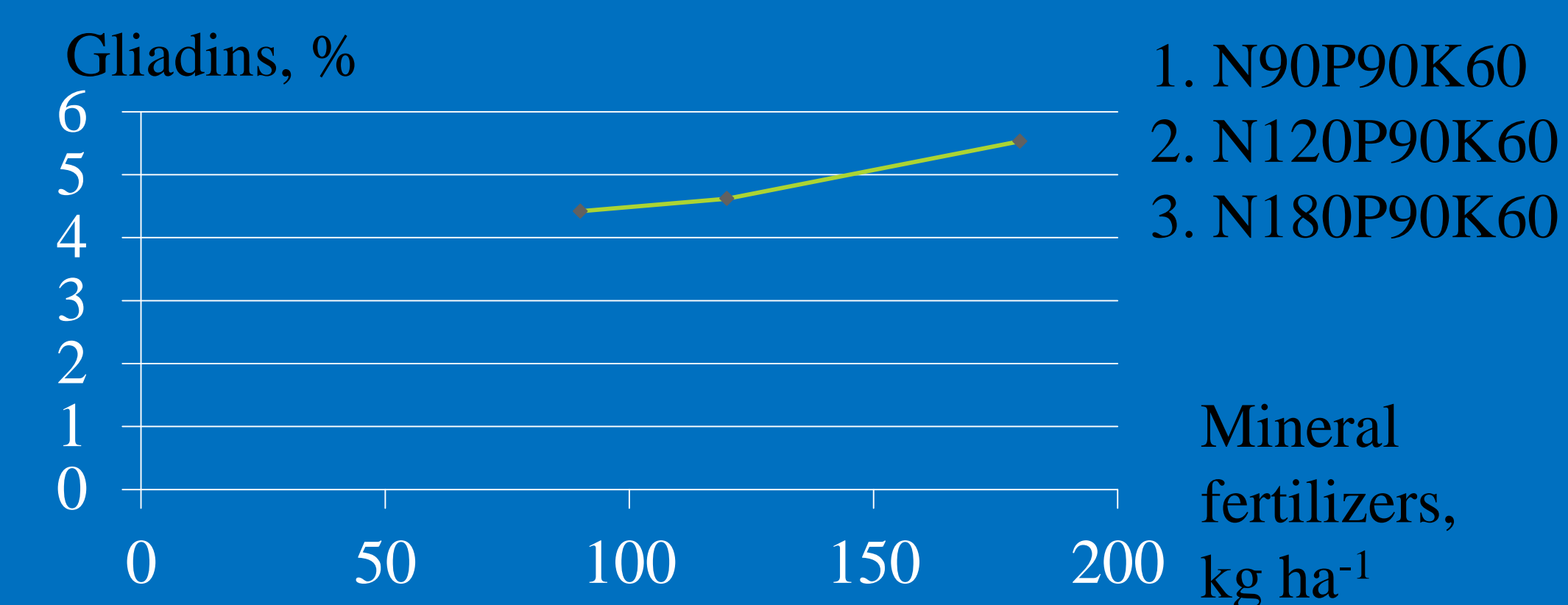


Fig. 6. Positive linear correlation between increasing N fertilizer rates and Glutenins content in irrigated winter wheat (R<sup>2</sup> = 0.95).

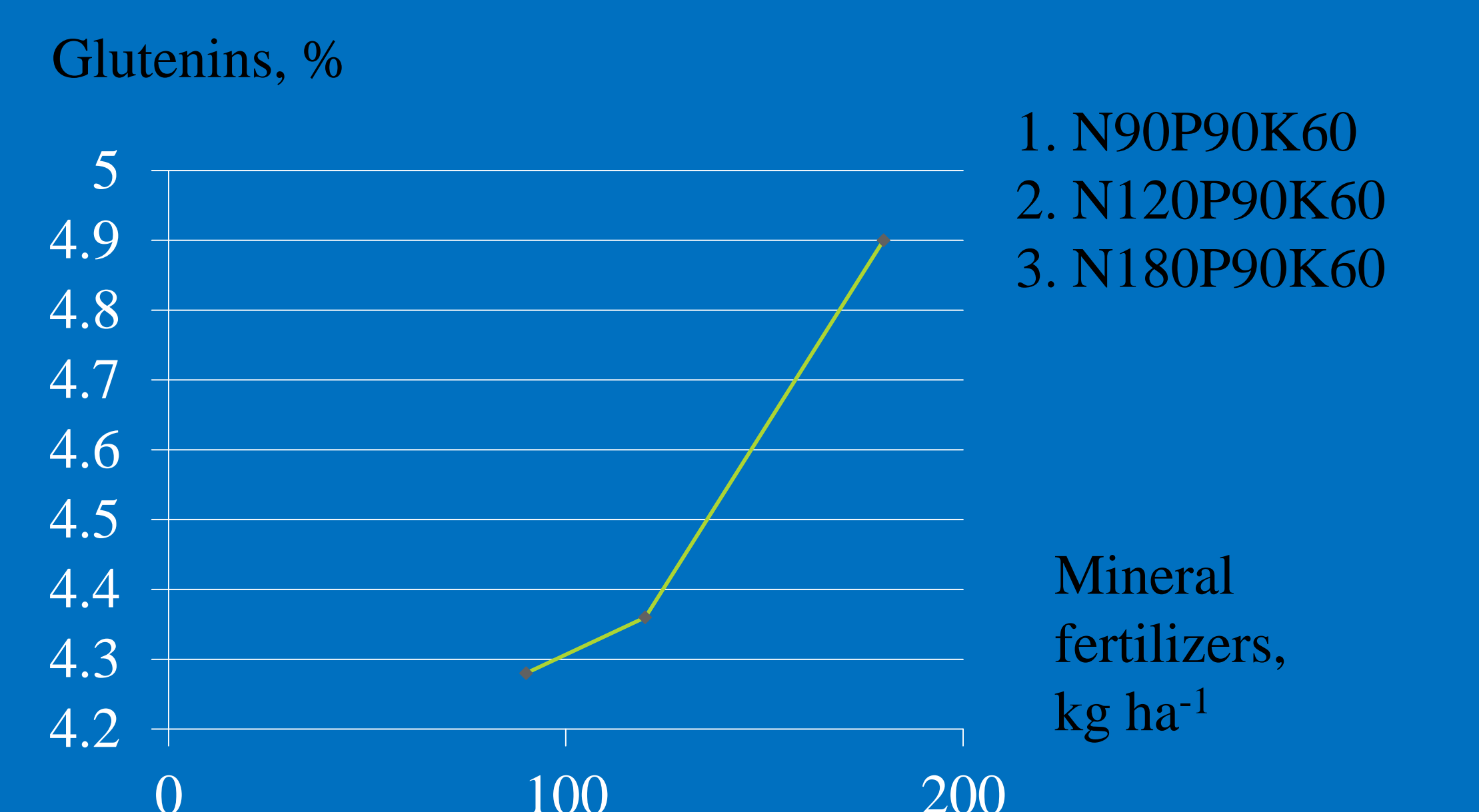
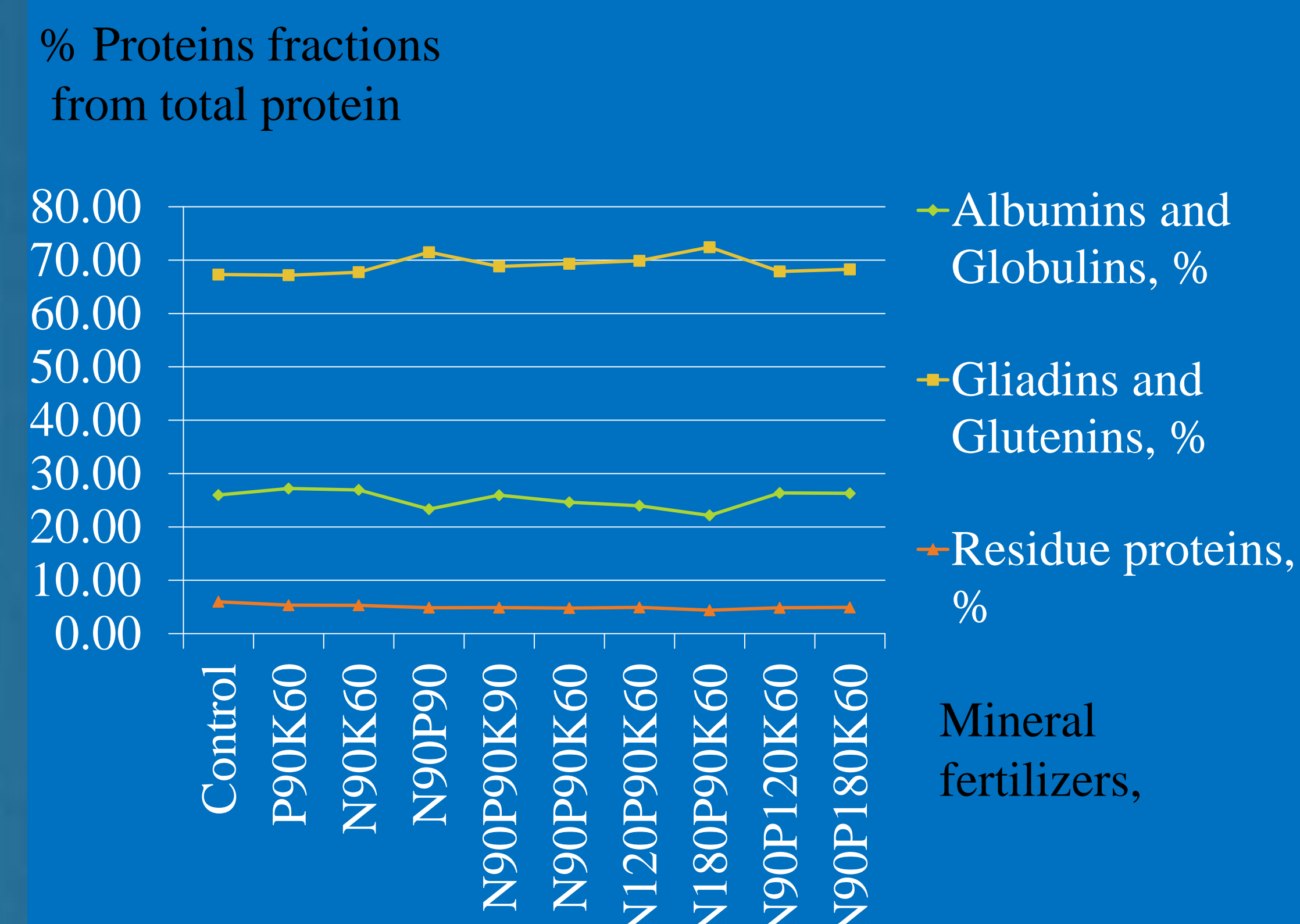


Fig. 4. Proportions of Albumins and Globulins, Gliadins and Glutenins, Residue proteins in total protein content in wholemeal wheat flour.



## Literature Cited

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## Acknowledgements

The authors thank to Department of Soil, Geology and Geography of the Moldova State University faculties for their assistance in field research and express appreciation to the Tiraspol Agrochemical Unit of the South Agrochemical Experiment Station staff for their technical assistance.