EFFECTS OF FERTILIZERS ON THE AMINO ACID COMPOSITION OF CEREAL PROTEIN

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ABSTRACT

We tested samples from the experiments conducted by the Crop Cultivation Department of the Keszthely University of Agricultural Sciences on faintly eluviated brown forest soil at Keszthely in 1963, and on highly eluviated pseudogleyed brown forest soil at Szentgyörgyvölgy in 1965 to find out the effect on N P and K fertilizers on yields, crude protein and on amino acid contents of wheat and maize. In wheat protein, methionine and lysine were present in the smallest amount and were decreased by N fertilization, P and K with no N added were found to reduce, 87 kg/ha N, on the other hand, to increase the methionine, lysine, valine, phenylalanine and isoleucine content of wheat protein. As compared to a dressing of 87 kg/ha, 174 kg/ha N proved to decrease the total amino acid amount, while 261 kg/ha N continued reducing the amounts of lysine and arginine. EAAI of the wheat protein was the lowest on application of 174 kg/ha and the highest at 87 kg/ha N. In maize protein, lysine and methionine were found in the lowest amount. In the no-N treatment, with the exception of arginine and methionine, the rest of the amino acids were found to decrease, 87 kg/ha N proved to increase lysine, valine, histidine and phenylalanine and decrease the rest; 174 kg/ha N continued decreasing them, except leucine. On application of 261 kg/ha N, all amino acids tested—except methionine—were found to increase, whereas in response to 348 kg/ha N the amount of amino acids was increased without exception; so the EAAI for the maize protein was at its highest at 348 kg/ha N. K and N fertilization without P proved to decrease, the addition of 120 kg/ha P2O5 to increase all essential amino acids of wheat protein, though in response to 180 kg/ha P2O5 they were decreased, except leucine. EAAI of maize protein was decreased by both P deficiency and P2O5 dressing exceeding 120 kg.

In maize protein, amino acid content was less adversely affected by P deficiency than in wheat protein, it was only methionine that decreased, the rest increased, while the application of 120 kg/ha P2O5 involved an increase in the
amino acids examined, with the exception of leucine. The EAAI of maize protein was the highest in response to 180 kg/ha P$_2$O$_5$.

P and N fertilization without K was found to decrease the amount of essential amino acids except histidine in wheat protein and to increase it in maize protein.

INTRODUCTION

At the present stage of agricultural development, the role of quality is more and more often emphasized. Cereals give most of the vegetable proteins in the human diet, though if we examine cereal protein, it appears that it is poor in several essential amino acids; especially in lysine. Potsubay et al. /1966/ found that - from the point of view of feeding - the essential amino acid content of cereals is less favourable as compared to other feeds; mostly because of their low lysine content.

N fertilizers have different effects on the amounts of amino acids. Németh and Keresztes /1969/, Müller /1965/ and Michael /1964/ find that the biological value of protein does not decrease as a result of N fertilizers if supplemented with adequate amounts of P and K. The utilization of proteins, consequently their biological value, depends mostly on the quality and quantity of amino acids they contain /Mitchell 1959, Popov 1961, Nehring and Schröder 1962/.

Examining the protein percentage and amino acid composition of wheat grain, Vincze and Szüts /1978/ found that higher levels resulted in an increase in ASP, GLU, GLY, LYS, to a lesser degree in SER, ALA, ILE, LEU, TYR, PHE, whereas there was no change in the absolute amount of PRO, CYS, MET, HIS, ARG. The maximum amounts of TYR, ILE and ALA were observed when N was applied at 120-160 kg/ha, while the lowest level of methionine and proline could be detected at the same rate of N application.

Stock breeds try to improve protein and amino acid percentage by using feed mixtures. Also, synthetic amino acids can be used as additives.

Methionine is produced in the greatest quantities /200000 t/year/; 95 % is used in chick mash and 5 % in various feeds for swine.

The addition of synthetic amino acids implies extra charges and it calls for an adequate industrial background. The application of fertilizers not only increases the average yields of maize and wheat considerably but also effects the feeding value. Consequently, we must find the ratio of nutrients giving the highest yields with the most favourable feeding value.