THE RESEARCH ON NON-CONVENTIONAL FOLIAR FERTILIZERS WITH PROTEIN HYDROLYSATES APPLIED TO MAIZE CROP

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Abstract

The use of chemical fertilizers is one of the most important causes of environmental pollution. The reduction of nutrient losses can be achieved using an alternative fertilization system, a system that includes foliar fertilization. The paper presents experiment results obtained into the greenhouse applying three new ranges of non-conventional foliar fertilizers. These fertilizers contain protein hydrolysates and macro-and micronutrients with the role to stimulate the plant metabolism. On chernozem soil, their application to maize (H Oriente, HS Talman) ensured important yield increases of dry matter and had a positive effect on nutrient absorption and uptake in the tested plants.

Key words: *protein hydrolysates, maize, foliar fertilizers*

INTRODUCTION

The excessive use of chemical fertilizers is one of the most common causes of environmental pollution (Chiurciu, I.A. et al., 2022). The reduction of nutrient and soil losses can be achieved by using an alternative fertilization system, a system that also includes foliar fertilization. In this context, foliar fertilization with mineral nutrients and organic substances, applied to plants in order to stimulate nutrition, as well as to correct nutritional deficiencies, can be a possibility to reduce the risk of chemical pollution of the environment. With soil fertilization as an obligatory measure in plant culture technologies, current plant production takes place between the imperatives imposed by society to obtain large, quality and cheap plant crops and the risks of environmental degradation through various effects of chemical pollution (Chiurciu, I.A. et al., 2020).

Therefore, increasing the real and apparent degrees of productive use in crop growth of nutrient ions from fertilizers is one of the principle bases of preventing and reducing the incidence of chemical pollution phenomena in the environment of plant production (Dana, D. et al., 2019, Drzymała, K. et al., 2020).

Non-conventional means of fertilization with hydrolysis products of residual protein and glycoprotein materials applied to

leaves in vegetation, can have a contribution significant in the prevention of chemical pollution of the plant production environment. (Dana, D. et al., 2017, Wang, S. et al., 2020).

MATERIALS AND METHODS

Non-conventional fertilizers have been manufactured by National Research-Development Institute for Soil Science, Agrochemistry and Environmental Protection Bucharest. The new fertilizers contain protein hydrolysates with the role to stimulate the plant metabolism and also besides macro-and micronutrient.

The experiment took place in the greenhouse and the soil from the experiment was vermic chernozems from Fetesti.

The chemical composition of the fertilizers was:

- V_1 - N amide 238.0 g/; P_2O_5 129.8 g/; K_2O 110,1 g/; S 35.80 g/; Mn 0.3 ppm: Fe 0.8 ppm; Zn 0.5 ppm; Cu 0.2 ppm; B 0.3 ppm;
- V_2 - N amide 117.8 g/; P_2O_5 185.6 g/; K_2O 133.4 g/; S 32.42 g/; Mn 0.4 ppm: Fe 0.6 ppm; Zn 2.0 ppm; Cu 0.2 ppm; B 0.9 ppm.

The experiments were organized in Mitscherlich-type vegetation pots with a capacity of 20 kg of soil. Corresponding to the testing methodology, 3 repetitions were ensured for each treatment variant. A fertilizing soil of 100 mg N/kg soil, 100 mg P_2O_5/kg soil and 100 mg K_2O/kg soil was made in the vegetation pots. The 16-16-16 complex fertilizer was used for basic fertilization.

The fertilizing compositions were applied to the plants in the form of diluted solutions, in a concentration of 1-1.5%. The amount of solution used was 30 ml of solution/pot for a single application.

During the vegetation period, three foliar treatments were carried out with an interval of 7 days between them. The plants were harvested 7 days after the last foliar treatment.

RESULTS AND DISCUSSIONS

Agrochemical characterization of the soil from the experiment

The soil had a slightly alkaline reaction and the humus content was small-medium.

The insurance status with mobile phosphorus was excessive, and with mobile potassium low (Table 1).

Table 1. Agrochemical properties of the soil

Agrochemical indicator	pH	Humus, %	PAL, ppm	KAL, ppm
Value	7.6-7.7	3.4-3.7	113-235	84-106
Interpretation	weakly alkaline	small-medium	high	small

Source: own determination

Effect of tested foliar fertilizers on dry matter production in maize crop

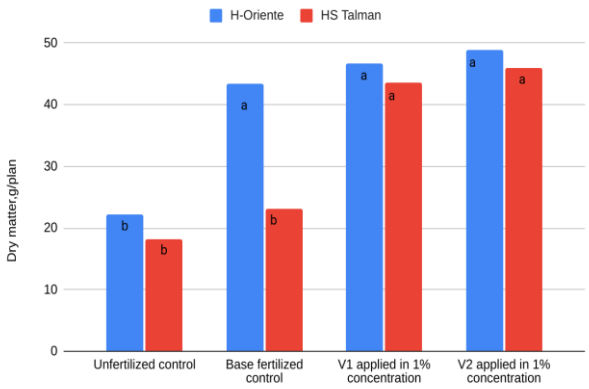

Figure 1 The influence of non-conventional foliar fertilizers on dry matter production in maize

Source: own determination

Figure 1 shows the results obtained for the maize crop, the Oriente and Talman hybrids. From the analytical data obtained, it was found that the tested foliar fertilizers ensured positive increases in dry matter production, significant compared to the basic unfertilized control, at H Oriente. The

production increases obtained were statistically ensured compared to both experimental controls at HS Talman.

With regard to the influence of these treatments on the content of N, P and K in the dry matter of the plants, an increasing trend can be found, compared to both experimental controls, in the Oriente hybrid, which demonstrates the effect of these compositions to correct and optimize plant nutrition (Figures 2-4).

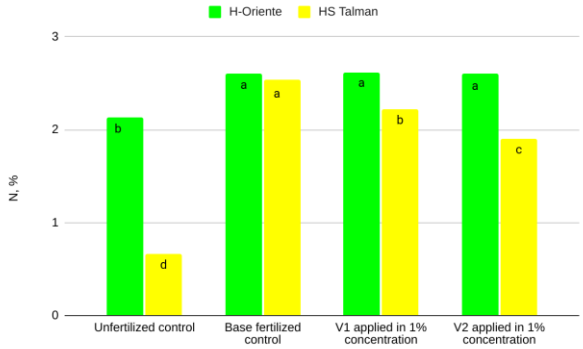

Figure 2. The influence of non-conventional foliar fertilizers on the N content of maize plants
Source: own determination

In the Talman hybrid, the NPK contents recorded in the foliar fertilized variants were higher compared to the basic unfertilized control in the soil, and lower compared to the basic unfertilized control in the soil, as a result of the dilution effect (Figures 2-4).

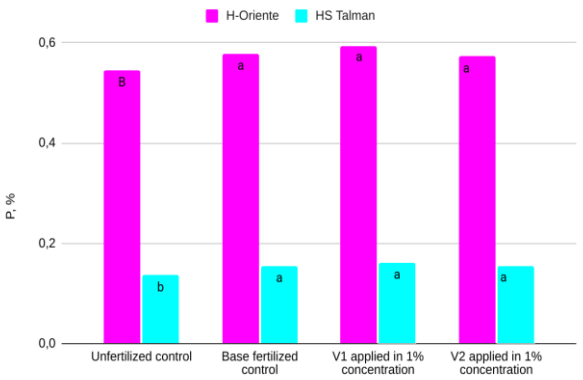

Figure 3. The influence of non-conventional foliar fertilizers on the P content of maize plants
Source: own determination

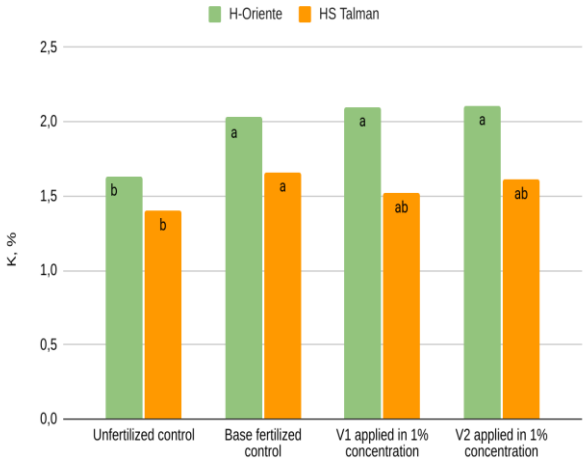

Figure 4. The influence of non-conventional foliar fertilizers on the K content of maize plants
Source: own determination

Also, the content of Zn and Fe shows the same tendency of growth under the influence of foliar treatments (especially in the case of Zn - composition V_2, H Oriente), which indicates that the fertilizers produced can be used to correct nutritional deficiencies with micronutrients, deficiencies frequently reported on soils with an alkaline reaction (Figures 5-6).

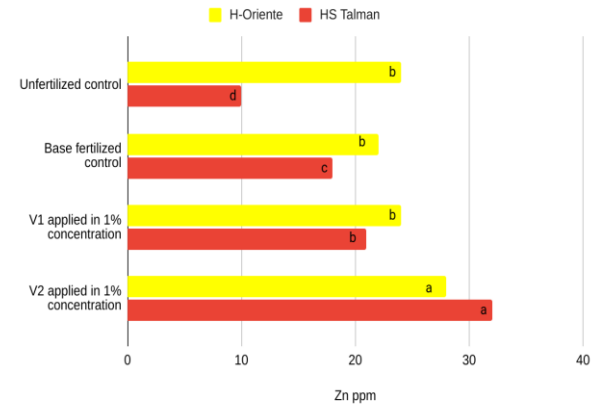

Figure 5. The influence of non-conventional foliar fertilizers on the Zn content of maize plants
Source: own determination

At HS Talman (Figures 5-6) the same trend of increasing the Zn content of plants under the influence of foliar treatments is observed. In the case of the microelement Fe, there is a tendency to increase it in the dry matter of plants, as a result of foliar fertilization.

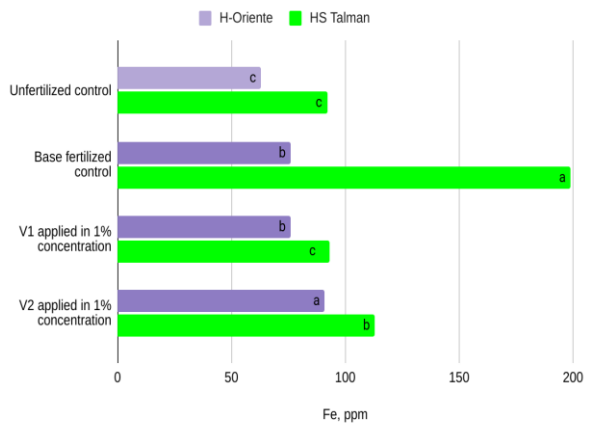

Figure 6. The influence of non-conventional foliar fertilizers on the Fe content of maize plants
Source: own determination

CONCLUSIONS

The new fertilizers contain protein hydrolysates that stimulate the metabolic processes in plants.

The analytical data obtained shows that the tested foliar fertilizers ensured positive increases in dry matter production in comparison with the controls.

The content of Zn and Fe shows the tendency of growth under the influence of foliar treatments.

This fact indicates that the fertilizers produced can be used to correct nutritional deficiencies with micronutrients, deficiencies reported on soils with an alkaline reaction.

ACKNOWLEDGEMENTS

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