

NUTRIENTS UPTAKE IN MAIZE PLANT UNDER ORGANIC FERTILIZATION TREATMENT

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Abstract

The opportunity of introducing plant analysis in the context of modern agriculture has become the practice of fertilization as a tool for diagnosis and substantiation of the application of fertilizers. There were studied the changes of some chemical characteristics of maize leaves under the influence of organic fertilization with or without mineral fertilization. As organic fertilizer compost made from cattle manure was used. In the experience of maize organised on Haplic Chernozems there were taken samples of leaves which have been dried at room temperature, then in the oven, followed by the crushing process and analyzed. The combination of the two types of fertilization resulted in significant increases in total nitrogen in leaves of maize. Regarding the phosphorus content of leaves, although the organic fertilization associated with mineral fertilization determined the increasing of available phosphorus level in soil, this increasing did not lead to statistically significant changes in phosphorus content in leaves. The effects of combining both types of fertilization have resulted in significant changes in distinct potassium content in maize leaves. The effects of the two fertilization systems were highlighted significant changes separate the calcium and magnesium insignificant for the content.

INTRODUCTION

In order to improve the biological phenomena in soil, organic fertilization seems to be a good solution. This is done with organic materials of different origins, composted after precisely established principles on the platform or in the field. It is obvious that these organic fertilizers are cheap and reach for each farmer and, in addition, be supplemented with chemical fertilizer to achieve optimal nutrient requirements for crops. On the other hand, manure, in particular, can be processed and converted into concentrated substance that can be exploited through marketing as a fertilizer, thus solving the problem of excess waste on the farm [1]. Efficiency of manure is greater when administered together with mineral fertilizers. Maintaining soil fertility depends on the balance between nutrient inputs (from different sources) and its loss by absorption in plants.

MATERIAL AND METHODS

There were organized experiments in field using the subdivided parcels method, studying the two gradients:

A factor - organic fertilization with compost made from cattle manure, in 5 doses:

a_1 – unfertilized;

a_2 – fertilized with compost equivalent to 100 kg N/ha;

a_3 – fertilized with compost equivalent to 200 kg N/ha;

a_4 – fertilized with compost equivalent to 300 kg N/ha;

a_5 – fertilized with compost equivalent to 400 kg N/ha.

B Factor – mineral fertilization with nitrogen and phosphorus, in 3 doses:

b_1 – unfertilized;

b_2 – $N_{50}P_{50}$;

b_3 – $N_{100}P_{100}$.

Experiments were organized with maize cultivated on Haplic Chernozems. There were taken samples of leaves which were dried at room temperature, then in the oven, followed by the crushing process and analyzed.

The processing of experimental data was performed using analysis of variance and Tukey test.

RESULTS AND DISCUSSION

Maize plants react positively to fertilization with organic fertilizers complex, but require a good supply of nutrients [2].

Nitrogen is a fundamental element in plants and it is found as a combination of protein, amino acids, nucleic acids, chlorophyll, etc. The combination of the two systems of fertilization (organic and mineral) resulted in lowest nitrogen content in maize leaves harvested in the variant unfertilized and the highest in the variant fertilized with compost at a dose equivalent to 200 kg N/ha. Following the incorporation of different doses of compost, the mean values of nitrogen content in maize leaves increased gradually from 1.84 to 2.13%. Changes statistically significant compared to the control variant and to the variant fertilized with compost at a dose equivalent to 100 kg N/ha, were observed only in the case of organic fertilization with the maximum dose of compost (Table 1).

Phosphorus is an essential element in plants. It exists in plants as organic compounds. In the experience organised on Haplic Chernozems it was noticed a slight upward trend in mean values of phosphorus content in maize leaves with increasing dose of compost applied from 0.26 to 0.31%, but increases are not statistically significant (Table 2).

Table 1**Effects of fertilization with composted cattle manure and mineral fertilization with nitrogen and phosphorus, on nitrogen content in maize leaves**

Mineral fertilization	Compost fertilization					Mean value mineral fertilization
	Unfertilized with compost	Compost fertilization equivalent to a nitrogen rate of				
		100 kg N / ha	200 kg N / ha	300 kg N / ha	400 kg N / ha	
	----- % -----					
Unfertilized	1,68	1,79	1,93	2,03	2,16	1,92 A⁽¹⁾
N ₅₀ P ₅₀	1,81	1,84	1,85	2,05	2,11	1,93 A
N ₁₀₀ P ₁₀₀	1,95	1,90	2,23	1,97	2,13	2,04 B
Mean value compost fertilization	1,81 W⁽²⁾	1,84 W	2,00 WX	2,02 WX	2,13 X	

⁽¹⁾ or ⁽²⁾ - Values followed by the same letter (A, B, C or W, X, Z) are not significantly different at the p=0.05 level (Tukey's honestly significant procedure)

Phosphorus had the lowest content in the unfertilized variant, and the highest in the variant fertilized with compost at a rate equivalent to 400 kg N/ha.

Table 2**Effects of fertilization with composted cattle manure and mineral fertilization with nitrogen and phosphorus, on phosphorus content in maize leaves**

Mineral fertilization	Compost fertilization					Mean value mineral fertilization
	Unfertilized with compost	Compost fertilization equivalent to a nitrogen rate of				
		100 kg N / ha	200 kg N / ha	300 kg N / ha	400 kg N / ha	
	----- % -----					
Unfertilized	0,23	0,24	0,29	0,31	0,33	0,28 A⁽¹⁾
N ₅₀ P ₅₀	0,28	0,29	0,30	0,32	0,31	0,30 A
N ₁₀₀ P ₁₀₀	0,23	0,26	0,30	0,30	0,29	0,28 A
Mean value compost fertilization	0,25 W⁽²⁾	0,26 W	0,30 W	0,31 W	0,31 W	

⁽¹⁾ or ⁽²⁾ - Values followed by the same letter (A, B, C or W, X, Z) are not significantly different at the p=0.05 level (Tukey's honestly significant procedure)

The role of potassium in the plant is multiple: increasing water absorption, reduces sweating, enhance photosynthesis, stimulating plant growth and cell division [3].

Potassium content in maize leaves, recorded minimum value in unfertilized variant and maximum value in the variant with compost fertilization equivalent to a nitrogen rate of 400 kg N/ha on a fund N₁₀₀P₁₀₀ mineral fertilization (Table 3).

Changes statistically significant compared to control variant, of mean values of potassium content in maize leaves were determined after mineral fertilization with N₁₀₀P₁₀₀.

The increasing rates of compost applied led to increased statistically significant compared to the control of the mean value of potassium content in maize leaves, from 3.52% obtained after fertilization with compost in a rate equivalent to 100 kg N/ha to 3.81% corresponding to the variant fertilized with compost rate equivalent to 400 kg N/ha.

Table 3

Effects of fertilization with composted cattle manure and mineral fertilization with nitrogen and phosphorus, on potassium content in maize leaves

Mineral fertilization	Compost fertilization					Mean value mineral fertilization
	Unfertilized with compost	Compost fertilization equivalent to a nitrogen rate of				
		100 kg N / ha	200 kg N / ha	300 kg N / ha	400 kg N / ha	
Unfertilized	2,83	3,51	3,63	3,63	3,81	3,48 A⁽¹⁾
N ₅₀ P ₅₀	3,21	3,50	3,75	3,61	3,77	3,57 AB
N ₁₀₀ P ₁₀₀	3,37	3,54	3,63	3,57	3,86	3,59 B
Mean value compost fertilization	3,14 W⁽²⁾	3,52 X	3,67 Y	3,60 XY	3,81 Z	

⁽¹⁾ or ⁽²⁾ - Values followed by the same letter (A, B, C or W, X, Z) are not significantly different at the p=0.05 level (Tukey's honestly significant procedure)

Calcium is present in all cells, especially in the old ones; it provides flexibility particularly in cell membranes. In small quantities, it is necessary for growth of all cells.

There were observed statistically significant increases of the calcium mean values content in leaves in mineral fertilized variant N₁₀₀P₁₀₀ irrespective of organic fertilization (Table 4). Organic fertilization in dose equivalent to 400 kg N/ha, resulted in increased statistically significant compared with variant fertilized with a quantity of compost equivalent to 300 kg N/ha.

Magnesium is designed to supply nitrogen and phosphorus plant cells making it indispensable in developing plant tissues.

The content of magnesium in maize leaves samples harvested in the experience organised on a Haplic Chernozems ranged 0.28-0.34%, as part of the normal concentration range.

Table 4**Effects of fertilization with composted cattle manure and mineral fertilization with nitrogen and phosphorus, on calcium content in maize leaves**

Mineral fertilization	Compost fertilization					Mean value mineral fertilization
	Unfertilized with compost	Compost fertilization equivalent to a nitrogen rate of				
		100 kg N / ha	200 kg N / ha	300 kg N / ha	400 kg N / ha	
Unfertilized	0,46	0,57	0,59	0,55	0,61	0,56 A⁽¹⁾
N ₅₀ P ₅₀	0,58	0,58	0,58	0,46	0,64	0,57 A
N ₁₀₀ P ₁₀₀	0,74	0,59	0,57	0,62	0,62	0,63 B
Mean value compost fertilization	0,59 WX⁽²⁾	0,58 WX	0,58 WX	0,54 W	0,62 X	

⁽¹⁾ or ⁽²⁾ - Values followed by the same letter (A, B, C or W, X, Z) are not significantly different at the p=0.05 level (Tukey's honestly significant procedure)

Statistically significant increases compared with the control variant of the mean value of magnesium contents in maize leaves were observed in variant fertilized with N₁₀₀P₁₀₀, without organic fertilization (Table 5).

Table 5**Effects of fertilization with composted cattle manure and mineral fertilization with nitrogen and phosphorus, on magnesium content in maize leaves**

Mineral fertilization	Compost fertilization					Mean value mineral fertilization
	Unfertilized with compost	Compost fertilization equivalent to a nitrogen rate of				
		100 kg N / ha	200 kg N / ha	300 kg N / ha	400 kg N / ha	
Nefertilizat	0,30	0,28	0,28	0,34	0,31	0,30 A⁽¹⁾
N ₅₀ P ₅₀	0,28	0,33	0,30	0,32	0,32	0,31 AB
N ₁₀₀ P ₁₀₀	0,34	0,32	0,31	0,37	0,33	0,33 B
Mean value compost fertilization	0,30 WX⁽²⁾	0,31 WX	0,29 W	0,34 X	0,32 WX	

⁽¹⁾ or ⁽²⁾ - Values followed by the same letter (A, B, C or W, X, Z) are not significantly different at the p=0.05 level (Tukey's honestly significant procedure)

CONCLUSIONS

1. The content of organic matter and nutrients in composted cattle manure recommends its use as organic fertilizer. The fertilization with composted cattle manure has not reported problems in terms of production quality in maize.

2. To avoid possible negative effects such as nutritional imbalance issues, it is necessary to comply with the uniform application of compost and crop-specific technologies.

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