INFLUENCE OF DIFFERENT FERTILIZERS ON NPK CONTENT IN SOIL, IN CONSERVATION AGRICULTURE SYSTEM

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ABSTRACT

This paper presents the results obtained from an experiment carried out in conservation agriculture system. Six types of fertilizers, i.e. N, NP, NPK and potassium humate NPK that contain various forms of nitrogen were tested. The experiments placed on cambic phaeozem at SCDA Teleorman were conducted using soybeans as crops, and fertilizers dosages of 50, 100, 150 and 200 kg N/ha. The influence of fertilizers on the nitrogen, phosphorus, potassium, content in the soil after the harvest was investigated. Soil samples were collected at a depth of 0-20 cm. The laboratory tests were performed on conditioned soil samples. The experimental data was statistically processed using analysis of variance. It was observed that the use of fertilizers increased of the nitrogen content from the soil from 0.157% for the unfertilized sample to 0.189% for the sample fertilized with NPK 15:15:15 at the application dosage of 100 kg N / ha (21.8%). The phosphorus content increased from 72 ppm P_2O_5 in the case of the unfertilized sample to 98 ppm P_2O_5 for the sample fertilized with NP 20: 20: 0 (200 kg / ha dosage).

INTRODUCTION

The humanity is facing a stage of accelerated population growth, especially in developing countries, and is expected to exceed 9 billion in 2050, while food resources become scarce. Agriculture will have to face a new situation due to the pressure exerted on the soil and water resources, and also due to climate change. The soil, water and energy resources are becoming insufficient, and the pollution of these resources reduces the quality and quantity of food. The disposal of different substances resulted from agriculture in the environment contributes to a number of environmental concerns/impacts, i.e. effects on human health, loss of biodiversity and climate change (Dumitru, 2014).

Brown et al. (1995) mentioned three of the limits involved in the downturn of world food production: the sustainable production of marine fisheries, the amount of fresh water produced by the hydrological cycle and the quantity of fertilizers which can be used for existing crops.

In order to maintain the balance as regards the available soil nutrients supply, OECD (Organisation for Economic Cooperation and Development) recommends maintaining the balance between nutrient inputs and outputs in accordance with the output production (Dumitru 2005).

Soil degradation is caused, accelerated and intensified mainly by human activity through conventional farming (E. Dumitru et al., 2005).

In order to decrease soil degradation, no-tillage strategy can be used. Due to its adaptability and powerful benefits to soil biodiversity, no-tillage has been adopted in various regions of the world, especially in countries such as Argentina, Australia, Brazil, Canada and the United States (Derpsch et al., 2010).

The results obtained from the experiments conducted by E. Dumitru et al. (1983) on a cambic chernozem which investigated the physical condition of the soil as a result of direct sowing in comparison to the conventional technology, showed some changes in the state of compaction and at the same time an increase in water permeability due to the improvement of the macroporosity. Water permeability is enhanced by natural processes. These processes are particularly intense and lead to soil break-up, which improves water permeability.

The development of no-tillage systems is mainly related to the increased productivity observed on crops such as: cereals and legumes (Carlos Crusciol A.C. et al., 2016).

It was reported that inserting grain legumes in cropping systems can represent a good strategy to reduce N fertilizer dependency with a decrease of 40-49 kg N / ha, and a wheat production increase of 8% (Daniel Plaza-Bonilla et al., 2016).

MATERIAL AND METHOD

This paper presents the results obtained from an experiment placed on cambic phaeozem at SCDA Teleorman.

Soil characteristics: humus content 3.0 - 3.6%, clay content (0-45 cm): 45-48%, total nitrogen 0.186%, phosphorus 76 mg / kg, mobile potassium 250 mg / kg, pH (in water) 6.3.

The experiment included 25 variants in three replicates, in which six different types of fertilizers were tested: Urea, ammonium nitrate, NP 20: 20: 0, NPK 15:15:15, potassium humate liquid fertilizer AH-U, sulphur- coated urea and a non-fertilized control variant. The application dosages were: 50, 100, 150, 200 kg N / ha. The fertilizers contain different forms of nitrogen: cyanamide - urea and sulphur-coated urea, ammoniacal and nitric-calcium nitrate, all three forms of nitrogen (cyanamide, ammoniacal and nitric) - NP 20: 20: 0 and NPK 15:15:15, and humic compounds with mineral and organic nitrogen - AH-U in matrix NPK and.

The experiments were conducted using soybeans (Condor variety) as crops and in no-till system.

The herbicides, insecticides and fungicides treatments were applied as follows: Frontier Forte 1.3 l / ha, Pulsar 1.0 l / ha, Pantera 1.5 l / ha and desiccant Elastiq (prior to harvest).

Soil samples were collected at the depth of 0-20 cm, according to the methods used in the Testing and Quality Control of Fertilizers Laboratory.

The analysis methods were as follows:

• total nitrogen (N%): Kjeldahl method according to SR ISO 11261: 2000.

• mobile phosphorus: Extraction according to Egner-Riehm-Domingo; The mobile phosphorus content was determined by spectrophotometry according to Murphy-Riley method.

• mobile potassium: Extraction according to Egner-Riehm-Domingo; The mobile potassium content was determined by flame photometry.

RESULTS AND DISCUSSIONS

• Influence of fertilizer type and application dose on the nitrogen content in soil

Figure 1 shows the results obtained by applying different types of fertilizers that contain different forms of nitrogen in dosages of 50 kg N / ha.

As it can be observed from *Figure 2* the use of 100 kg N / ha dosage led to significant increases of total nitrogen content in the soil compared to the non-fertilized control. From *Figures 3* and *4* it can be noticed that for the application dosages of 150 kg N / ha and 200 kg N / ha, the total nitrogen concentration in the soil remained unmodified.

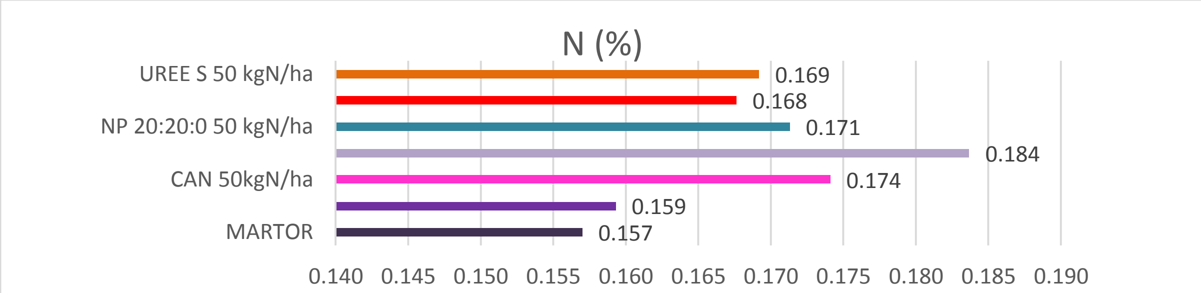

Figure 1.

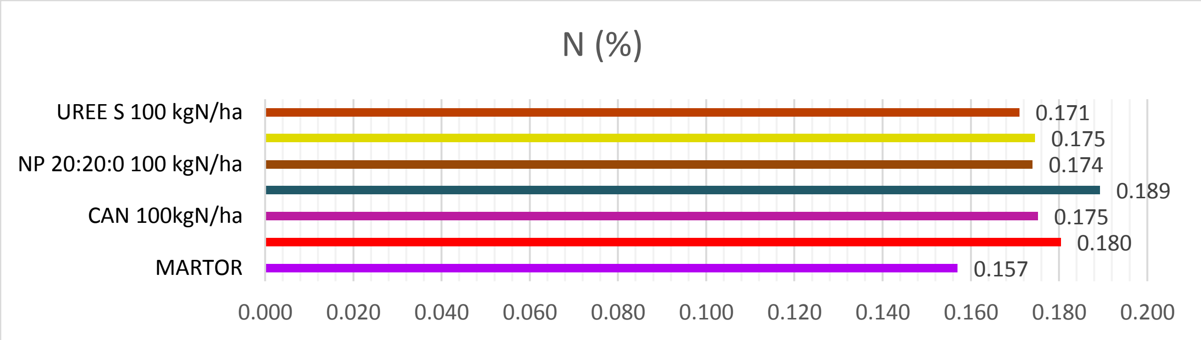

Figure 2.

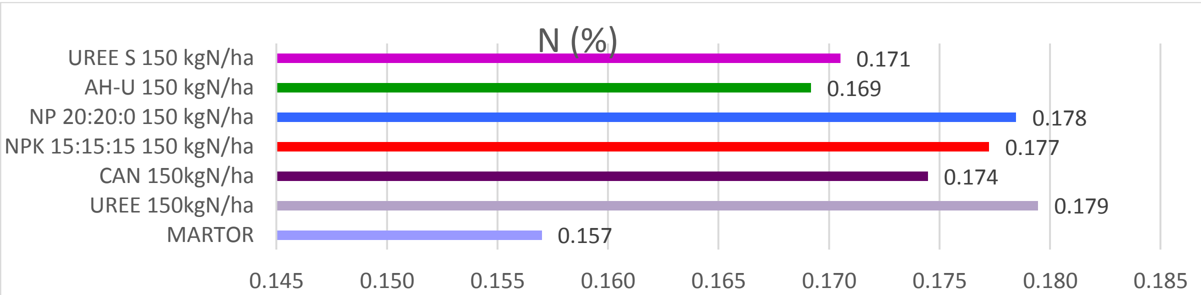

Figure 3.

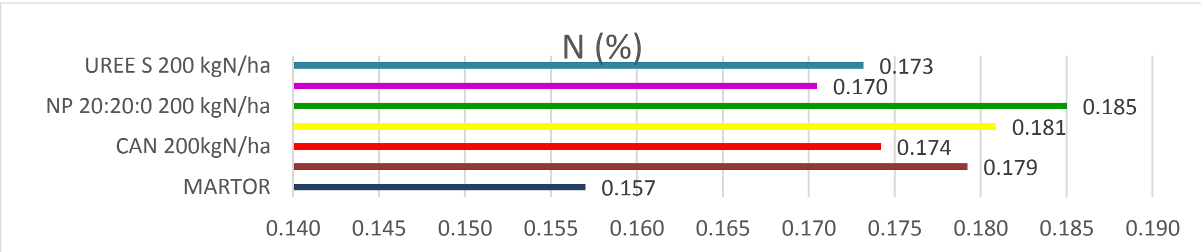

Figure 4.

• Influence of fertilizer type and application dose on the mobile phosphorus content in soil

The phosphorus content in the soil after NP 20: 20: 0 fertilization increased by 21% for the application dosage of 100 kgP / ha, 29% for 150 kgP / ha and 36% for 200 kgP /ha. The accumulation of mobile phosphorus in soil after NPK 15:15:15 treatment increased for the dosages of 100, 150 and 200 kgPAL / ha. The values increased with the increase of the application dosage (16% for 100 kgP / ha, 19% for 150 kgP / ha and 28% for 200 kgP / ha).

As shown in *Figure 5*, the variants treated with phosphorus fertilizers in dosages of 100, 150 and 200 kgP / ha led to significant increases of the mobile phosphorus in the soil.

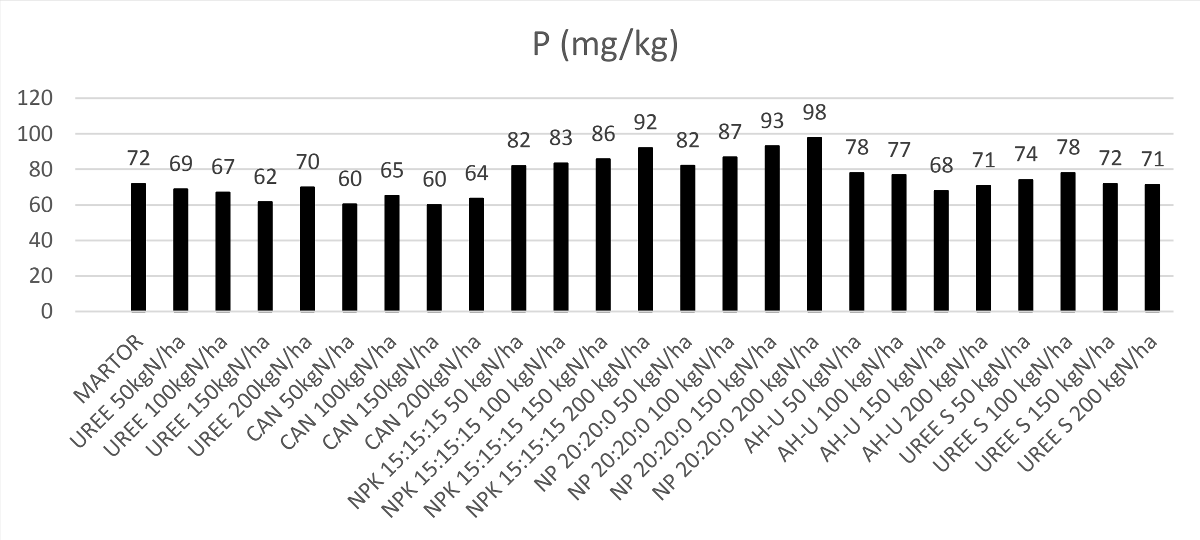

Figure 5.

• **Influence of fertilizer type and application dose on the mobile potassium content in soil**

The fertilized experimental variants did not show changes as regards the content of potassium in soil after urea, calcium nitrate, NP 20: 20: 0 and sulphur- coated urea application, since these fertilizers do not contain potassium in their matrix. NPK 15:15:15 fertilization in all 4 application dosages increased the content of mobile potassium in soil from 263 mg / kg for the non-fertilized control to 285 mg / kg (50 kgK / ha application dose). The use of 100 kgK / ha application dosage led to an increase of 11% of the mobile potassium (292 mg / kg). The KAL soil contents increased with increasing application dosage from 14% (300 mg / kg) for 150 kgK / ha to 307 mg / kg for 200 kgK / ha *(Figure 6.).*

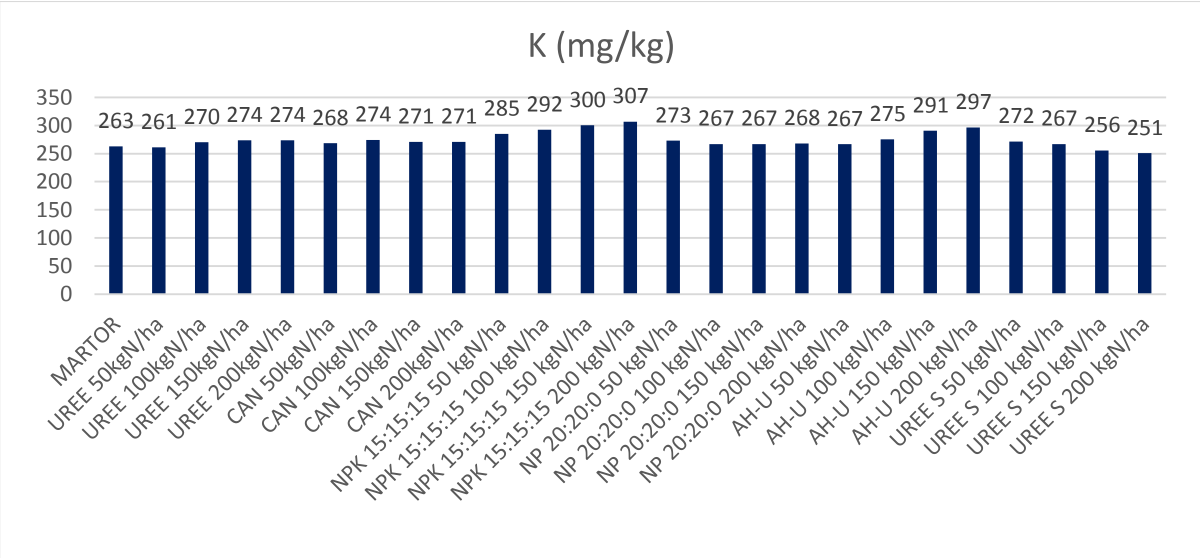

Figure 6.

CONCLUSIONS

• Calcium nitrate fertilization led to a significant increase of the total nitrogen content in soil for all application dosages. The accumulation of nitrogen in soil increased from 0.157% for the non-fertilized control to 0.175% for the application dosage of 100 kg N / ha. The nitrogen content remained at a constant value of 0.174% for the application dosages of 50, 150 and 200 kg N / ha. Therefore, the increase of the amount of nitrogen applied using calcium nitrate did not led to an increase of the nitrogen content in soil.

• The use of urea in dosages of 100, 150 and 200 kg N / ha increased the total nitrogen in soil. However, the increase of the application dosage did not led to the increase of the nitrogen content in soil. The obtained results were 12% higher in comparison to the non-fertilized control for all 3 treatments.

• The presence of the three forms of nitrogen (ammoniacal, nitric and cyanamide) in NPK 15:15:15 and NP 20: 20: 0 fertilizers led to the increase of nitrogen content in soil up to 0.181% in the case of NPK 15:15:15, 200 kg N / ha, respectively to 0.185 % for NP 20: 20: 0, 200 kg N / ha.

• The mobile phosphorus content in soil registered significant increases compared to the non-fertilized control as a result of using NP 20: 20: 0 and NPK 15:15:15 fertilizers in application dosages of 100, 150 and 200 kg/ ha. The use of urea (50 kg N / ha) and calcium nitrate (50 and 150 kg N / ha) fertilization led to the decrease of phosphorus concentration in soil.

• The fertilized experimental variants did not show statistically insured changes as regards the content of potassium in soil after urea, calcium nitrate, NP 20: 20: 0 and sulphur- coated urea application.

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