

A PRELIMINARY STUDY ON THE EFFECT OF THE NATURAL CLINOPTILOLITE AND BENTONITE ADDITIONS ON THE TOMATO "NEMO NETTA" GROWTH

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ABSTRACT

The present paper deals with the agricultural use of the natural clinoptilolite from the Igroš deposit near Brus and bentonite from the Mečji Do deposit near Vlasotince (Serbia) in the tomato growth at an agricultural field near Novi Sad. The preliminary study indicates that these minerals as natural and non-toxic solids could improve the physical properties of soils and that they exhibit a positive effect on the tomato growth and yield.

Key words: clinoptilolite, bentonite, soil, agrochemicals, tomato growth.

INTRODUCTION

The increasing demand on environmental protection and the production of health food give rise to many investigations in the production of ecologically acceptable materials for use in agriculture. In Serbia, an excessive and usually uncontrolled use of mineral fertilizers has led to an undesirable effect on the quality of vegetables and fruits. Regeneration of soils is not only costly but also a long-term process. As an example, regeneration of soils affected by uncontrolled use of mineral fertilizers and pesticides could take more than 20 years [1]. Accordingly, minerals such as natural zeolites and bentonites, being cheap, non-toxic and environmentally suitable materials, attract great attention in the remediation of soils and in the agricultural use [2, 3]. Positive effect of the use of zeolites and clays in enhancing plant productivity has been attributed to their influence on physico-chemical properties of soils (creating favorable air and water regime close to the plant root system) as well as to an increase of the ion-exchange capacity of soils, leading to a regular and rational plant nutrition [4].

EXPERIMENTAL

The as-received zeolitic tuff from the Igroš deposit with a grain size of 60-100 μm and bentonite from the Mečji Do deposit with a grain size of about 80 μm were used for the preparation of two types of natural based substrates. The first substrate, denoted as G1, was obtained by mixing of bentonite (30 wt. %), zeolite (30 wt. %) and peat (40 wt. %), and the second one, denoted as G2, contained bentonite (30 wt. %), zeolite (20 wt. %) and peat (50 wt. %).

Experiments were carried out in three variants on a small field in the village Mošorin near Novi Sad from January to October, 2007. G1 or G2 were used in two variants and peat without minerals was used in the control. The "Nemo Netta" type of tomato was chosen for the growth monitoring.

RESULTS AND DISCUSSION

Until now, zeolitic tuff from the Igroš deposit has mainly been investigated as an adsorbent [5]. It has been reported that the tuff consists of approximately 75% clinoptilolite; several minor constituents (approximately 5% of each) are calcite, analcime, plagioclase feldspars, mica (biotite and/or celadonite) and quartz [3]. For bentonite, a qualitative X-ray

powder diffraction analysis indicates that it consists of approximately 90% montmorillonite with a small amount of quartz and calcite.

It has been reported that the zeolite-based fertilizers can significantly increase the yields of various plants such as the root biomass in parsley, carrot or onion [3]. In strawberries, an increase in the harvest of as much of 70% has been found [3]. In this experiment we have found that the simple use of a mixture of two as-received minerals - zeolite and bentonite - positively effects the vegetable growth and yield. The mixture was easily applied at the beginning of the vegetation period and it seems to exhibit a positive effect throughout the period.

Table 1 shows the data on the vegetative growth and yield of tomato. The average yield per a productive branch obtained from the fields treated with G1 substrate was similar to that treated with G2 (0.95 kg). The yield is by about 20% higher than in the control. It is also evident that the yield per plant obtained in the presence of G1 and G2 was by 35% higher than in the control. The Figure 1 gives the photo of a productive branch.



Figure 1. Photos of the experimental field (left) and the productive branches (right). On the left side of the left picture are the plants grown in the presence of the substrates. The productive branches have grown by about 10% higher in the field treated with substrates as compared to the control.

Table 1. The effect of substrates on the vegetative growth and yield of the tomato "Nemo Netta".

Monitored feature	G1	G2	Control
Number of productive branches (floors)	12-15	12-15	10-13
Number of produce on productive branches	5-8	5-8	5-7
Produce weight, kg	0.16-0.22	0.16-0.22	0.16-0.20
Yield per productive branch, kg	0.9-1	0.9-1	0.7-0.8
Yield per plant, kg	12.4	12.8	8.3
Plant height, cm	5.2	5.3	4.8

CONCLUSIONS

Preliminary results indicate that addition of the clinoptilolite-rich zeolitic tuff and bentonite has a positive effect on the tomato growth. These minerals are available in the Republic Serbia and are of low cost. They could find simple application in agriculture and the plant growing. Further study will be directed toward detailed investigations of the influence of these minerals on the soil properties as well on the plant quality.

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