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Improvement Possibilities of Soil Quality

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Abstract: In this paper we follow the effects of adding zeolitic tuff (clinoptilolite rich tuff) in soil for treating. Because of it's essential features and structure this high-silicon type generates in soil an effective pH buffering process, an increase of soil humidity and the enrich of cationic content in soil solution. The applying of zeolitic tuff on soil is beneficial for the enhance of cationic exchange and soil adsorption processes. Alone or in mixture with organic nitrogen fertilizer the tuff supplies establish in soil the enhance of global soil fertility particularly in the neighborhood of rizosphere, rising the crop production.

Keywords: zeolites, soil, pH, humidity and crop.

1. Introduction

Often the soil is unable to supply the plant with adequate amounts of water and essential nutrients or they are leached out. Most of the soils do not fulfill the plants nutrition demands during the whole vegetation period.

Acid and alkaline soils or soils that tend to become acid or alkaline are considered to be low fertile soils. The presence of clinoptilolite in soil ensures the absorption and retaining of large water amounts conditioning the soil water balance [1, 2]. Also the addition of natural zeolites creates a pH buffering effect and a higher production of grain.

New effective application into soil

Application: for all vegetable crops of protected soil, berries, for interior flower-growing. Advantages of a zeolite substrate:

- good physical properties
- longevity
- sterility
- high exchange capacity
- absence oftoxicologically harmful substances
- easy in operation, transport, storage
- uncakeness
- good aesthetic appearance
- high seed germination, good implantation, development of strong root system which is valuable when you grow seedlings;
- earlier fruiting of vegetable crops (7-12 days) and germination of flower crops (25-30 days);
- increasing of productivity and improvement of fruits quality because vitamin "C" raises by 30%; prevention oftoxicological impact of nitrates;
- absence of weeds if do not use chemical means of plant protection high ability of ammonia exchange
- water absorption and desorbtion
- retention of nutrient substances from wash-out
- optimization of process of assimilation of macro- and micro elements
- reduction of fertilizer use by 3-5 times because of their higher efficiency
- increase of periodicity of application of fertilizers (one time in 2-3 years)
- keeping of soil with additional micro elements enrichment of soil with necessary volume of potassium, sodium, calcium, magnesium, alumosilicates reduction of nitrates in plants by 5-6 times and complete prevention from radionuclids and heavy metals
- zeolite is a basis of application. It possesses by a number of unique properties making indispensable for the usage as independent substrate and application into soil. For this purpose it is widely used in farming in Japan, US, Bulgaria, Hungary, Poland.

Basic characteristics are: crystal hydrate alumosilicate of alkaline and alkaline and earth metals with high (1.5-1.8 mg equivalent per 1 g. of rock) exchange capacity. Exchange complex is represented by 60% important for plant elements- calcium and calcium with gross content 2.5-3.0% KiO and 2.0-2.8% CaO. It possesses high selective capacity to ammonia ion which, thanks to entering to structural channels does not retrograde into nitrate form. It contains up to 15% zeolite water. General water capacity is up to 40%. It has weak alkaline reaction pH from 7.2 to 7.5. Bulk weight is 0.98 $Vm.^{3}$.

Zeolite effectiveness is explained by its stable alumosilicate cell and its exchange ability by some nutrient substances. Zeolites provide increase the ability of cation exchange of soils with lasting effect giving necessary vitamins to plant's root system during growth and taking them back when plants are dry. Zeolite increases soil porosity serving like a soil conditioner. It accumulates moisture and slowly gives is back. Improving water and physical and agro- and chemical soil properties zeolite has stimulating impact on micro flora viability protecting plant's roots from decay and deceases during a long period. As a soil component zeolite positively influences on formation of vegetable mass of plants, development of

photosynthetic process, more chlorophyll content. Zeolite is applied into soil with mixture of mineral and organic fertilizers or it is applied separately. Also it is applied with a combination of natural organic raw (turf, sawdust). During application of zeolite into soil it is recommended to mix one part of fertilizers and four parts of zeolite. Fertilizers with zeolite must be placed to the depth of roots. The application of addition for growing of vegetables and berries will provide higher yield by 20-100% depending on sort and type, for example: strawberries grown with zeolite use will ripe 2 weeks sarlier, the yield will be 150%, vitamin C content will rise by 36%, the content of dry matter and sugar will increase 5-2 times. Application of zeolite soil improver, regulating soil fertility is a guarantee of higher yield, environmentally safe products and protection of water resources.

2. Experimental section

The experiment was realized on 6 m^2 of plots in the field. Soil was treated with three different tuff doses of 20 tones (V_1), 40 tones (V_2) and 60 tones/ha (V_3) administered alone or mixed with 100 kg nitrogen per hectare (10000 m^2)(V_4, V_5, V_6).There are seven experimental alternatives all together with the control plot which was untreated (V_0). The experimental plots were planted with oat. Soil samples were taken monthly and the analyzed soil features were pH, humidity. In order to ensure the research statistics all experimental alternatives were carried out in three repetitions. The final crop production was established. The soil features analysis has been done using special soil laboratory methods such as potentiometry and gravimetry.

3. Results and Discussion

Matter soil humidity evolution in the experimental research and climatic dates it is show that humidity of the control probe grow up to zeolitic tuff alternatives.

To experimental period from climatic dates (Tab 1) it coud be observed that precipitation was in deficit and temperature was higher and that explain clearly the role of zeolitic tuff from retaining water.

TABEL 1. Climatic dates on experiment period

Period		Apr	May	June	July
Precipitation (mm)	Multiyearly media	50.0	66.7	81.1	59.9
	Year 2003-2004	46.3	51.4	81.0	55.4
Deviation from normal	Excelent (+)	-	-	-	-
	Deficit(-)	3.7	15.3	0.1	4.5
Temperature (°C)	Multiyearly media	11.3	16.4	19.6	21.6
	Year 2003-2004	10.4	20.2	23.8	22.4
Deviation from normal	Excelent(+)	-	3.8	4.2	0.8
	Deficit(-)	0.9	-	-	-

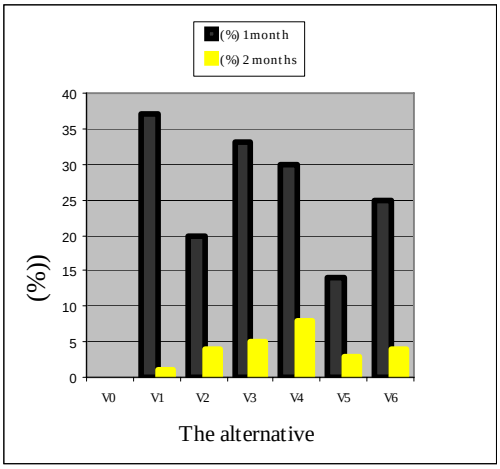


Figure 1. The dynamics of humidity soils at 1 mounth, respective 2 mounth

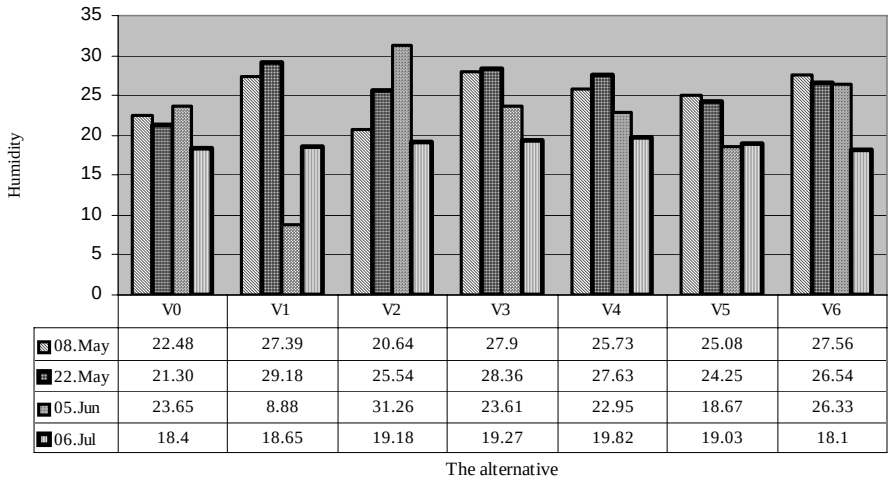
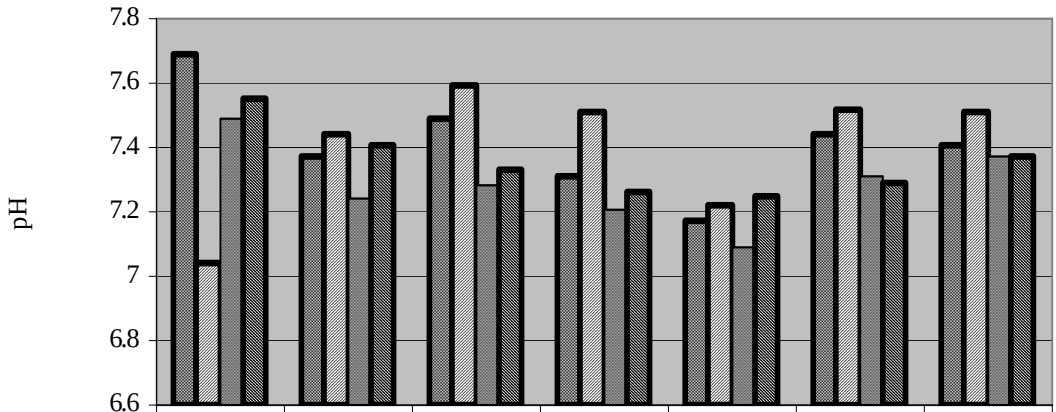


Figure 2. The humidity of the soil at four diferent times (08.05.2003 – 06.07.2003)



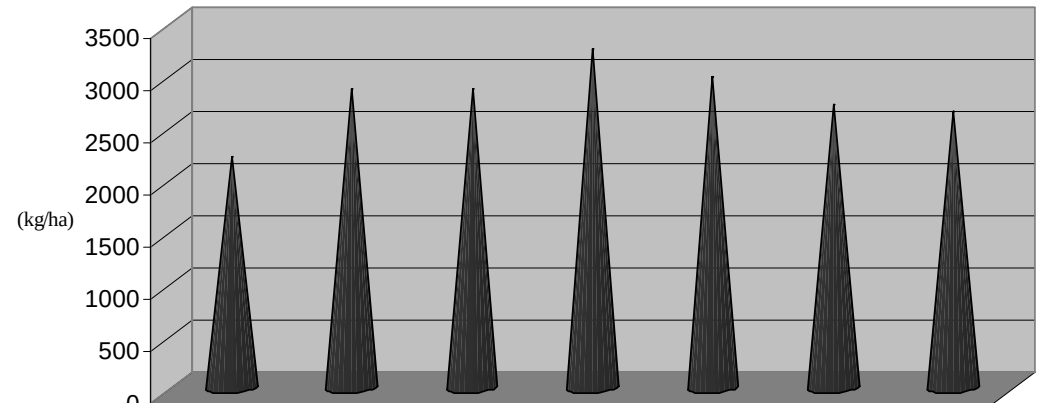
	V0	V1	V2	V3	V4	V5	V6
08.05.03	7.69	7.37	7.49	7.31	7.17	7.44	7.41
22.05.03	7.04	7.44	7.59	7.51	7.22	7.52	7.51
05.06.03	7.49	7.24	7.28	7.21	7.09	7.31	7.37
06.07.03	7.55	7.41	7.33	7.26	7.25	7.29	7.37

The alternative

Figure 3. The evolution of pH during experiment period

The values of pH is differentin accordance with the administration of tuff doze. The rezultes obtain on all the period take in study, we observe clear that zeolitic tuff doze modified soil pH to neultral field (neutral pH= 6.8 – 7.2) against the control probe in special in plot V3, where tuff doze is 60 t tuff / ha.

After zeolitic tuff applied in normal condition without artificial wetting. Most of the rise plantes after one mounth from planting was in plots balanced zeolitic tuff (from 40 t tuff / ha).



	V0	V1	V2	V3	V4	V5	V6
Oat crops	2225	2870	2865	3260	2985	2725	2655

The alternative

Figure 4. The variation of oatseeds crop in rapport with the administrate tuff dose

4. Conclusions

The experiment efectuated demonstrate that includding tuff in soil, determined maintaining pH value in 6,8-7,2 limit.

Behind the investigation, it is observed that humidity grow up against the control probe to zeolitic tuff alternative.

Correlating climatic dates to investigation period, it coud be observed that precipitation was in deficit and temperatures was heigher, explaining clear the role of volcanic tuff of retaining water.

From investigation was concluded that to zeolitic tuff alternative, grain production is heigher.

Another positive effect of zeolit tuff administration is that of concentrating soil solution in exhange cations, necesarry to the vegetation process.

The high crop productions values obtained for alternative V_3 (3260 kg oat/ha) and V_4 (2985 kg oat/ha) show that this tuff doses and the mixture with nitrogen fertilizer improves soil fertility. The most propitious alternatives (V_3 and $V_{4)}$ under pedoclymatic conditions in Timisoara allow both an increase of soil fertility as well as a high quality crop production inreached by essential minerals.

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