CHARACTERIZATION OF SOIL FOR PRODUCTION OF CABBAGE

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ABSTRACT: This paper reviews a part of analyses of soils used for production of cabbage in the production fields around the village of Futog near Novi Sad. The analyzed soils are heterogeneous but invariably of light mechanical composition. The topsoils have unfavorable water/air properties, low total porosity (from 36.82% to 42.70%) and medium water permeability (from 10^{-3} to 10^{-5} cm/s). Low humus content (from 1.62% to 2.17%), highly variable phosphorus content (from 6.5 to 107.0 mg 100^{-1} g of soil) and medium to high potassium content (from 15.5 to 70.0 mg 100^{-1} g of soil) are common properties of the surface soil layers of all soil profiles studied. Based on the proportion and biodiversity of the studied groups of microorganisms and dehydrogenase activity, it has been concluded that the analyzed soils have a high biological value.

Key words: chernozem, soil properties, cabbage

INTRODUCTION

Because the quality of agricultural produce depends largely on soil, maintenance and protection of the physical, chemical and microbiological soil properties are important from the ecological and economic points (Hadžić *et al*., 2004).

Prevention, recognition of dangers and determination of feasible solutions are most important measures in soil protection from degradation. To achieve these targets, systematic control of soil fertility and contents of harmful and hazardous substances, i.e., soil quality monitoring, are recommended.

The Futog cabbage has exceptional biological and technological characteristics which makes it a popular food item in the country and abroad. Sauerkraut produced in Futog is exported to Germany, France, England and USA. This explains the importance of quality analyses of the soils used for the production of the Futog cabbage.

MATERIAL AND METHOD

The study object has been a 5000-ha land tract located west of Novi Sad, between the villages of Veternik and Begeč. Five soil profiles have been opened in representative locations. Geomorphologically, the tract is located on an alluvial terrace along the Danube River, at the altitude of 81 to 84 m.

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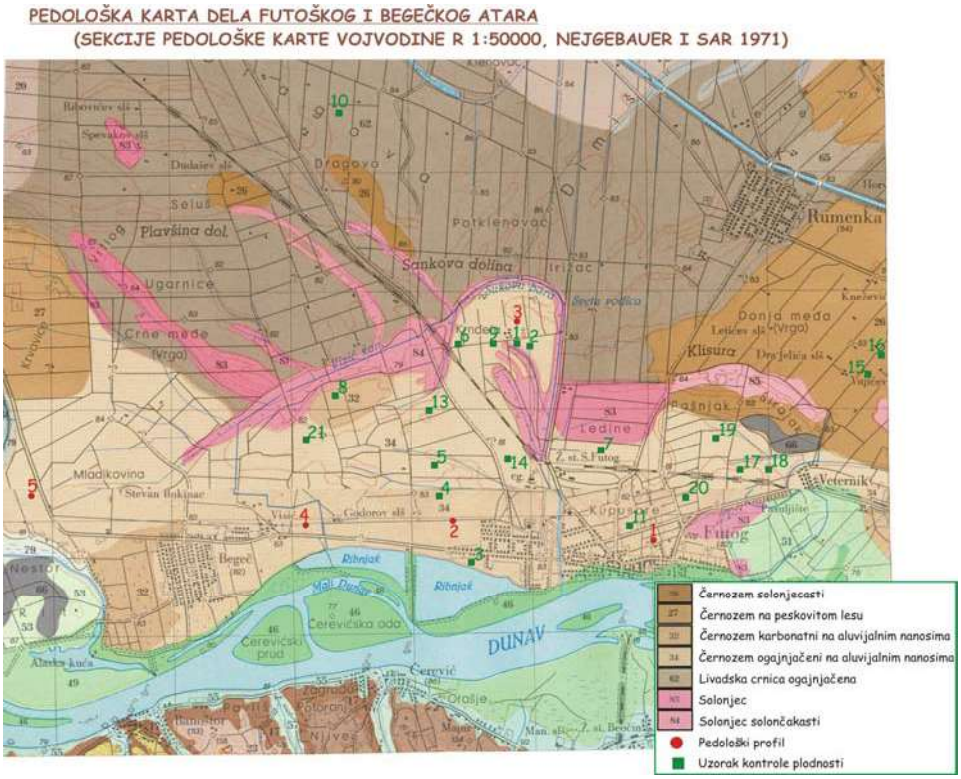
The physical, water-physical, chemical and microbiological soil properties have been analyzed in laboratories of Department of Soil, Agroecology and Fertilizers of Institute of Field and Vegetable Crops in Novi Sad. In addition to the standard methods approved by JDPZ (1966, 1971, 1997), up-to-date international methods have been used in this study.

RESULTS

According to the soil map of the Vojvodina Province R 1: 50000 (Nejgebauer *et al.*, 1971), most of the analyzed samples come from the systematic unit no. 34, i.e., the brownized chernozem soil on alluvial drifts. According to our study, the soil type in the analyzed locations is chernozem, with two subtypes (on alluvial drifts and on loess and loess-like sediments) and two varieties (calcareous gleyed and brownized gleyed). All profiles have the same form– shallow (classification according to Škorić *et al.*, 1985).



Mechanical composition and water-physical soil properties are presented in Tables 1 and 2. For brevity, only results from representative profile 1 age given.

The analyzed soils were heterogeneous but mostly they had a light mechanical composition. In the upper part of the profile, the soils have unfavorable water-air properties, low total porosity (from 36.82% to 42.70%) and medium water permeability

(from 10^{-3} to 10^{-5} cm/s). Compacted soils prevent normal root development, which entails a reduced supply of plants with water and nutrients. Generally, soil compaction in the range from 1.15 to 1.25 g cm^{-3} does not aggravate the water-air regimen of the soil. In the case of the Vojvodina chernozem, the allowed compaction of the plowed layer ranges from 1.30 to 1.35 g cm^{-3} (Vučić, 1992).

Table 1. Mechanical composition

Profile 1, horizon	Depth cm	% of particles				Texture designation
		>0.2 mm	0.2-0.02 mm	0.02-0.002 mm	<0.002 mm	
Amo,p	0-33	4.90	64.22	16.88	14.00	Loamy fine sand
AC	33-55	4.30	70.74	14.52	10.44	Loamy fine sand
C1	55-105	10.30	62.14	19.92	7.64	Loamy fine sand
C2	105-133	63.20	30.16	4.32	2.32	Loamy coarse sand
CGso,r	133-170	74.50	23.90	0.40	1.20	Loamy coarse sand

Table 2. Water-physical properties

Profile 1, horizon	Depth (cm)	K – Darcy (cm/sec)	Volumic mass (g/cm^3)	Specific mass (g/cm^3)	Total porosity (%)
Amo,p	0-33	2.39×10^{-4}	1.48	2.56	42.18
AC	33-55	1.09×10^{-3}	1.41	2.55	44.70
C1	55-105	3.28×10^{-4}	1.41	2.61	45.98
C2	105-133	7.67×10^{-3}	1.52	2.74	44.53

The unfavorable water-physical properties of the surface horizons seem to be due to inadequate soil tillage and the date of soil sampling. Namely, in early November when the samples were taken, harvest was in due course or it has been completed and this operation was bound to cause additional compaction and further aggravation of the water-physical soil properties.

Table 3. Main chemical properties

Profile 1, horizon	Depth cm	pH		$CaCO_3$ %	Humus %	N %	P_2O_5 mg/100g	K_2O mg/100g
		1M KCl	H_2O					
Amo,p	0-33	6.80	8.01	4.24	1.62	0.118	107.0	22.3
AC	33-55	7.16	8.15	15.27	0.92	0.059	21.3	6.8
C1	55-105	7.41	8.25	40.30	0.48	0.030	6.1	3.0
C2	105-133	7.86	8.40	10.61	0.75	0.010	3.0	2.2
CGso,r	133-170	8.18	8.57	9.33	0.66	0.007	6.9	2.2

The main chemical properties are presented in Table 3 (for brevity, only results from representative profile 1 age given). The soils were mostly calcareous on the surface

(except for one location in profile 2), slightly alkaline to alkaline in reaction. Low humus content (from 1.62% to 2.17%), variable phosphorus content (from 6.5 to 107.0 mg 100-1 g of soil) and medium to high potassium content (from 15.5 to 70.0 mg 100-1 g of soil) were common characteristics of the surface soil layers of all soil profiles studied.

Table 4. Microbiological activity

Profile 1, horizon	Depth cm	Log no. of cells /g^{-1}						DHA μg TPF/ g^{-1} of soil
		Total no.	Ammoni-fiers	Azoto-bacter	Free N-fixing	Actino-mycetes	Fungi	
Amo,p	0-33	8.53	7.57	2.60	7.87	5.18	4.33	680
AC	33-55	8.17	7.63	0.00	7.34	4.32	3.11	151
Cca	55-105	8.11	6.36	0.00	7.15	3.17	2.69	148
C1	105-133	7.81	5.00	0.00	5.23	0.00	0.00	91
C2	133-170	0.00	5.10	0.00	4.44	0.00	0.00	74

Microorganisms play an important role in the forming and maintenance of soil fertility. They affect plant growth and development (supply of the main biogenous elements N, P and K, production of biologically active substances such as vitamins, gibberellins and auxins). Also, they decompose pesticide and are indicators of negative effects of heavy metals and changes in physical-chemical soil properties (Milošević *et al*., 1999, 2003). Based on the presence and biodiversity of the analyzed groups of microorganisms and dehydrogenase activity, it was concluded that the analyzed soils have a high biological value (Table 4).

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