STUDIES UPON THE QUALITY STATUS OF A TERRAIN OCCUPIED BY A SUGAR MANUFACTURING WASTE DEPOSIT

STUDII PRIVIND STAREA DE CALITATE A UNUI TEREN OCUPAT DE UN DEPOZIT DE DEŞEURI PROVENITE DE LA FABRICAREA ZAHĂRULUI

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Abstract *The paper presents the established studies in order to determine the quality and reliability of the soils for agriculture purpose from the "decantation lake" belonging to a Romanian sugar industry. Towards these it were made 3 soil profiles and it were assayed 3 soil samples from each profile in order to determine the physic-chemical characteristics. Each profile was investigated "in situ" through specific pedological methods being identified two soil classes and two types of soil. It were also determined the bonity notes and the soil fertility showed by the trophicity index. The obtained results indicated the analyzed soils have a low trophicity index that means that they are into oligotrophic and extremely oligotrophic classes. The area is into the 5th class of pretability that comprise terrains with very severe limitations, unpretable for agriculture purpose in terrain undevelopment conditions and for valorification there are necessary the application of agropedireliability works.*
Keywords: *soil, sugar, pretability, fertility, troficity index.*

Rezumat. *În lucrare se prezintă studiile realizate în vederea stabilirii stării de calitate şi de pretabilitate, pentru arabil a solurilor din zona "iazului de decantare" aferent unei fabrici de zahăr din România. În acest scop, au fost executate 3 profile de sol iar din fiecare profil au fost recoltate câte 3 probe de sol în vederea determinării principalelor caracteristici fizico-chimice. Fiecare profil a fost cercetat direct "in situ" prin metode pedologice specifice, fiind identificate 2 clase de sol şi 2 tipuri de sol. Au fost determinate de asemenea, notele de bonitare precum şi fertilitatea solului redată prin indicele de troficitate. Rezultatele obţinute au arătat faptul că solurile analizate au un indice de troficitate scăzut încadrându-se în clasele oligotrofic şi extrem oligotrofic. Zona se încadrează în clasa a V-a de pretabilitate, cuprinzând terenuri cu limitări foarte severe, nepretabile pentru arabil în condiţii de neamenajare iar pentru valorificare se impun aplicarea de lucrări agropedoameliorative.*
Cuvinte cheie: *sol, zahăr, pretabilitate, fertilitate, indice troficitate.*

INTRODUCTION

The Romania adhesion to U.E. had imposed the harmonization of its politics with European ones in all fields of activities. Towards this the Romanian

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standards, the projects, the studies and the investigations from environmental protection field, of the natural resources, of infrastructure, etc. constitutes country integration measures into the European system of values.

One of the most important objectives of the European objectives is constituted by the conservation and the turning into advantage of the natural resources of each country. The rehabilitation of the degradation terrains and the turning into advantage to high cotes of the existent ones there are line up as a strategic importance objectives for our country.

The alimentary industry which use, most of the time, raw materials without a pollution character and there are, also presently, a recuperation – turning into advantage system of the raw material (most of it of organic nature) constitutes the technological sludge: the deposit in order to dehydrate and compost in so cold "fields" or "lakes" of sludge. After dehydration and compost (decomposed), the deposit sludge can be used as a agricultural fertilizer.

In our country and also in the world it exists a large number of terrain and laboratory investigations which aimed the solutions finding for reliability for agricultural purpose of the ash and cinder deposits of the electro – thermal central Rovinari (Fodor and Lazar, 2006; Racoceanu et. al., 2012), of deposits of mining tailings (Dunca and Ciolea, 2013).

The paper comes with another problem: the deposit which contain these kind of sludge, which were not turned into advantage, through time, can they be rehabilitate today for agricultural purpose?

For the application of one of the methods of rehabilitation we must accuracy know the physic – chemical characteristics from pedologic point of view, and to make a soil bonity exposed to the rehabilitation. This main objective is carried on in the paper for an auxiliary sludge deposit (lake) of a sugar beet factory.

MATERIAL AND METHOD

The studied area is placed to western of Cordun town, Neamt district, being characterized by continental climate, with temperate nuances and belonging, from geomorphologic point of view, to the Moldavian chute. From hydrographic and geomorphologic point of view the area is placed on the second terrace of Moldova river, left tributary of Siret river. The studied area can't be flooded even to overflows at overturn probability of 1%. From geologic point of view the area belongs to the central sector of Moldavian platform. From hydrogeologic point of view the phreatic water is placed to variable depths depending on the distance to the river: nearby the river the phreatic water depth is 5 m and in Cordun locality the phreatic water depth is 3 m.

From agricultural point of view the area is used as a paddock.

In this area there exist a 24.45 ha (fig. 1) area which belongs to S.C. AGRANA ROMANIA S.A. which was used for 50 years long for depositing the soil sludge, a result of the washing the sugar beet and the carbonate sludge, a result of the sugar

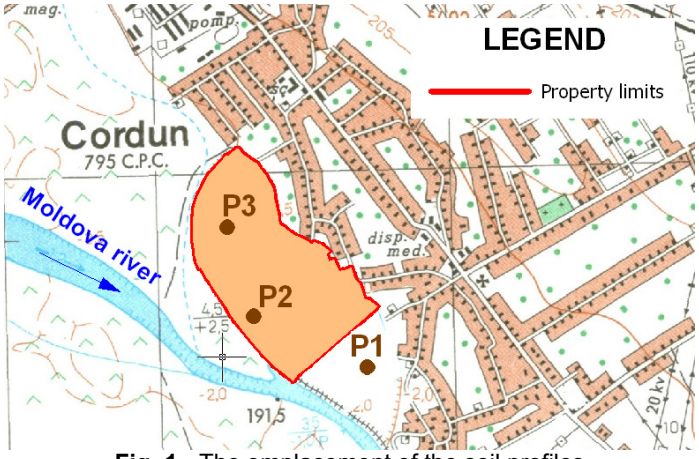

Fig. 1 - The emplacement of the soil profiles

For this terrain (actually a depositing lake), it was taking the problem of determining the classes and the types of soils, for which, finally, within the physic – chemical characteristics analysis determined in laboratory to be indicated the fertility of the soils, synthetic expressed by the trophicity index.

Towards this, as it can be observed in fig. 1, it were made 3 soil profiles (P1, P2 and P3), and from each profile were assay 3 soil samples as it follows:

- profile 1 (P1) placed in the control area – from depths of 10, 25 and 45 cm;
- profile 2 (P2) placed on the south – west area of the deposit - from depths of 20, 55 and 80 cm;
- profile 3 (P3) placed on the north area of the deposit – from depths of 15, 40 and 80 cm.

Each profile was investigated "in situ" through specific pedologic methods and the assayed nine samples of soil from the terrain were analyzed in laboratory and it were determined the following parameters: pH, carbonates, humus, total nitrogen, phosphorus, mobile potassium, aggregate grading and apparent density.

It was also determined the trophicity index (T_p), being used the following equation (Chirita, 1974):

$$T_p = \Sigma t_p = \Sigma (H \cdot d \cdot V \cdot 0.1 \cdot R_V)$$

In which: H is the humus content (%);
d – the horizont thickness (dm);
V – the base saturation level (%);
R_V – the ratio between the fine soil volume (without skeleton and roots etc.) and the total soil volume.

RESULTS AND DISCUSSIONS

The made terrain studies have marked out the following pedologic characters aspects:

- *In profile 1 area (P1) - control*

Type of soil: Aluviosol calcurus - prundic.
Thichness: superficial moderate (symbol d_2/MS, cod 035).
Identified hirizonts: *Aok (0-10 cm), ACRk (10 – 35 cm), CRk (sub 35 m).*

It is characterized by the following equation:

$$ASka - pr\frac{K_1 - d_1 - \frac{s}{sq_2} - \frac{Tfmg}{NB} - A}{C - OC - P_{01} - 0 - X_3 - Q_6}$$

- *In profile 2 area (P2)*

Type of soil: Technosoil mixtic – clinogleic - calcic

Thickness: profundity moderate (symbol d_4/MP, cod 088).

Identified horizonts: *Sludge (0-30 cm), A1 (30–60 cm), AC (under 60 cm).*

It is characterized by the following equation:

$$TTmi - cl - ca\frac{G_6 - W_6 - K_1 - \frac{t}{a} - \frac{Tfa}{NB} - A - C_{63}}{C - OC - P_{01} - 0 - Q_6}$$

- *In profile 3 area (P3)*

Type of soil: *Technosol mixtic-clinogleic-calcic.*

Thickness: *Profundity moderate* (symbol d_4/MP, cod 088).

Identified horizonts : *Ao (0 – 18 cm), $CaCO_3$ (18 – 24 cm),ACk (24 – 45 cm),$CaCO_3$, (45 – 63 cm),Ck (63 – 70 cm),$CaCO_3$ (70 – 90)* şi *Cca (under 90 cm).*

It is characterized by the following equation:

$$TTmi - cl - ca\frac{G_6 - W_3 - K_1 - \frac{s}{u} - \frac{Tfm}{NB} - A - C_{63}}{C - OC - P_{01} - 0 - X_3 - Q_6}$$

Laboratory tests performed on the 9 (nine) of soil samples revealed the physical and chemical characteristics shown in Table 1.

To calculate the bonity notes from the many environmental conditions that characterize each field unit (UT or TEO) defined in the pedological studies were chosen only those considered most important, easier and more accurately measurable that is (in brackets show the indicator according to Teaci, 1980: 1-the average annual temperature, corrected values, (3C); 2-the average annual precipitation, corrected values, (4C);-the gleyzation, (14);-the pseudogleyzation, (15);-the salinization or alkalization, (16) or (17);-the texture in Ap or in the top 0-20 cm, (23A);-the pollution, (29);-the gradient (33);-the landslides, (38);-the groundwater depth, (39);-the inundability, (40);-the total porosity in the restrictive horizon, (44);-the total $CaCO_3$ content in the 0 + 50 cm, (61);-the reaction in Ap or in the top 20 cm, (63);-the degree of base saturation in Ap or in the top 0-20 cm, (69);-the edaphic volume, (133);-the humus reserve in the 0-50 cm layer, (144);-the excess surface moisture, (181).

The detailed analysis of all these environmental conditions led to the following results regarding the trophicity:

- *the territorial unit from the control area (P1):* the potential trophicity index has the value 19.03 and the soil comply into *oligotrophic* class (OL simbol, 023 cod), because of the thinness of the soil profile and the low quantity of humus;

Table 1

The physico-chemical properties of the soil profile

Profile	Horizon	Depth (cm)	pH	$CaCO_3$ (%)	Humus (%)	Nt (%)	P (ppm)	K (ppm)	Sampling humidity (%)	Granulometry					DA
										Sand		Dust (%)	Clay		
										Coarse sand (%)	Sand (%)		Clay (%)	Natural clay (%)	
1	Ao	1 - 10	7.79	3.32	10.00	0.618	524.6	300	24.50	10.8	48.10	24.00	17.1	30.6	1.15
	ACR	15 - 25	7.32	2.61	4.36				22.45	25.7	46.50	12.50	15.3	22.1	
	CR	35 - 45	7.83	7.35	3.76				19.75	14.7	48.50	17.30	19.5	29.9	
2	Sludge	10 - 20	7.95	2.69	14.36	0.680	303.5	2750	78.30	0.1	34.00	28.60	37.3	55.9	
	Al	45 - 55	7.97	16.84	6.48				36.20	0.1	23.10	25.50	51.3	68.9	
	AC	70 - 80	8.35	39.42	4.24				40.00	0.9	48.90	19.40	30.8	43.2	
3	Ao	5 - 15	8.14	40.32	4.42	0.227	381.9	700	31.75	0.1	63.8	20.10	16.0	25.8	1.13
	AC	30 – 40	8.42	34.94	2.12				33.00	0.8	80.0	10.10	9.1	12.5	1.12
	$CaCO_3$	70 - 80	8.42	68.10	1.70				47.25	shows no silicate solid phase					0.79

- *the territorial unit from the profile 2 area (P2):* the potential trophicity index has the value 12.15, and the soil comply into *extremely oligotrophic* class (EO simbol, 0008 cod), because of the thinness of the soil profile and the very low quantity of humus;

- *the territorial unit from the profile 3 area (P3):* the potential trophicity index has the value 5.64, and the soil comply into *extremely oligotrophic* class (EO simbol, 0008 cod), because of the thinness of the soil profile and the very low quantity of humus.

CONCLUSIONS

As a result of the studies presented in this paper, we came to the following conclusions:

1. On the analyzed site were identified two soil classes, respectively, protisoils and antrisoils class, and two types of soil, respectively, aluviosoil and tehnosoil according to Romanian System of Soil Taxonomy (SRTS) (Florea et al., 2012).

2. The trophicity index in the deposit area of the earth sludge and the carbonate sludge is very low determining the soil class as *extremely oligotrophic.* And the soil from the control area is characterized as being *oligotrophic.*

3. The area is into the 5th class of pretability that comprise terrains with very severe limitations, unpretable for agriculture purpose in terrain undevelopment conditions.

4. In order to valorificate the soil are necessary the application of agropedireliability works (Cojocaru and Statescu, 2014) that will determine the switching field tested in a higher class of pretability.

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