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Pedological studies and agricultural development in hydrographic basin Barcau

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Abstract: This paper presents the steps necessary to execute a pedological study for agricultural development in the hydrographic basin Barcau. First you have made soil profiles to complete existing soil studies, but incomplete. From these profiles are collected soil samples in natural and modified structure for determining the main properties of soil. To determine cultures suitability on existing soil types in that area were calculated evaluation notes in natural conditions and their potentiation by land reclamation works.

Keywords: pedological studies, land evaluation, capacity and soil suitability

1. INTRODUCTION

Soil studies can be:

- General pedological studies aimed knowledge of soil cover and processes of pedogenesis and soil relations with the environment and which presents the soil data in a generalized form and adapted to the objective and or established purpose;

- Special pedological studies that solve some concrete needs to be performed on existing pedological studies and involves interpretation or evaluation of pedological materials.

They must deal with two issues. The first issue concerns the need for improvement works and the second relates to the suitability of land for respectively performance improvement work.

This paper presents the pedological study for improvement works against soil erosion in the catchment Barcau, study had the following purposes:

- execution of soil profiles to complete existing soil studies and preparation of soil map;

- sampling of soil profiles to determine in the laboratory the main pedological parameters design. They are: size composition (texture), hydraulic conductivity, plasticity index, stability index of mole drains, and field capacity for water, total capacity and aeration porosity.

- developing recommendations for setting optimal soil suitability land cultivation and fundamentation direction of evolution of soil in conditions of arrangement through land reclamation works.

2. MATERIAL AND METHOD

To solve the objective of studying soil profiles has followed the methodology recommended by the ICPA Bucharest by "Development methodology soil studies" and Romanian System of Soil Classification in 2003.

Soil samples were collected both natural structure and the modified structure at depth of 0-50 cm and 50-100 cm.

On soil samples collected in the modified structure were determined:

- size composition, sedimentation method, pipetting;
- soil density by pycnometer method;
- plasticity index by Casagrande method;
- mole drains index;

On soil samples collected from the natural structure were determined:

- apparent density of the metal cylinder;
- total porosity and aeration, by calculation according to the relation 1 and 2:

$$PT = [1 - \frac{DA}{D}]100 \quad (\%) \qquad (1)$$

$$PA = \frac{Va}{Vt}100 \quad (\%) \qquad (2)$$

where: PT - total porosity, %
DA - apparent density, g/ cm^3
D - density, g/ cm^3
PA - aeration porosity, %
Va - volume of pore air, cm^3
Vt – total volume, cm^3

- humidity in the metal cylinder;
- field capacity by suction (pF 2.53);
- total capacity by suction (pF 0.01);
- saturated hydraulic conductivity, through permeability meter method with constant gradient;
- the degree of settling, by calculation using relation 3:

$$Gt = \frac{PMN - PT}{PMN}100 \quad (\%) \qquad (3)$$

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where: Gt - degree of settling, %
PMN - minimum porosity required,%
PT - total porosity,%

3. RESULTS AND DISCUTIONS

a). Soils cover in the study area consists of the following main types of soil (table 1).

Table 1. Soil types

Nr. crt.	Soil type and subtype name	
1.	Typical Preluvosol	ELti
2.	Mollic Preluvosol	ELmo
3.	Stagnic Luvisol	LVst
4.	Salinic Solonetz	SNsc
5.	Gleyic Vertosol	VSgc
6.	Mollic-gleyic Fluvisol	ASmogc
7.	Vertic-gleyic Fluvisol	ASvsgc
8.	Erodosol	ER
9.	Stagnosol-Eroded phase	ERst
10.	Pelic stagnosol- Eroded phase	ERpest

b). The main properties of mollic gleize aluviosol from which soil samples were collected are shown in Tables 2 -5.

Table 2. Size composition, %

Granulometric fractions, %	Depth, cm	
	0 -50	50 -100
Coarse sand 2-0,2 mm	1,758	1,680
Fine sand 0,2-0,02 mm	43,842	50,370
Dust I 0,02-0,01 mm	11,400	7,000
Dust II 0,01-0,002 mm	12,050	10,900
Clay <0,002 mm	30,950	30,050
Textural class	loamy	loamy

Table 3. Physical and hydro-physical properties

Properties		Depth, cm	
		0-50	50 -100
Humidity, %		20,0	21,4
Apparent density	g/cm^3	1,57	1,47
	appreciation	high	moderate
Field capacity	%	27,3	27,7
	appreciation	high	high
Aeration porosity	%	1,46	4,78
	appreciation	very small	very small
Total capacity	%	36,3	36,9
	appreciation	high	high
Total porosity	%	40	46
	appreciation	middle	middle

Table 4. Physical and hydro-physical properties

Properties		Depth, cm	
		0-50	50 -100
Capacity Draining, %		9,0	9,2
Hydraulic conductivity	mm/h	1,985	3,074
	appreciation	small	middle
Degree of compaction	%	16,37	8,71
	determining scarifying need	urgency 2	urgency 3

Table 5. Stability mole drains

Properties		Depth, cm
		50 -100
Plasticity index	%	11,07
	appreciation	mole drains haven't stability
Mole drains index	%	0,0081
	appreciation	mole drains not working

Loamy texture, due to the sand, dust and clay approximately equal, gives good physical and chemical soil properties and create optimal relationships with soil water and air.

Physical characteristics such as total porosity, apparent density and degree of compaction have medium values, ensuring good water movement in soil and large quantity of water available to plants.

Apparent density is affected by soil structure, respectively as compaction is increasing and/or decreasing and as the characteristics of contraction - inflation occurs in the soil.

Knowing the apparent density allow calculating the settling degree of soil and total porosity. The depth of 0-50 cm soil is moderately settling, which means the urgency 2nd of the scarifying need and to depth of 50 -100 cm poorly compacted soil that qualifies in 3rd urgent scarifying need.

Because soil is moderate - low settling, drain ability is upper to critical limit of 6-7% i.e. reaching values of 9.0 to 9.2%.

Hydraulic conductivity of soil property to let water pass through it under the influence of potential differences of the water. If an environment saturated soil moisture is equal to the total capacity for water.

It is closely related to apparent density and degree of soil settling.

c). Soil suitability for crops and capacity for land reclamation works was estimated on the basis of land evaluation studies.

Land evaluation of agricultural land is a complex knowledge operation of the conditions for growth and development of plants. Also, land evaluation it determines the suitability degree of land for specific crops or categories of use, through a system of technical indicators and land evaluation notes.

Agricultural plant productivity depends on environmental conditions (relief, climate, hydrology, soil) and human influence can better alter the natural factors or plant characteristics. Of the conditions chosen to assess the production capacity of agricultural land most important are: the conditions of relief, climate, hydrology and physico-chemical characteristics of the soil.

Table 6. Land evaluation notes and potentiation through land reclamation works

Soil type	Culture					
	Corn		Maize		Trefoil	
	initial	after fitting	initial	after fitting	initial	after fitting
Tipic Preluvosol, ELti	52	62	46	60	30	36
Mollic Preluvosol, ELmo	73	80	73	80	58	64
Stagnic Luvisol, LVst	73	80	73	80	58	64
Salinic Solonetz, SNsc	13	14	7	8	6	7
Gleyic Vertosol, VSgc	45	72	54	81	43	60
Mollic Gleyic Fluvisol, ASmogc	52	73	58	70	47	66
Verti Gleyic Fluvisol, ASvsgc	58	64	57	63	45	50
Erodosol ER	31	40	21	32	26	34
Stagnosol eroded phase ERst	37	48	33	46	23	30
Pelic Stagnosol eroded phase, ERpest	34	44	26	36	21	27

Soil suitability for use and culture is expressed through notes of land evaluation in natural conditions and empowering land evaluation notes in the case of land reclamation works and reclamation technologies.

Note of land evaluation is calculated multiplying the coefficients product by 100 of the 17 indicators directly involved in establishing land evaluation notes (equation 4).

$$Y = (X_1 \cdot X_2 \ldots\ldots\ldots\ldots X_{17}) \cdot 100 \qquad (4)$$

where: Y – Note of evaluation

$X_1 \cdot X_2 \ldots\ldots\ldots\ldots X_{17}$ - coefficients of the 17 indicators

Coefficients of the 17 indicators varies from 0 to 1, respectively 0 when property is totally bad and 1 when property is optimal for use or culture taken into account.

If an indicator is 0 for plant considered, resulting grade 0, this excludes that culture from the evaluated land.

Calculation of average production per hectare for each evaluated plant is based on land evaluation marks given in relation to the technology level that can provide at a time and determines the productive capacity for each point of land evaluation.

Achieving improvement works corrects negative properties of land so that there appears a need of annihilation or reduce penalty made for a property of unimproved land, operation called potentiation of land evaluation.

Potentiation consists in increase the land evaluation coefficients of properties on which are acting by having improvement works with lasting effect.

Given that the area will perform land reclamation works such as surface drainage, deep drainage, flood control, prevention and control of soil erosion, scarification and amendment of calcium, the land evaluation notes were potentiated for wheat, corn and clover.

Drainage eliminates water stagnation on surface and cancel or reduce penalties introduced for precipitation, surface moisture excess and stagnogleyzation.

Drainage cancel penalty for groundwater depth and decreases the penalty for gleyzation.

Damming defense land of flood and cancel penalties for flooding through coefficients between 1 and 3.3.

Preventing and erosion control reduces the penalty for slope and landslides.

Scarification, which increases porosity, modifies note of land evaluation by multiplying the total porosity coefficient with 1 -1.1.

Amendment of calcium, which corrects extreme acid pH, is potentiation through coefficients between 1-9.

Marks obtained in natural and potentiated conditions for the existing soil types are presented in Table 6.

It appears that after potentiation, soil wins fertility by 5-10 points, making it good for basic crops such as wheat, corn and clover.

Based on the maps with soil units and table their evaluation notes is made soil suitability maps by use or crop, grouping land evaluation marks from 10 to 10 points, in cause of detailed maps, or from 20 to 20 points in cause of synthetic maps. These maps allow zoning and microzoning of land. In our country there are 115 microzones characterized in terms of soil types, climatic factors and the relief.

d). Evolution of soils from hydro-ameliorative systems is conditioned by many factors such as: natural conditions in which the hydro-ameliorative system is, type and quality of improvement works and hydro-ameliorative systems operating mode.

Natural conditions play an important role in soils evolution because they can lead to salinization processes development, sodiumisation, swamp formation etc.

Regarding the type and quality of improvement works, it is known that regulation of hydric regime of soils with excess moisture can be done by executing of surface and subsurface drainage systems. Effect of surface and subsurface drainage works and therefore soil development depend on the following elements: surface and subsurface drainage network type, its density, depth drainage, etc.

Hydro- ameliorative system operating mode is of particular importance because it relates how it is controlled and adjusted the water from soil. Thus, the effectiveness of surface and subsurface drainage systems depends on the operating and network maintenance mode. Negative consequences on soil evolution reach also through poor maintenance and operation of dams and areas.

Cultivated plants influence the evolution of land by the accumulation process, by bringing in the surface horizon of soil nutrients and by protecting the soil of physical and mechanical negative effects of water.

Also presents importance the agrophytotechnical measures applied.

The forecast soils require research on degree of natural drainage of territory, basement lithology, hydro-physical properties, the initial degree of salinity of the soil - parent material – groundwater system, hydrogeological forecast, water balance, critical depth of marsh and salinity.

Because for the development forecast through fluid balance method or modeling are not sufficient data and there is not pedohidrogeological standing may be used only pedo-ameliorative analogy method, given the existence in the area of some territories with similar conditions furnished.

The hydro and pedo- ameliorative works that will apply will produce positive changes in the evolution of stagnic luvisol that after amendment of calcium and surface and subsurface drainage works gradually move in preluvosol.

Mollic gleyic and vertic gleyic Fluvisol can evolve after drainage and scarification works in mollic alluvisols and chernozems.

Erodisols stagnic will evolve after measures to prevent and combat soil erosion and ameliorative fertilization, to preluvisols.

4. CONCLUTIONS

1). Soils from studied catchment, from group of stagnic Luvisols require adjustment works of aerohidric regime such as drainage in ditches, gutters and mole drainage. These works will be carried out on land previously leveled.

2). Stagnic luvisols requires amendment with calcium.

3). Gleyic Fluvisols with the shallow layer pedofreatic require drainage works.

4). Preluvisols, although moderate clay content (30%) have advanced compaction (high apparent density, 1.47 to 1.57 g/ cm^3), a poor aeration (aeration porosity is extremely low with values of -1.46% and 4.78%) and a high degree of settling (16.3%).

Therefore, for these soils is recommended scarification to 0.7 m because mole drains not working (Idc = 0.008). Through this ameliorative work aims to increase permeability.

5). For the area occupied by erodisols are proposed complex works of arrangement against erosion.

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