

Soil quality in the Gurahont depression

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Abstract Soil reaction in the Gurahont Depression is as follows: of the 8,938 ha of arable land, 1,609 (18%) are acid, 5,810 ha (65%) are less acid, 536 ha (6%) have a neuter reaction and 983 ha (11%) have an alkaline reaction.

In this paper, the authors present the eco-pedologic features of two types of soil representative for the agricultural area of the Gurahont Depression: typical luvosoil, moderate stagno-gleyed, medium clay/loamy-clayish on altered disaggregated materials in situ very fine not carbonated and entic-gleyic aluvisoil, strongly gleyed, sandy/clayish/clay-sandy, on coarse not carbonated fluvial materials.

Key words

soil, features, types, profile, content

The interaction of natural factors together with local economic factors have resulted in pedogenetic processes and, implicitly, in soil.

Under the strong impact of local factors (rock, relief, water table), pedogenetic processes in the area differ from those of other areas. On greater slopes, the relief has a decisive role in the genesis of the eroded soils and of the poorly evolved soils since drainage water from the slopes also carried soil on the slopes. On the slopes there are, besides the solidification and erosion processes, antagonism whose result is – or should be – balance. Erosion can maintain at a certain level, it can withdraw, or it can advance depending on the ratio between the constructive force of the solidification and the destructive force of the water [1].

Soils formed on crystal rocks are skeleton soils: lithosoils, mountain soils eroded differently and podzoles differently, superficial or little deep, in which the fragmented crystal rock is along the entire profile based on the massive rock [2].

In the flooded meadows and valleys, the predominating pedogenetic factor is the lithologic material represented by alluvial deposits, alone or mixed (alluvo-colluvo-proluvial), but only when the impact of the water is low. Depending on the age of these deposits, there are alluvial soils at different stages of humidification and of different depths. The soils thus formed are productive soils, due rather to the good physical features than to food reserves for the plants [3].

Along the valleys and flooding meadows with excess moisture, soil genesis is determined by the amount of water in the soil. Soils thus formed are gleyic or stagno-gleyic. When the level of the water table affects the entire profile and not only its lower part, the soils are stagno-gleyic, and when the lower

part of the profile is affected by the water table and the upper part is affected by surface waters from precipitations and from lateral drainage, soils are gleyic.

Material and Method

The characterisation of the physical state, as well as the agro-chemical characterisation of the soils was done according to the Romanian System of Soil Taxonomy (SRTS- 2003).

From the point of view of the physical state, soils are analysed through the prism of the following features:

- soil granulometric composition or soil texture;
- compactness, i.e. the setting degree or apparent density;
- potential aeration, total porosity, and aeration limit;
- water content, plant water availability at different levels, and water reserve;
- soil water permeability or saturated hydraulic conductivity;
- hydrostability of structural aggregates, dispersion, and structural instability indicators.

From an agrochemical point of view, we have taken into account the following features:

- soil reaction (pH in water solution);
- humus content;
- macronutrient content: phosphorus and mobile potassium, total nitrogen.

The characterisation of the physical state, as well as the agro-chemical characterisation of the soils was done according to the Romanian System of Soil Taxonomy (SRTS- 2003).

Results obtained

The types of soil formed in the Gurahont Depression according to the Romanian System of Soil Taxonomy (SRTS- 2003) and to the data from the Pedologic Institute in Arad (Arad County) can be grouped into 6 classes, 9 soil types, 18 soil subtypes and into numerous other varieties and units

distinguishable due to their features, productive ability, and soil fertility maintenance and improvement measures.

The soil map containing all the types and subtypes of soil on the 7,147 ha of agricultural land of the Commune of Gurahont is shown in Table 1.

Table 1

Types and subtypes of soil on the agricultural land of the Commune of Gurahont

Soil type	Area (ha)	Share (%)
Lithosoils	864.79	12.1
Alluviosoils	1493.73	20.9
Redzines	7.15	0.1
Eutricambosoils	879.52	12.3
Preluvosoils	857.64	12
Luvosoils	2365.65	33.09
Gleysoils	121.5	1.7
Stagnosoils	135.79	1.89
Erodosoils	421.68	5.9
Total area	7147.45	

Typical luvosoil, moderate stagno-gleyed, medium clay/loamy/clayish on altered disaggregated materials in situ very fine not carbonated .

Formula: LV ti - W₃- 42/61- 122₆₀

Location: about 0.7 Km SV from Bonțești

Relief: high terrace, undulated plane

Parental material: altered disaggregation material in situ

Water table: 5.1-10.0 m.

Bioclimatic area: oak forest area

Natural drainage: slow

Vegetation: *Agrostis tenuis*, *Anthoxanthum odoratum*, *Festuca rubra*,

Use: arable

Soil chemical features

Low pH values in the processed stratum (pH = 5.2 moderate acid) show a rather strong debasification. Deep down in the soil, pH values oscillate within normal limits for parental materials in the area (Table 1).Hydrolytic acidity (SH) has medium values within

the interval 0-40 cm and very high values within 40-80 cm, the sum of the changeable bases (SB) presenting very low values within 0-30 cm and medium values within 40-165 cm (Table 1).

In the research profile, the values of the base saturation degree of 57-73% range the soil in the class of mesobasic values, while the values of the base saturation degree of 77-9-% (Table 1) range the soil in the class of eubasic values.

Soil humus content differs according to both climate conditions and the entire complex of pedogenetic factors. Thus, depending on the granulometric composition and on the mineralogic features of the humus content of the studied profile , it has medium values within 0-30 cm and low values within 30-40 cm.

As for the content in phosphorus of the studied profile, it has values that ensure a medium supply of the interval 0-40 cm . Potassium is represented by amounts that ensure a medium supply within 0-40 cm.

Table 2

Chemical features of the typical luvisoil moderate stagno-gleyed medium clay/loamy-clayish on altered disaggregated materials in situ very fine not carbonated

Depth (cm)	Pedogenetic horizon	pH in H ₂ O	CaCO ₃ %	SB me/100 g sol	SH me/100 g sol	V %	Humus	Mobile P ppm	Mobile K ppm	Na% T	Salts mg/100g sol (1:5)
0-16	Ap	5,2	-	5.07	5,6	57	2,26	34	110	-	-
16-30	Atp	5,2	-	5.73	5,9	59	2,02	30	70	-	-
30-40	Elw ₂	5,2	-	9.07	7,2	67	1,09	28	78	-	-
40-57	EBw ₂₋₃	5,4	-	15.56	10,0	73				-	-
57-80	Bt1yw3	5,6	-	18.23	10,2	77				-	-
80-103	Bt2yw ₃₋₄	5,8	-	16.62	6,9	85				-	-
103-165	BCw ₃	5,8	-	16.62	6,9	85				-	-
165-200	Cw ₃	5,9	-	20.62	6,9	90					

Soil physical features

Soil texture in the research profile is medium clayish (LL) within 0-30 cm, medium clayish-sandy

(SM) within 30-40 cm, medium clayish-loamy (TT) within 40-57 cm, loamy-clayish (AL) within 57-200 cm

Table 3

Typical luvisoil moderate stagno-gleyed, medium clay/loamy-clayish on altered disaggregated materials in situ very fine not carbonated

Horizon	Ap	Atp	Elw ₂	EBw ₂₋₃	Bt1yw3	Bt2yw ₃₋₄	BCw ₃	Cw ₃
Depth (cm)	0-16	16-30	30-40	40-57	57-80	80-103	103-165	165-200
Skeleton % (above 2 mm)	-	-	-	-	-	-	-	-
Coarse sand % (2-0.2 mm)	2,77	2,89	4,22	2,07	1,80	1,78	2,02	1,60
Fine sand % (0.2-0.02 mm)	38,80	39,01	42,25	35,33	22,60	19,40	19,43	24,40
Dust I and II % (0.02-0.002 mm)	31,60	32,40	32,68	29,50	27,80	27,70	29,21	27,70
Loam % (below 0.002 mm)	26,83	25,70	20,85	33,10	47,80	51,12	49,34	46,30
Texture	LL	LL	SM	TT	AL	AL	AL	AL

Entic alluviosoil strongly gleyed sandy-clayish/clayish-sandy on coarse not carbonated fluvial materials

Formula: AS en-gc- G4- 22/32- 212₀₁

Location: about 0.4 Km E from Pescari,
Crişului Alb flooding meadow
Relief: flooding meadow, plane-undulated
Parental material: coarse not carbonated
fluvial material
Water table: 1.1-2.0 m
Natural drainage: imperfect
Bioclimatic area: area of flooding meadows
(*Salix* sp., *Populus* sp.)

Vegetation: *Setaria viridis*, *Agropyron repens*,
Digetaria sanguinalis, *Festuca pseudovina*, and
Agrostis tenuis
Use: arable
Soil chemical features
The values of pH within the first 18 cm (pH =
5.8 moderate acid) shows a rather strong
debasification. Deep in the soil, the values of pH (pH =
5.9-6.0 low acid) oscillate within normal limits for the
parental materials in the area (Table 4).

Table 4

Chemical features of the entic alluviosoil strongly gleyed sandy-clayish/clayish-sandy on coarse not carbonated fluvial materials

Depth cm	Pedogenetic horizon	pH in H ₂ O	CaCO ₃ %	SB me/100 g sol	SH me/100 g sol	V %	Humus	Mobil e P ppm	Mobil e K ppm	Na % T	Salts mg/100g sol (1:5)
0-9	Atel	5,80	-	12,80	6,9	78	2,25	38	250	-	-
9-18	Ao	5,85	-	17,45	6,4	88	1,74	38	200	-	-
18-35	C	6,00	-	23,60	7,9	90	1,59	36	280	-	-
35-70	Cg ₃	6,00	-	23,60	7,9	90	1,33	41	300	-	-
70-95	Cg ₃₋₄	5,90	-	22,40	8,6	87		32	250	-	-
95-135	Cg ₄	6,00	-	23,60	7,9	90		8	140	-	-
135-200	Cg ₄	6,10	-	25,60	7,9	92		8	140	-	-

Content of calcium carbonate is absent within 0-200 cm, as shown in Table 4.

Hydrolytic acidity (SH) has high values within 0-200 cm, and the sum of the changeable bases (SB) has medium values along the profile.

In the studied profile, despite the fact that there are base saturation degrees of 78-90%, its values on the whole range the soil in the eubasic value class (Table 3).

Table 5

Physical features of the entic alluviosoil strongly gleyed sandy-clayish/clayish-sandy on coarse not carbonated fluvial materials

Horizon	Atel	Ao	C	Cg ₃	Cg ₃₋₄	Cg ₄	Cg ₄
Depth (cm)	0-9	9-18	18-35	35-70	70-95	95-135	135-200
Skeleton % (above 2mm)	-	-	-	-	-	-	-
Coarse sand % (2-0.2 mm)	23.10	23.10	25.90	20.10	4.90	12.53	84.62
Fine sand % (0.2-0.02 mm)	56.60	56.60	48.80	56.80	77.60	73.72	4.53
Dust I and II % (0.02-0.002 mm)	9.90	9.90	9.40	10.40	12.80	8.55	6.25
Loam % (sub 0.002 mm)	10.40	10.40	15.90	12.70	4.70	5.20	4.60
Texture	UM	UM	SM	SM	NM	NM	NG

Soil humus content differs depending on both climate conditions and on the entire complex of pedogenetic factors. Thus, depending on the granulometric structure and on the mineralogic features, humus content of the studied profile (Table 4) has medium values within 0-9 cm and low values within 9-70 cm.

Soil content in P_2O_5 and K_2O as main nutritious macroelements determines together with the other features of the soil, the potential and real fertility levels at a certain point in time. As for the content of phosphorus of the studied profile, it has values ensuring a good supply of the interval 0-95 cm, decreasing gradually down to a very low supply within 95-200 cm (Table 4).

Soil potassium reaches amounts that ensure a very good supply within 0-95 cm and a good one within 95-200 cm.

Soil physical features

Soil texture in the studied profile is medium sandy-clayish (UM) within 0-18 cm, medium clayish-sandy (SM) within 18-70 cm, medium sandy (NM) within 70-135 cm and coarse sandy (NG) within 135-200 cm (Table 5).

Conclusions

In the case of the typical luvisoil moderate stagno-gleyed medium clay/loamy-clayish on altered disaggregated materials in situ not carbonated very fine, the rather strong debasification is caused by

repeated fertilisations with strong acid physiological reaction.

In the case of the entic-gleyic alluviosoil strongly gleyed sandy-clayish/clayish-sandy on coarse not carbonated fluviatile materials soil reaction has some extra features compared to the soil type, which points out some improper anthropic intervention.

The importance of studying soils derives mainly from their role from the point of view of the amount and quality of agricultural crops, of the state of the entire vegetal cover, of the river, lake, and underground water quality. Due to its features, soil is a true buffer against pollution; it can biologically degrade organic matter and chemical or physical pollutants, it is a regulator of the ratio between water, air and nutrients and a bioregulator of the circuit of matter in nature.

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