

IDENTIFICATION AND CHARACTERIZATION OF SOILS IN LUGOJ AREA, TIMIȘ COUNTY

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Abstract: *The town of Lugoj is situated in the south-west of Romania, where parallel 45°41' north meets meridian 21°53' east, 123 meters above sea level. It covers 9.855 hectares, being the second largest town in Timiș County in what its size, importance and population is concerned. The town was formed on both banks of Timiș River, at the foot of the hills descending from Poiana Ruscă Mountains. The hills are covered by orchards and vineyards. Morphologically, Lugoj area is part of the High Plain of Lugoj and Lugoj Hills, being situated at the confluence of these two units. The town was developed on both banks of Timiș River, more exactly on its lower terrace. The relief unit Lugoj lies on is Lugoj Plain, which reaches deep into the piedmont hills. The average altitude of the area is 124 m above sea level. For the most part, the area the town lies on is flat, with some elevations that do not however exceed 2 to 3 m altitude as against the terrace. To the north-west of the plain there are Lugoj Hills, which make the transition to Poiana Ruscă Mountains. South of Timiș River Valley, Lugoj area stretches to the floodplain of Cernabora, the closest local tributary of Timiș River. The soils in the research area were formed and have developed through the interaction of a complex of pedogenetic factors, among which the relief, the water, the parent rock, the vegetation and human intervention are the most important. In the low plain, Timiș River has played a significant part. Through repeated bed changes and overflows, this river has deposited alluvial material over another material which was in the course of solidification. Thus, soils in this area appear as alternate layers with different solidification degrees. Due to damming, accumulation of new alluvial matter has been stopped, and so the solidification started. These processes that led to the formation of the current soils have been strongly influenced by phreatic water. As the area used to be frequently flooded, the humidity excess frequently prevented oxygen from getting into the soil, and anaerobic microorganisms, in the process of decomposing organic matter, have got oxygen from mineral elements (iron and manganese).*

Key words: *fertility, soil, humus, morphological, material deposited*

INTRODUCTION

Soil is a great treasure for humankind. Therefore, it has to be protected and used rationally, for sustainable use. Besides being the space people settle on, soil is involved in the life of society by being the infrastructure for all other anthropic activities, thus playing a part in fulfilling all society needs and ensuring continuity for life on Earth. It is a limited resource, but at the same time it is one of the most precious things which are indispensable for humankind, as it sustains the life of plants, animals and people.

Proper identification and characterization of the soil allow us to establish the natural conditions of the area under study, if we take into consideration that soil reflects the action of all chemical and physical factors. The study of the natural setting and of the soil is important both for theory, regarding soil genesis, as well as for practice, as it is linked to the yields obtained on a certain type of soil, depending on the natural conditions of the respective area.

The town of Lugoj has two dependent villages, Măguri and Tapia, and together they cover an area of 9.956 ha.

For the characterization of the climate, we used climate data processed in "agro-climatic resources of Timiș County", edited by the National Institute of Meteorology and

Hydrology in Bucharest, as well as some data collected directly from Lugoj Meteorological Station.

The climate in the perimeter under study is moderate temperate continental, with an annual average temperature of 10,7°C.



Figure 1. The geographical position of Lugoj (after <http://www.pescarul.com/judete/timis>)

MATERIAL AND METHODS

Identification of the soils in Lugoj area was performed directly in the field. Their characterization was made in the Soil Science and Agrochemistry laboratories belonging to Banat University of Agricultural Sciences and Veterinary Medicine in Timișoara. We also used other data soil from studies made by OJSPA Timișoara.

RESULTS AND DISCUSSIONS

The total area under study is 8.805 ha, including the inhabited area, being divided as follows: 53% arable land, 38% pasture, 5% vineyards, 2% orchards, 2% hay lands.

The main soils we identified are:

1. Preluvisols;
2. Luvisols;
3. Gleysols;
4. Colluvic fluvisols.

1. Vertic preluvisol

Morphological characterization:

The profile is of the type: **Ao – E1 - EB – Btzy - C**

Horizon Ao – is shorter, of **0-20 cm**, due to limited bioaccumulation processes and to higher content of fulvic acids; its color is light grey-brown; the structure is grainy and the texture is clayish or dusty-clayish;

Horizon E1 - **20-40 cm**, is light grey, brown-yellowish with reddish hues; the structure is dusty and friable due to clay losses through levigation; the texture is dusty-clayish.

Horizon EB - **40-54 cm**, presents a mixture of color - light grey, yellowish brown, angular polyhedral structure; texture clayish loam;

Horizon Btzy - is **120 cm** thick, reddish brown, prism structure; the texture is loamy, with ferromanganese separations;

Horizon C – appears below the level of **180 cm**, is faint; rusty brown, with clayish texture.

The physical and chemical characteristics of Vertic preluvisol are presented in Table 1 and Table 2.

Table 1.

The physical characteristics of Vertic preluvisol

Horizon	Depth (cm)	Coarse sand %	Fine sand %	Dust %	Clay %	DA %
Ao	0-20	1,6	34,2	38,0	26,2	1,58
E1	20-40	2,8	32,7	36,8	27,7	1,43
E/B	40-54	1,3	30,6	31,6	36,5	1,47
Btzy	60-160	0,5	26,3	25,4	47,8	1,41
C	160-180	0,7	26,4	26,3	46,6	1,38

Vertic preluvisol presents clayish or dusty-clayish texture in horizon Ao and loamy in horizon Bt with texture differentiation index of 1,3-1,5 (Table 1.).

Coarse sand content is relatively low, of 0,4-2,8%, which reflects medium-fine texture for the parent material. Fine sand content is 23-34%, with insignificant differentiations between horizons. The lower horizons have a higher content of dust, of 22-39%.

The structure of this soil also undergoes degradation in horizon Ao, being grainy and polyhedral towards the base. In horizon E1, the structure is dusty or lamellar, and in horizon Bt this is prismatic. In this soil, following structure degradation and levigation for a part of the clay-humus complex, the ratio between water and air gets worse.

Apparent density has values between 1,38 and 1,58 g/cm³.

Table 2 presents the chemical characteristics of vertic preluvisol in Lugoj.

Table 2.

The chemical characteristics of Vertic preluvisol

Horizon	Depth (cm)	pH	Humus %	Index N	P mobile ppm	K mobile ppm	SH	SB	T	V%
Ao	0-20	5,45	1,63	0,16	25,6	59	5,55	10,40	15,95	65,20
E1	20-40	5,65	0,66	0,12	2,0	49	5,73	11,00	16,73	65,70
E/B	40-54	5,65	0,49	-	10,4	52	4,97	13,72	18,69	73,40
Btzy	60-160	5,75	-	-	10,3	-	5,91	18,70	24,61	75,90
C	160-180	7,05	-	-	-	-	-	-	-	-

Preluvisol has an acid soil reaction, its pH being 5,45 in the upper horizons and an alkali reaction, pH of 7,05 in lower horizons. The humus content is low, with values between 2 and 2,5%, where fulvic acids predominate, of poor quality and easily soluble.

The P and K supply is medium. The total capacity of cationic exchange has values ranging from 15,95 to 24,61 m.e./100 g completely dry soil.

2. Albeluvisol

Morphological characterization:

The profile for these soils is: **Ao – Ea – EB – Btzy - C**

Horizon Ao – is **15-20 cm** thick, gray in color due to the low content of humus of poor quality; grainy structure, poorly developed with friable aggregates; clayish-sand texture; porous and loose;

Horizon Ea – is **15-30 cm** thick, strongly levigated by mineral and organic colloids; whitish gray in color, due to the residual colloidal silica content and to mineral particles not covered by clay-humic particles; with no structure or lamellar structure; clayish sand texture; porous, with small spots of iron;

Horizon Btzy – is **50-150 cm** thick, color not very well defined (mottled), given by the alternance between colors (yellowish brown, rusty and gray; the texture is clayish or even lighter for the soils formed on coarse material, it presents ferromanganese separations and spots; it is compact and hardly permeable; horizon zy appears;

Horizon EB – is **15-20 cm** thick, represents the transition to the illuvial horizon; yellowish brown with rusty and gray spots; loamy-clay texture, angular polyhedral structure, towards small prism, presents silica powdering, formed on the spot or leaked from horizon Ea;

Horizon C – appears under **2-2,5 m**, being made up of material resulted from weathered rock, frequently lacking carbonates.

The physical and chemical properties of albeluvisol are presented in Tables 3 and 4.

Table 3.

Horizon	Depth (cm)	The physical properties of albeluvisol						PT %	PA %
		Coarse sand %	Fine sand %	Dust %	Clay %	DA %			
Ao	0-20	1,9	33,9	44,0	20,2	1,40	54	23	
Ea	25-55	1,3	36,5	37,2	25,0	1,57	45	10	
EB	55-75	1,2	26,8	30,7	41,3	1,38	45	5	
Btzy	85-185	0,5	22,0	22,1	55,4	1,37	44	5	
C	<2,2	0,8	22,6	26,7	48,5	-	-	-	

The texture of albeluvisol is up to light. Total porosity is medium in horizon Ao and very low in horizon.

Tabelul 4.

Horizon	Depth (cm)	pH	The chemical properties of albeluvisol							
			Humus %	Index N	P mobile ppm	K mobile ppm	SH	SB	T	V %
Ao	0-20	6,75	1,10	0,16	31,7	47	4,02	10,80	18,82	72,87
Ea	25-55	5,40	0,86	0,08	4,1	42	6,75	7,66	14,41	53,15
E/B	55-75	5,30	0,41	0,07	1,3	57	9,40	15,40	24,80	62,09
Bty	85-185	5,90	0,20	-	-	-	8,18	25,28	33,36	75,47
C	<2,2	8,05	-	-	-	-	-	-	-	-

The humus content is 1.5-2%, being dominated by fulvic acids, soil solution reaction is strongly alkaline. Total cationic exchange capacity varies between 10 and 30 m.e./100 g completely dry soil. The base saturation degree is high, and the supply of nutritive elements is very poor.

3. Gleysol

Morphological characterization:

The profile is of the type: **Ao - A/Gox-Gr**

Horizon Ao – is **15-30 cm** thick, grey or brown grey; in some places it is peaty at the surface; grainy or angular polyhedral structure; loamy-clay texture, presents ferromanganese separations and poor gleysation;

Horizon A/Gox – is **40-60 cm** thick, color - olive or bluish -greenish color with rusty or yellowish-rusty spots, with obvious oxidation characteristics, but lighter in color; compact, prism-like, columnoid structure;

Horizon Gr – is over **50 cm** thick, greenish-bluish or bluish-grayish in color, with over 50% reduction colors; presents much more intense aspects of reduction.

Tables 5 and 6 present the chemical and physical characteristics of gleysol.

Table 5.

The physical characteristics of gleysol								
Horizon	Depth (cm)	Coarse sand %	Fine sand %	Dust %	Clay %	DA	PT%	PA%
Ao	0-20	0,1	18,8	48,3	32,8	1,35	-	-
A/Go	20-80	0,1	26,0	47,7	26,2	1,43	-	-
Gr	120-180	4,4	41,7	31,8	19,7	1,51	-	-

Texture varies within relatively large limits, being more influenced by the mineralogical composition of the parent material, being clayish or loamy-clayish. The structure is grainy or angular-polyhedral in Ao horizon, but with lower stability. These are compact soils, with excess humidity, and therefore their air-water regime is lean.

The fraction of coarse sand is relatively low, with values between 0.1 and 4.4%. Fine sand values are between 18 and 42%, with small differences between horizons. The upper horizons present higher content of dust: 44-52%, and the apparent density has values between 1.35 and 1.52 g/cm³.

The reaction of soil solution is low acid, with pH values of 5.0-6.5. Base saturation degree presents low values: 55-70%, while the cationic exchange capacity varies between 20-50 me/100 g completely dry soil. The nutrient supply is poor, and the existent supplies are mobilized hardly, because of the unfavorable air and water regime and of poor microbiologic activity.

Table 6.

The chemical characteristics of gleysol.										
Horizon	Depth (cm)	pH	Carbonates %	Humus %	Pmobile ppm	K mobile ppm	SH	SB	T	V%
Ao	0-20	5,95	-	1,32	0,11	-	-	-	18,7	69,09
A/Gox	20-80	5,90	-	1,19	0,09	-	-	-	23,18	69,19
Gr	120-180	6,00	-	-	0,03	-	-	-	13,81	58,79

4. Colluvic fluvisol

Morphological characterization:

The profile is of the type **Ao - C**

Horizon Ao – 25-30 cm, dark brown when wet and grey when dry; grainy or subangular polyhedral structure, poorly developed; different texture depending on the nature of the alluvial material, with no differentiation per profile

Horizon C – appears over **50 cm** deep, being represented by colluvium, which means non-humus materials resulted from the erosion of certain soils.

Tables 7 and 8 present the properties of colluvic fluvisol in the area under research.

Table 7.

The physical characteristics of colluvic fluvisol								
Horizon	Depth (cm)	Coarse sand %	Fine sand %	Dust %	Clay %	DA	PT %	PA %
Ao	0-30	0,6	20,3	39,9	39,2	1,2	1,41	-
C	60-100	1,1	22,0	33,6	24,5	1,1	1,42	-

The texture is clayish loam, but this depends very much on the nature of the colluvial material. The structure is grainy or polyhedral, not well defined. These are generally poorly

compacted soils, with apparent density of 1,2 to 1,3 g/cm³ and total porosity between 1,41 and 1,53%.

Table 8.

The chemical characteristics of colluvic fluvisol										
Horizon	Depth (cm)	pH	Carbonates %	Humus %	Pmobile ppm	K mobile ppm	SH	SB	T	V%
Ao	0-30	5,30	-	1,5	18,2	121	10,50	13,92	24,42	57
C	60-100	5,90	-	1,8	2,7	51	5,15	9,76	14,19	65

The humus content of colluvic fluvisol is low, 1-2%, and so is the nutritive elements content. The reaction of these soils is acid to alkaline, with pH values of 6,5 to 8,3, being base-saturated, or, in some cases, even debased.

CONCLUSIONS

Most part of the land where the town lies is flat, with some elevations that do not however exceed 2 to 3 m altitude in comparison to the terrace. To the north-west of the plain there are Lugoj Hills, which make the transition to Poiana Ruscă Mountains. South of Timiș River Valley, Lugoj area stretches to the floodplain of Cernabora, the closest local tributary of Timiș River.

The climate is transitional continental, mild, with Mediterranean influences. Precipitations are variable and irregular, the largest quantities being registered in summer. Winds blow predominantly from the north.

The total area of the perimeter under study is 8.805 ha, including the inhabited area, being divided as follows: 53% arable land, 38% pasture, 5% vineyards, 2% orchards, 2% hay lands.

The climate, humidity, rock and even relief have determined the formation of various types of soils belonging to several classes.

Fluvisols cover quite large areas, namely 38,7% of the area under research, with higher concentration on Timiș Valley. These are fertile soils, being used for all agricultural crops, but they are best suited for vegetable growing.

Luvissols are widely spread on high plains. In this category we include the typical luvisols and albeluvisols. In the north, due to excess of humidity, they become gleyed. These have very good fertility, areas covered in such types of soils are used in agriculture for growing crops.

Gleysols are widely spread, being linked to water excess and an elevated level of phreatic water, especially in low plains (Timișului). The low fertility of gleysol is caused especially by the excess of humidity. This limits the placement of agricultural crops on them. Nevertheless, after hydroameliorative works, crops can be cultivated successfully on these soils.

BIBLIOGRAPHY

1. BORZA I.- 1997 – *Ameliorarea și protecția solului*, Editura Mirton, Timișoara, 1997;
2. CANARACHE A. – 1997 – *Însușirile fizice ale solurilor agricole din Banat*, Lucrări științifice SNRSS Timișoara, 1997;
3. DUMITRESCU D. – 1971 – *Lugoj*. Editura Stadion, București, 1971;
4. GOIAN M., IANOȘ GH., RUSU I. – 1993 – *Cercetări asupra evoluției solurilor din Câmpia de Vest*, Lucr. Șt. USAMVB Timișoara, vol.XXVII, partea I, 1993;

5. IANOȘ GH., PUȘCĂ I., GOIAN M. – 1997 – Solurile *Banatului-condiții naturale și fertilitate*. Editura Mirton, Timișoara, 1997;
6. LUCESCU GHE. – 1994 – *Lugojul, vatră a unității naționale*, Ed. Europa Nova, București, 1994;
7. MIHUȚ CASIANA, RADULOV ISIDORA – 2012 – *Științele Solului*. Ed. Eurobit, Timișoara, 2012;
8. POPESCU D. – 1993 – *Ghid turistic Lugoj și împrejurimi* Ed. Fundația Europeană Drăgan, 1993;
9. POSEA GH. – 2009 – *Solurile din partea de vest a României*. Ed. Mirton, Timișoara, 2009;
10. ȚĂRĂU D. ȘI COLAB. – 2007 – *Particularități ale condițiilor ecologice și de restaurare a fertilității solului în vestul României*. Ed. Eurobit, Timișoara, 2007;
11. <http://www.pescarul.com/judete/timis>
12. *** – 2012 – Sistemul Român de Clasificare a Solurilor, ASAS – ICPA, București, 2012.