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ECOPEDOLOGICAL CONDITIONS THAT DEFINE THE LANDS FAVORABILITY FROM TIMIȘ LOW PLAIN FOR THE MAIN CROPS

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Abstract

The purpose of the studies and researches undertaken, over many years, finds its origin in the current increasingly assiduous scientific and practical pursuits, regarding the accumulation of knowledge in the characteristics of the natural environment and its zonal peculiarities, as eco-pedological elements, which define the structure of the edaphic cover and its quality, respectively its favorability for the main cultivated plants, in order to develop sustainable management systems of soil and land resources . The topic covers an area of 39215 ha, located in the Timiș Low Plain, in the western part of Romania. The area taken into account and its zonal peculiarities, determining a great diversity of ecological conditions, generated by the variability of the factors that compete to create the environment in which plants grow and achieve production. It is presented in more detail, the composition of the soil cover, some restrictive characteristics of the quality and suitability of land for certain agricultural uses, with requirements and specific improvement measures and the favorability of arable land for the main cultivated plants.

Key words*: soil, evolution, factor, resource, soil, land, plants.*

INTRODUCTION

Among the determining factors and physical geographical conditions of the environment in which plants grow and bear fruit, the soil presents a major component, having the role, on the one hand, of a complex indicator of the state of evolution of the properties that determine the growth of plants and on the other hand, accumulation of the influence of all other vegetation conditions and factors (Borcean et al. 1996).

Being an open ecological system, it is in close connection with the elements of the surrounding environment, from the immediate vicinity, through a continuous flow of matter and energy, phytocenoses acting on the soil both directly and indirectly (Rogobete et al., 1997).

Numerous studies and researches at the national level have highlighted that there are interdependence relationships between agricultural technological systems of plant cultivation, the state of the environment, the level of economic development and the quality of life (Coste et al., 1997).

Considering these, the paper presents a series of data prepared on the basis of the existing pedological information in the OSPA archive in Timisoara, as well as on the basis of the SPED1 information system and the BDUST-B system (ICPA Bucharest).

Based on the research carried out over time by the authors, within OSPA, ULS (USAMVB) from Timişoara, some aspects related to the pedoclimatic characteristics are also included as elements that define the quality and favorability of soils in order to ensure, for land users, the specialized support for the development of management programs, sustainable use of renewable natural resources (Rogobete et al., 1997).

MATERIALS AND METHODS

The topic addressed refers to an area of 39215 ha (Table1), from which 35223 ha (89.82%) are agricultural lands (28236 ha, respectively 72% being arable land) and 134 ha (0.34%) land with forest vegetation, located in the Low Plain of Timiș, which from an administrative point of view belong to a number of 5 territorial administrative units (ATU) from Timis County.

Table 1. The situation of the land fund (ha)

ATU	Arable	Grass land	Hayfield	Vine yard	Orch ards	Agricul tural
Foeni	4728	931	151	0	6	5816
Giulvaz	7083	1804	20	0	1	8908
Parta	4845	672	42	1	0	5560
Peciu Nou	9113	1959	882	24	210	12188
Şag	2467	216	28	30	10	2751
Totally ha	28236	5582	1123	55	227	35223
%	72.00	14.24	2.86	0.14	0.58	89.82

The research of ecopedological conditions was carried out in accordance with the "Methodology for the Development of Pedological Studies" (vol I, II, III), developed by ICPA Bucharest in 1987, completed with specific elements from the Romanian Soil Taxonomy System (SRTS-2012), as well as other normative acts updated by MAAP Order 223/2002, respectively MADR Order 278/2011, based on the pedological information accumulated in the archive of the Office of Pedological and Agrochemical Studies in Timişoara (over 65 years), but also based on research carried out during to the authors, within OSPA and ULS (USAMVB) from Timişoara, studies that were completed with elements recently collected from the field.

RESULTS AND DISCUSSIONS

The researched area is located in the Banato-Crişana Plain, part of the Western Plain of Romania, in the south-western area of the Timiş Low Plain, respectively in the alluvial plateau of Timiş-Bega interfluvial plain (Ţărău et al., 2018), a unit formed exclusively by the cumulative action of the Timiş river until the contact with the cleared Bega river.

This sector presents itself as an alluvial plain of fluvial-lacustrine subsidence, with beds suspended above the field (raised by the alluvium transported by the rivers that once meandered in the area), and between them, low swampy lands with the underground water close to the surface. The altitude varies between 84 and 90 m, with a very slight slope, the general slope being less than 1%, frequently even below 0.5%. The very weak slope explains the complicated meanders of the rivers of the past, currently regularized and dammed.

The specificity of this sector is the fact that, although macroscopically it appears as a simple and monotonous low plain, in reality it represents a special morphometric, stratigraphic, hydrogeological and pedological complexity, which justifies its similarity, genetically, to a plain of subsidence and hydrographic convergence.

The origin of the plain is attributed to the evolution over time of the Pannonian Depression, whose foundation formed by a massive crystalline block (Tisia), following some vertical movements, predominantly antagonistic, was fragmented into a series of small blocks, which they underwent sinking movements of different intensities.

From a lithological point of view, the researched area is made up of fluvial-lacustrine successive layers with a cross structure, very uneven in thickness and extent, represented by clays, marly clays and sands in which loessoid materials appear. The parental material is represented by fluvial deposits, fluviolacustres, respectively, carbonated clays (rarely non-carbonated), swelling clays. These materials often contain inside them, in addition to plant remains in advanced stages of decomposition, soluble salts (especially sodium), representing one of the causes of the formation of halomorphic soils.

This area is part of the Timiş-Bega hydrographic basin, which crosses it from east to west and drains it for most of the year.

The role of Timiş in feeding the surface water level is manifested only in excessively rainy periods (from the end of winter and the beginning of spring and, less often, at the end of spring).

The old branches and meanders of Timiş have undergone changes following extensive hydro-improvement works (the area is part of the Timiş-Rudna-Caraci hydro-improvement system). So, following the leveling and modeling performed, some of them can no longer be identified on the ground, and others have been arranged, channelized, having the role of collecting surplus water and discharging it into the Timiş river.

The climatic peculiarities of the researched area are determined by its geographical position. So it is characterized by a temperate-continental climate with shorter and milder winters, frequently being under the influence of cyclone activity and air masses crossing the Mediterranean and Adriatic Seas (Berbecel et

al., 1979; Mircov, 2015). Its general features are marked by the diversity and irregularity of atmospheric processes.

The multiannual average temperature is 10.9ºC at the Timişoara Meteorological Station (Mircov, 2015). The multiannual average value of precipitation is 585.8 mm for the interval 1871-1975 (Răuţi station). In the Timişoara municipality area, 600.4 mm was recorded.

Referring to the natural vegetation, which has succeeded until now in the Western Plain of Romania (therefore also to the one in the researched area), CV Oprea et al. (1971), mention the following formations: swamp (today occupying very small areas in depressed areas) and forest-steppe (subjected in recent years to obvious aridification trends, signaled by the increase in the attack of rodents, insects, fungi, etc.).

The predominance of woody plant associations lasted until the 18th century, when a massive deforestation of the forests took place. In the south-eastern vicinity of the researched area, on the territory of Parţa commune, a witness of them was kept, consisting of species such as: *Quercus robur*, *Fraxinus excelsior*, *Ulmus foliaceus*, *Acer campestre*, *Crataegus monogyna*.

The current situation determines negative influences on the climate, which impresses an accelerated rate of steppeization, a condition also accentuated by the intense land improvement works.

The grassy vegetation is well developed, showing variations related to the position it occupies in relief.

On soils with good global drainage, groups such as *Festuca sulcata*, *Salvia pratensis*, *Lolium perenne*, *Bromus inermis*, *Cynodon dactylon*, predominate.

On soils with poor global drainage, there are associations of *Phragmites communis*, *Carex* spp., *Juncus* spp.

Crops specific to the area are corn, wheat, barley, alfalfa, soybeans, sunflowers, etc.

The saline lands, with their specific flora, located near Diniaş, are protected as a pedological reserve, a measure initiated and promoted in the 60's of the last century by C.V. Oprea (Munteanu, 2000).

Living expression of the pedo-hydro-climatic and floristic conditions, as well as due to human intervention (starting with those from the pre-Roman period until now), the soils in the researched area present a great diversity, according to the Romanian Soil Taxonomy System (SRTS-2012), being identified 9 types of soil (Figure 1), comprising 6 of the 12 soil classes (Protisols, Cernisols, Cambisols, Vertisols, Hydrisols and Antrisols).

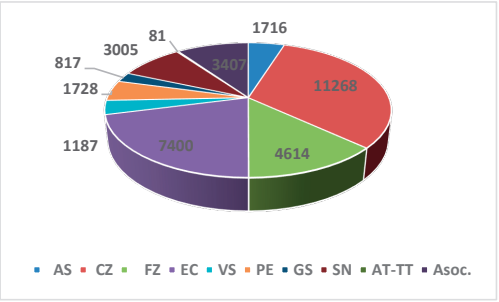

Figure 1. The main types of soil (ha)

In the context of what has been presented, the quality of agricultural land as a result of the diversity of the physical-geographical conditions and their intrinsic properties, as well as of the anthropic interventions that have occurred over time, is very different in space, a fact for which the Romanian methodology for crediting agricultural land, which includes the synthesis the knowledge in this field of the different credit rating schools, as well as the local experience (Teaci, 1980), defines the earth from an ecological aspect in relation to the cosmic-atmospheric and technical-edaphic factors (David et al., 2018).

The basic principle of the credit rating methodology developed in our country is that according to which, for each unit of ecologically homogeneous territory (TEO), within a territorial administrative unit (ATU), defined according to the current Methodology for Elaboration of Pedological Studies, using the 23 credit rating indicators, which are usually found in the pedological mapping works, prepared after 1987 by the territorial OSPA, under the methodological guidance of ICPA Bucharest, their quality is determined by credit rating, from 1 to 100 (Ţărău et al., 2019).

Each of the units identified within the researched space were characterized according to the methodology in force, using the 23 creditworthiness indicators (Table 2).

Table 2. Quality classes for Arable category of use (ha)

ATU	Arable ha	Class I ha	Class II ha	Class III ha	Class IV ha	Class V ha
Foeni	4728	720	1610	1145	1121	132
Giulvaz	7083	68	1859	2708	1943	505
Parta	4845	90	2200	1832	649	74
Peciu Nou	9113	425	4998	2663	440	587
Şag	2467	46	1108	960	320	33
Total ha	28236	1349	11775	9308	4473	1331
%	100	4.78	41.70	32.97	15.84	4.71

Pretability, according to the pedology school from our country, represents the suitability of a land for a certain use and development-improvement works (which highlights the restrictions or limitations that affect the growth of plants, specifying their intensity and nature, respectively the appropriate remedial measures). From this point of view, the lands are divided into suitability classes, from the best and most usable in agriculture to those with no agricultural or forestry value, but which can be used for other purposes (David et al., 2019).
Favorability represents the extent to which a land satisfies the life requirements of a crop plant, under normal climatic conditions and within the framework of the rational use of the ecological offer, for which the lands are divided into 10 fertility classes (from 10 to 10 credit rating points for a certain culture) or five favorability groups (from 20 to 20 credit points), respectively: very favorable (81-100 points), favorable I (61-80 points), favorable II (41-60 points), slightly favorable (21-40 points) and unfavorable (1-20 points). In the case of this paper, the favorability of arable land was chosen for the main agricultural crops, namely: wheat (Table 3), barley (Table 4), maize (Table 5), sunflower (Table 6) and soybeans (Table 7).

Table 3. Favorability classes of arable land for wheat

ATU	Arable ha	Class I ha	Class II ha	Class III ha	Class IV ha	Class V ha
Foeni	4728	766	1029	1211	1121	601
Giulvaz	708	1234	1266	2125	1416	1042
Parta	4845	685	1938	1599	388	235
Peciu Nou	9113	1956	3395	1990	584	1188
Şag	2467	335	981	818	186	147
Total ha	28236	4976	8609	7743	3695	3213
%		17.62	30.49	27.42	13.09	11.38

Table 4. Favorability classes of arable land for barley

ATU	Arable ha	Class I ha	Class II ha	Class III ha	Class IV ha	Class V ha
Foeni	4728	661	1160	1041	1464	402
Giulvaz	708	537	1412	2546	1713	875
Parta	4845	436	1599	1834	533	443
Peciu Nou	9113	975	2944	2749	878	1567
Şag	2467	235	906	1022	282	22
Total ha	28236	2844	8021	9192	4870	3309
%		10.07	28.41	32.55	17.25	11.72

Table 5. Favorability classes of arable land for maize

ATU	Arable ha	Class I ha	Class II ha	Class III ha	Class IV ha	Class V ha
Foeni	4728	1004	1207	1109	1003	405
Giulvaz	708	159	1864	2479	1494	1087
Parta	4845	1011	2100	775	626	333
Peciu Nou	9113	2153	3423	1851	335	1351
Şag	2467	614	1118	417	299	19
Total ha	28236	4941	9712	6631	3757	3195
%		17.50	34.40	23.47	13.31	11.32

Table 6. Favorability classes of arable land for sunflower

ATU	Arable ha	Class I ha	Class II ha	Class III ha	Class IV ha	Class V ha
Foeni	4728	1110	1103	1105	1100	310
Giulvaz	708	852	1420	3656	256	899
Parta	4845	559	1905	1706	428	247
Peciu Nou	9113	950	4012	2507	522	1122
Şag	2467	284	970	869	218	126
Total ha	28236	3755	9410	9843	2524	2704
%		13.30	33,33	34.85	8.94	9.58

Table 7. Favorability classes of arable land for soybean

ATU	Arable ha	Class I ha	Class II ha	Class III ha	Class IV ha	Class V ha
Foeni	4728	763	1096	1146	1512	211
Giulvaz	708	64	1417	2762	1754	1086
Parta	4845	521	1584	1789	230	721
Peciu Nou	9113	981	2975	3367	433	1357
Şag	2467	232	973	827	410	25
Total ha	28236	2561	8045	9891	4339	3400
%		9.07	28,49	35.03	15.37	12.04

The operation of classifying agricultural land into quality classes, based on credit rating and analysis of their suitability, highlighted a series of limiting factors, which act on the production capacity of agricultural land within the researched area. Among them we mention: the granulometric composition (texture of the soil), the reserve of humus, the reaction of the soil, the degree of compaction or compactness, the excess of moisture. Some of them are exemplified by the affected surfaces (Tables 8-10).

In the conditions of a good natural ecological potential at first sight, the soil quality situation is still below the level of expectations, since most of them are affected by the existence of one or more limiting or restrictive factors.
The limiting factors that affect the potential of the soil cover in this area refer mainly to limitations due to excess stagnant and phreatic moisture (Table 8), salinization and acidification of the soil (Table 9) and the degree of compaction-settlement (Table 10).

Table 8. The situation of lands affected by excess of surface and groundwater moisture

No. crt.	ATU	Total Ha (agricultural)	of which lands with:					
			surface moisture excess			phreatic moisture excess		
			weak	moderate	strong; excessive	moderate	strong	very strong; excessive
1	Foeni	5816	320	560	12	2993	966	552
2	Giulvaz	8908	1150	890	620	4256	282	0
3	Parta	5560	25	990	360	1100	400	0
4	Peciu Nou	12188	1690	1120	920	3119	2605	418
5	Șag	2751	33	1070	395	1138	341	0
	Total ha	35223	3218	4630	2307	12606	4594	970
	%		9.14	13,14	6.55	35.79	13.04	2.75

Table 9. The situation of lands affected by salinization and acidification

No. crt.	ATU	Total Ha (agricultural)	of which lands with:					
			salinization			acidification		
			weak	moderate	strong; excessive	weak	moderate	strong; excessive
1	Foeni	5816	2160	175	233	905	70	0
2	Giulvaz	8908	3138	1935	1514	402	37	0
3	Parta	5560	317	126	8	1620	260	0
4	Peciu Nou	12188	2223	986	1103	1663	422	0
5	Șag	2751	120	100	2	1320	396	0
	Total ha	35223	7958	3322	2860	5910	1185	0
	%		22.59	9.43	8,12	16.78	3.36	0.0

Table 10. The situation of lands affected by compaction and moisture deficit

No. crt.	ATU	Total Ha (agricultural)	of which lands with:					
			compaction			Moisture deficit		
			weak	moderate	strong	weak	moderate	strong; excessive
1	Foeni	5816	2160	175	233	905	70	0
2	Giulvaz	8908	3138	1935	1514	402	37	0
3	Parta	5560	317	126	8	1620	260	0
4	Peciu Nou	12188	2223	986	1103	1663	422	0
5	Șag	2751	120	100	2	1320	396	0
	Total ha	35223	7958	3322	2860	5910	1185	0
	%		22.59	9.43	8,12	16.78	3.36	0.0

Pedo-hydro-ameliorative measures (drying, drainage, deep loosening, etc.) are required to achieve a balanced aero-hydric regime and measures aimed at favoring the development of nutrient and organic matter concentration processes in the soil (ameliorative fertilizing, long-term rotations with ameliorative plants from legumes and perennial grasses, etc.).
All the measures aimed at raising the quality of the soil will have in mind the favoring of the processes that lead to the concentration of nutrients and organic matter. In order to prevent the physical degradation of the soil, it is necessary to minimize its preparation works, perform agrotechnical works at optimal humidity, as well as ensure an adequate structure of crops with ameliorative plants.
Since a good part of the soils of the researched agricultural area are affected, during the growing season, by excess humidity, with negative effects on agricultural production, the specific technologies will aim, at the same time, to increase the porosity of aeration as well as the permeability for water, through works of deep loosening, associated with agrotechnical works executed at the right time and of good quality and through long-term crop rotations with improving plants (from legumes and perennial grasses, etc.), or through a restructuring, as appropriate, of the agricultural and forestry surfaces.
Considering the share of non-agricultural land and the pedoclimatic conditions specific to the area, which allow the development of a rich and varied melliferous flora, we recommend improving the floristic composition with species such as *Tylia tomentosa*, *T. cordata*, *Acer tataricum*, *Robinia* spp., *Salix* spp., etc.

CONCLUSIONS

Between the determined ecopedological factors and conditions of the production capacity of the land, the soil conditions represent a major component, with multiple manifestations, both in terms of its own properties, as well as that of the "repository" of the influence of the other environmental factors, recorded at a certain time in a certain place.
They are more stable over time and easier to record and study. Such knowledge, in detail, of the productive and technological characteristics of the favoring, restrictive or limiting factors of agricultural production, both under the current

aspect of manifestation and the real possibilities of their positive modification, can constitute important levers for the realization and implementation of the most appropriate practical measures to produce plant biomass, for the benefit of man to improve his living conditions.

Knowing the natural conditions and especially the ecological potential of the lands, for the main categories of use and crops, is of particular importance in carrying out the qualitative evaluation of the lands and the analysis of the limiting factors, has the main purpose of providing specialists and agricultural workers with a global picture of phenomena that take place within elementary units of the pedological landscape, from which the general strategy regarding the set of ameliorative measures can be derived.

In this conception, the determination of the production capacity of the lands, as well as the substantiation of the technologies for their improvement, can constitute for all those interested, an effective tool for the choice of working procedures, which favor an efficient use of the land resources within the researched space, in accordance with the specific pedoclimatic conditions. The processing and sale of agri-food products, thus being able to constitute an ecological and efficient solution for the future.

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