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THE ALLUVIAL SOLS OF THE LOWER JIU FLOODPLAIN AND THEIR MAIN AGROPRODUCTIVE PROPERTIES

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Abstract

Geomorphologically, the lower Jiu floodplain, located south of the city of Craiova, covers an area of approximately 40.000 hectares and is more developed on the left side of the river. Based on the materials deposited during floods, it includes three zones: the littoral zone, situated near the watercourse, where coarse alluvial materials were deposited; the central zone, the most extensive, where medium-textured materials were deposited; the pre-tertiary zone, the lowest and farthest from the watercourse, where the deposited alluvial materials are the finest. The alluvial soils identified in the researched area are typical, mollic, gleyic, and salic. Typical alluvial soils are specific to the littoral zone, where soil formation processes are weakly differentiated, resulting in low fertility. Mollic alluvial soils are found in the central zone, where the genesis processes are more advanced, making these the most fertile soils of the floodplain. Gleyic and salic alluvial soils occupy the pre-terrace zone, where groundwater is shallow, leading to gleying and even salinization processes at the base of the soil profile.

***Key words**: alluvial soils, floodplain, texture, structure, soil formation, fertility.*

INTRODUCTION

Sustainable management of natural and anthropogenic resources is a modern approach to ecosystem management, aiming to protect and promote biodiversity, as well as to ensure the long-term production of high-quality products. Thus, the identification and clear determination of the destination of each land area within the terrestrial space are essential for determining the ecological conditions and the specific role of a land in various activities (agricultural, forestry, socio-economic) (Nita et al., 2024). Among the factors and physical-geographical conditions that influence the environment in which plants grow and yield, soil plays an essential role, being, on the one hand, a complex indicator of the state of evolution of the characteristics that support plant growth and, on the other hand, a support for the influences of all other conditions and factors (Borcean et al., 1996; Feier-David et al., 2024). Numerous studies and research carried out at national level have highlighted the interdependencies between agricultural technology systems, the state of the environment, the level of economic development and the quality of life. Soil is an essential element for the food production on which life on this planet relies. The soil ecosystem provides various functional services, such as maintaining soil fertility, promoting ecosystem stability, and regulating climate change (Duka et al., 2024). Soil acts as an engineering environment, a habitat for soil organisms, a recycling system for nutrients and organic waste, a regulator of water quality, a modifier of atmospheric composition, and a medium for plant growth, making it a critical provider of ecosystem services (Dominati et al., 2010). The soil is used in agriculture, where it serves as the anchor and main nutrient base for plants. Globally, the arable area per capita in 1990 was 0.3 ha, in 2000, it decreased to 0.25 ha and it is estimated that in 2050, it will reach 0.15 ha and only 0.10 ha in 2150. Starting from this aspect, it is even more urgent to have a thorough knowledge of soil resources, their characteristics and through the innovative application of scientific technologies, humanity's requirements must be satisfied (Mușat et al., 2024). The expansion of the global population, which is driving an intensified development of agriculture, requires efficient use of soil, high-yielding varieties and hybrids, as well as the modernization of cultivation technologies to prevent damage to agricultural land. High temperatures and drought have continued to reduce production of all crop plants in many regions in recent decades. For this reason, irrigation is becoming increasingly important in agricultural activities. The interaction of factors reveals that irrigation and fertilization significantly increase yield compared to non-irrigated crops (Nițu et al., 2024a). These measures should be implemented at the level of large agricultural farms in order to achieve significant improvements in water use efficiency and crop productivity (Nițu et al., 2024b). In order to be able to feed the future world population, which is estimated to reach around 8 billion people, decisive action is needed to conserve soil resources, increase agricultural areas and, in particular, increase agricultural productivity (Bălan et al., 2024). Soil is an essential and valuable natural resource. It is extremely vulnerable to human activities, which can lead to its degradation and loss, both quantitatively and qualitatively. The rate of soil destruction considerably exceeds the rate of restoration, which makes it all the more important to limit the land areas affected by various degradation processes. The awareness of the value of soil as a limited and difficult to renew resource has led to the adoption of managerial practices designed to ensure its protection, conservation and improvement in the long term. Soil quality is defined by its chemical, physical and biological characteristics, which allow it to perform essential ecological functions (such as maintaining the global ecological balance, supporting local air circulation, storing water, regulating biological activities, providing nutrients, filtering and detoxifying), productive (supporting plant development) and protective functions. (Apostu et al., 2024; Bhattacharyya et al., 2017; Cherubin et al., 2016; Cojocaru & Abramov, 2023; Lazăr, 2010). When we talk about the natural fertility of a soil, we are referring to the fertility acquired by it during pedogenesis processes. The natural fertility of the soil can be diminished, by taking the soil in the crop or by the action of degrading, disruptive factors. However, the fertility of these soils can be improved, through good knowledge of their properties but also through the way in which various agropedo-ameliorative measures are applied (Popescu et al., 2024b). For a fertile soil, organic matter is very important, contributing to the improvement of its physical, chemical and biological properties (Bosch-Serra et al., 2023). Climate change in recent times represents a serious threat to agricultural activities. Their consequences, affect multiple aspects of life in all regions of the world, influence food security by reducing the production of cultivated species. The yields obtained from different plants grown in Romania are largely conditioned by the properties of the soils, the rainfall regime and the way in which the plants are provided with the appropriate nutrients (Iancu et al., 2024). In order to ensure good conditions for plant growth and fruiting, soil components must also be kept in optimal natural ratio, any disturbance of them causes a decrease in productive capacity (Popescu et al., 2024a). Knowing the characteristics of environmental factors, the physicochemical properties of the soil, are relevant aspects in establishing the soil production capacity in a given area (Popescu & Bălan, 2024). Sustainable land use is essential to maintain high production capacity and protect environmental quality (Zafiu & Mihalache, 2021; Bălan & Popescu, 2024). Soil quality is influenced by limiting factors, the same as those found in the creditworthiness system in Romania, but they manifest themselves differently depending on geomorphological, lithological, hydrological and climatic characteristics (Bălan & Popescu, 2024). The purpose of the present study was to identify the soils and determine the values of several soil parameters (physical, hydrophysical and chemical), in a meadow ecosystem (Figure 1), characterized by alluvial processes.

Figure 1. Aspects of the Jiu Meadow during the non-flood period

These processes are characterized by the deposition of the material brought by the watercourse, during overflows (Figure 2), which covers part of the surface of the meadow (Figure 3), leaving a layer of alluvium (Figure 4) when the waters recede, varying in thickness and texture, depending on the size of the flood and the nature of the rock from which the material comes.

Figure 2. Aspects of the Jiu Meadow during the overflow

Figure 3. Covering the old soil layer with a new one during floods

Figure 4. Alluvial material after the withdrawal of water from the waters

The area on which the lower Jiu meadow extends, south of the city of Craiova, is delimited to the east by the head of the Rojiște terrace on the line that connects the localities of Atârnați (Troaca) - south Romanești, Secui-Dobrești, Lișteava-Ostroveni and by the front of the Bârza terrace, between the localities of Dobrești-Sadova. To the west it is bounded by the edge of the Getic Piedmont, between the localities of Breasta-Podari, by the Sălcuța Field, between the localities of Podari-Drănic and the Danube terraces as follows: Perișoru Terrace - between the Drănic-Padea localities, Băilești Terrace between the Bârza-Valea Stanciului localities and the front of the Jiu Terrace (Teresa Malu Mare) between the Valea Stanciului-Zăval localities (Figure 5). The total area of the Jiu Meadow, south of the city of Craiova, is approximately 40,000 ha, with a greater development on the left side, being formed, from a geomorphological point of view, of three areas: the coastal area, which includes the areas in the immediate vicinity of the course of the Jiu River, with a variable width between 1.5 and 0.5 km and an altitude between 80 m, in the North and 30 m in the South. Coarse alluvial materials are deposited in this area. The central area, comprising the largest surfaces, is the most developed area of the meadow, where the alluvial materials with medium texture are deposited. In this area of the meadow, the most fertile soils are found. The pre-terrace zone is the area furthest from the watercourse, the lowest, depression and swampy area. In this area, the finest alluvial materials are deposited, the groundwater is found at a shallow depth, and meanders, swamps, or old riverbeds can be encountered. The soils found in this area are clayey, glazed and sometimes salty.

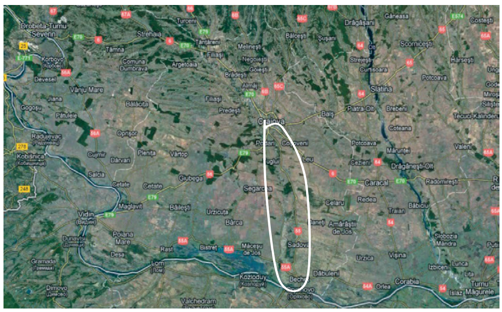

Figure 5. Lower Jiu Meadow

From a climatic point of view, the area is characterized by multiannual average temperatures of 10.8^{0}C (Figure 6) and precipitation of 532 mm (Figure 7). Solification materials are represented by alluvial deposits, with coarse to fine textures, by alluvial-proluvial and colluvial-alluvial deposits and by aeolian deposits.

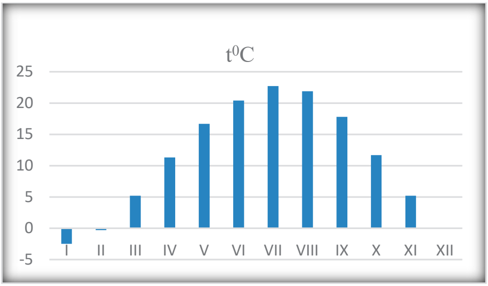

Figure 6. Average monthly temperatures

The natural vegetation specific to the Jiu meadow is very rich, represented by herbaceous species (mesophilic, hydrophilic and xerophilic) and by woody species of cvercinea.

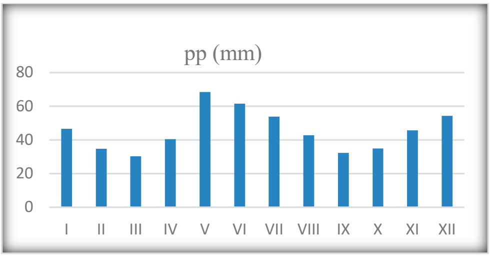

Figure 7. Average monthly rainfall

MATERIALS AND METHODS

The research carried out in the lower Jiu meadow is aligned with the current scientific and practical concerns, focused on the accumulation of knowledge about the physical-geographical conditions, which are essential for defining the quality of ecopedological resources. The paper provides essential information and methodological elements for the qualitative assessment of ecopedological resources, thus integrating into a broader framework of complex studies of natural resources. The physical and geographical conditions that influence the formation and evolution of the soil are briefly presented, emphasizing how the zonal particularities of the Jiu meadow determine a significant diversity of ecological conditions. Soil research was carried out to identify soil types and assess their fertility based on physicochemical characteristics. At the same time, soil samples were collected for laboratory analysis. In this regard, the natural conditions of soil formation in this area were studied, a study of the territory was carried out, during which the location points of the soil profiles were established, depending on the characteristics of the relief, so that each soil profile is as representative as possible for a larger area, according to the methodology established by the Research Institute for Pedology, Agrochemistry and Environmental Protection in Bucharest (ICPA Bucharest). After digging the soil profiles (Figure 8), they were studied in the field, from a morphological point of view (Munteanu & Florea, 2009).

Figure 8. Soil profile in the Jiu meadow

Soil samples collected from the field with natural soil structure and modified structure were prepared and analyzed in the laboratories of the Office for Pedological and Agrochemical Studies (OPAS) Dolj (Popescu, 2024). The analytical methods used to determine the physical properties were the following: The size fractions were determined by wet sieving, siphoning and pipetting, and the soil texture was established with the texture triangle;

- The bulk density was determined by the 100 cm^3 metal cylinder method;
- The density was determined by the pycnometer method;
- The total porosity was determined by calculation;

- The hygroscopicity coefficient was determined by drying the soil sample at 105^{0}C, after saturating it with water in a desiccator with water vapor, created by a 10% sulfuric acid solution;
- The wilting point, by calculation according to the value of the hygroscopicity coefficient;
- The field capacity, by the centrifugation method.

The interpretation of the results was carried out according to the methodology in force (Institute of Research for Pedology and Agrochemistry, ICPA, 1987). The analytical methods used to determine the chemical properties were as follows:
- The humus content was determined by the Walkley-Blak method;
- The pH value by the potentiometric method, in aqueous solution;
- $CaCO_3$ content by the gasometric method, using the Scheilbler calcimeter;
- The nitrogen content was determined by Kyeldahl method;
- Soluble potassium, by Egner-Riehn-Domingo method;
- Soluble phosphorus, by Egner-Riehn-Domingo method;
- Hydrolytic acidity, by Kappen method;
- The exchange capacity for bases, by Kappen method;
- The degree of saturation in bases, by calculation with the relationship V% = SB/Tx100.

The establishment of the suitability of the identified soils, for the main agricultural plants cultivated in the area, was achieved by the work of creditworthiness in natural conditions. The estimation of the productions that can be obtained on the identified soils was made with the help of the creditor notes, by multiplying them by the quantity of products per point of the creditworthiness note, for each plant, established according to the creditworthiness methodology in Romania.

RESULTS AND DISCUSSIONS

The soil cover in the lower Jiu meadow is presented in the form of a true mosaic, with very large variations on small surfaces, as a result of the complexity of natural factors and their influence on the solification process. The very large variation of the microrelief and microclimate also determines the modification of the other natural factors, which explains the diversity of soils encountered. It can be said that in the lower Jiu meadow, there is a combined action of all natural factors on the process of soil formation and evolution. However, the intensity of the action of natural factors is differentiated, with the water factor predominating, which is found at shallow depths and which determines more or less intense glazing processes. The water factor also intervenes in the alluvial processes so often encountered in the meadow and which are the basis for the formation of alluvial soils. Under the action of the multitude of general and especially local solification factors, in the lower Jiu floodplain, many soils have been formed, some occupying quite small areas while others occupy much larger areas. Considering the great diversity of the soils in the Jiu Meadow, they have been grouped into several classes. The class of Protosoils includes soils formed in the coastal and central areas of the floodplain, on alluvial materials, characterized by an undifferentiated or weakly differentiated profile, represented by typical alluvial soils, mollic alluvial soils, gleic alluvial soils, and entic alluvial soils. The hydrosol class includes soils that have been formed in conditions of permanent excess moisture, determined by the high level of the groundwater (0.5-1.5 m) or by the stagnation on the surface of water from floods, precipitations and coastal springs. They are mainly found in the pre-terrace zone and are represented by typical gleysols, chernozemic gleysols, and histic gleysols. The class of salsodisols includes soils with a soluble salt content higher than 0.1%. These soils appear as compact surfaces, mainly in the southern area (Rojiște-Dobrești-Sadova) and on smaller surfaces in the Podari - Livezi area. They are also found in the pre-terrace or central area and are represented by saline solonetz, alluvial solonetz, and solodic solonetz. This paper presents the characteristics of a typical alluvial soil, a mollic alluvial soil, and a gleic-saline alluvial soil.

The typical alluvial soil is found in the coastal meadow area, forming on coarse alluvial materials. The solification processes are poorly evidenced and the installation of vegetation is incipient.

For the characterization of this soil, the morphological, physical, hydrophysical and chemical properties of a soil profile executed near the city of Craiova, in the Romanești area, are presented.

Horizon Ao 0-15 cm, pale yellowish color 5Y5/4 in the wet state and whitish yellowish 5Y6/4 in the dry state, sandy-clayey, unstructured or granular very friable, loose, porous, rare herbaceous filiform roots, rare butterflies of mica white, does not effervescence, gradual transition;

Horizon AC 15-30 cm, faintly yellowish color 5Y5/3 in wet and whitish-gray state 5Y 5/6 in dry state, sandy-silt, unstructured, medium porous, medium compact, rare roots of phylloform plants, frequent grains of coarse quartz sand, revenge, weak effervescence, gradual passage.

Horizon C1 30-65 cm, whitish-gray 5Y 6/3 in wet state and dirty whitish 5Y 7/3 dry, sandy, unstructured, finely porous, compact, very rare threadlike roots, many grains of coarse sand, obvious effervescence, gradual passage;

Horizon C2 65-90 cm, whitish - dirty 5Y 7/3 in wet state and pale yellow 5Y8/3 in dry state, sandy, unstructured, medium porous, compact, very rare threadlike roots, very many grains of coarse sand, rare skeleton of 2-3 mm, obvious effervescence.

The particle size composition of the typical alluvial soil has a high coarse and fine sand content of over 85% and a very low dust and clay content of less than 15%. This particle size composition gives the soil a coarse, sandy or sandy-clayey texture to the soil over the entire profile (Table 1). Soil particle size composition is an indicator of soil sustainability, influencing several soil processes, including soil permeability (Zhao et al., 2024), water evaporation, pore space size and characteristics (Li et al., 2024), nutrient circuitry, stability of structural aggregates, and finally, soil fertility (Wang et al., 2022; Azaryan et al., 2022). In addition to influencing soil physicochemical properties, it has been established that soil particle size distribution influences several soil biological traits such as microbial biomass and decomposition (Iordache et al., 2024).

Table 1. Physical properties of typical alluvial soil

Horizon	Depth (cm)	Size fractions				Texture class	Bulk density (g/c	Density (g/cm³)	Total porosity (%)
		Coarse	Fine sand,	Silt,	Clay,				
Ao	0-15	22.8	63.8	5.6	7.8	NL	1.29	2.68	51
AC	15-30	3,6	52.7	5,1	7.8	N-	1.37	2.69	49
C1	30-65	46.8	44.6	3.7	4.9	N	1.45	2.71	46
C2	65-90	69.6	23.8	4.1	2.5	N	1.47	2.71	46

As a result of the high content in coarse fractions and low in dust and clay, the typical alluvial soils retain very little water, the hydrophysical indices have low values, at the lower limit. The hygroscopicity coefficient oscillates between 0.8% and 2.2%, the field capacity between 3.2 % and 7.6% and the usable water capacity is less than 5% (Table 2).

Table 2. Hydro - physical properties of typical alluvial soil

Horizon	Depth (cm)	HC, %	WP, %	FC, %	AWC, %
Ao	0-15	2.2	3.2	7.60	4.4
AC	15-30	1.8	2.6	5.80	3.2
C1	30-65	1.1	1.6	3.90	2.3
C2	65-90	0.8	1.2	3.20	2.0

The chemical properties show that the soil has a low humus content, below 2%, has a weak alkaline reaction, pH 7.6-8.1, has a high degree of base saturation, over 90% and is poorly supplied with nutrients (Table 3).

The mollic alluvial soil is more commonly found in the central area of the floodplain, on land that is less frequently flooded. Under these conditions, the vegetation has developed better and the solification processes are more advanced. For the characterization of this soil, the morpho-physico-chemical properties of a soil profile, located in the area of Malu Mare, Dolj County, are presented.

Horizon Am 0-31 cm, has a very dark brownish-gray color 2.5Y 3/2 in the wet state and dark grayish brown 2.5 Y 4/2 in the dry state, clayey texture, structure of well-formed grainy aggregates with high stability, fine porous, compact environment, dense roots of filiform plants, rare butterflies of small white, cervotocin and rare coprolite, gradual passage;

Table 3. Chemical properties of typical alluvial soil

Horizon	Depth (cm)	Humus (%)	Total nitrogen (%)	Soluble P (mg at 100 g soil)	Soluble K (mg at 100 g soil)	pH in H_2O	CEC	HA	BS	BSD %
							(me at 100 g soil)			
Ao	0-15	2.11	0.098	2.8	8.9	7.6	0.7	7.9	8.6	92
AC	15-30	1.10	0.68	2.1	10.2	7.9	0.3	6.8	7.1	96
C1	30-65	0.38	0.023	1.4	9.6	8.1	-	6.4	6,4	100
C2	65-90	0.22	0.013	1.4	9.3	8.1	-	6.1	6.1	100

Horizon AB 31-57 cm has a dark brown-grey color (2.5Y 4/3) when moist and light olive brown (2.5Y 5/2) when dry, a loamy-clayey texture, with a structure of medium and large angular polyhedral aggregates, finely porous, generally compact, with few filamentous roots, rare cervotocines, and coprolites, with a gradual transition;

Horizon BC 57-72 cm, light olive-brown 2.5Y 5/2 in wet state and yellowish olive 2.5 Y6/6) in dry state, loamy-sandy texture, unstructured or crumbly lumpy by drying, finely porous, compact, very rare roots of filiform plants, frequent coarse quartziferous sand grains;

Horizon C 72-105 cm, light yellowish-brown colour 2.5Y 6/4 wet and grey open 2.5Y 7/2 in dry state, sandy-loamy texture, unstructured or lumpy friable by drying, finely porous, compact, very although grains of coarse sand and skeleton of 2-3 mm of quartziferous nature, rare spots.

From a textural point of view, this soil contains a much lower percentage of coarse and fine sand, less than 50% and a much higher percentage of clay, 46.6%. This particle size composition makes the soil texture clayey in the first horizons, as a result of the higher content of fine fractions. The soil also shows a more pronounced settlement over the entire depth of the profile (Table 4).

Table 4. Physical properties of mollic alluvial soil

Horizon	Depth (cm)	Size fractions				Texture class	Bulk density (g/cm^3)	Density (g/cm^3)	Total porosity (%)
		Coarse sand, %	Fine sand, %	Silt, %	Clay, %				
Am	0-31	3.9	24.3	25.3	46.5	A	1.34	2.69	50
AB	31-57	8.6	35.1	21.7	34.6	LA	1.41	2.70	48
BC	57-72	16.8	48.9	18.5	15.8	LN	1.47	2.71	46
Cc	72-105	24.6	57.2	10.7	7.5	NL	1.44	2.71	47

The presence of fine fractions, dust and clay, in a high percentage, over 50%, have determined the increase of the hydrophysical indices to values tending towards the upper limits. The value of the hygroscopicity coefficient, in the first Am horizon, has the value of 13.8%, the wilting coefficient has the value of 19.4%, the field capacity is 33.7% and the useful water capacity has increased to almost 15% (Table 5).

Table 5. Hydro-physical properties of mollic alluvial soil

Horizon	Depth (cm)	HC, %	WP, %	FC, %	AWC, %
Am	0-31	13.8	19.4	33.7	14.3
AB	31-57	9.2	13.6	25.1	11.5
BC	57-72	4.1	6.2	11.4	5.2
C	72-105	2.2	3.2	6.9	3.7

The chemical properties show that the soil is better supplied with humus, over 3% and has a higher reserve of nutrients, as a result of the richness in colloidal complex.

The soil reaction remains in the weakly alkaline range, with a pH value above 7.1 (Table 6).

The gleic-saline alluvial soil is widespread in the pre-terase area of the lower Jiu floodplain, where the finest alluvial materials were deposited by the water during overflows. In this area, the groundwater is found at a shallow depth and produces glazing and salinization processes at the base of the profile.

For the characterization of this soil, the properties of a profile located in the area of Rojiște, Dolj County are presented.

Table 6. Chemical properties of mollic alluvial soil

Horizon	Depth (cm)	Humus (%)	Total nitrogen (%)	Soluble P (mg at 100 g soil)	Soluble K (mg at 100 g soil)	pH in H_2O	CEC	HA	BS	BSD, %
							(me at 100 g soil)			
Am	0-31	3.13	0.170	28.8	112.6	7.1	2.3	36.8	39.2	94
AB	31-57	2.30	0.130	24.9	120.2	7.6	1.2	31.6	32.8	96
BC	57-72	0.65	0.037	16.1	104.4	7.8	0.6	15.9	16.5	96
C	72-105	0.26	0.016	8.5	80.8	7.7	0.3	7.9	8.2	96

Horizon Am 0-28 cm, very dark brown-gray (2.5Y 3/2) in the wet state and brown-gray (2.5Y 5/2) in the dry state, loamy-clayey texture, structure of medium and large granular aggregates with evident edges and corners, finely porous, moderately compact, frequent herbaceous and woody roots, cracked, intense biological activity, does not effervesce, gradual transition;

Horizon AB 28-41 cm, dark gray brown 2.5Y4/4) in the wet state and light gray brown 2.5Y6/2 in the dry state, clayey texture, medium and large angular polyhedral structure, fine porous, compact, woody and grassy roots, small and medium ferro-manganese concretions, weak effervescence, gradual transition;

Horizon BGo 41-80 cm, olive brown 2.5Y 4/4 in wet state and light olive brown 2.5Y 45/2 in dry state, clayey texture, columnar-prismatic structure, porous fine, very compact, medium and high frequent iron-manganese concretions, purple-gray spots and rust-brick veins due to the glazing process, obvious effervescence, gradual passage.

The particle size analysis of this soil indicates a high clay content, over 45%. The clayey and loamy-clay texture gives the soil a strong compaction throughout the entire profile (Table 7).

The hydrophysical indices have values that tend towards the upper limit, correlating well with the granulometric composition of the soil (Table 8).

The soil has a humus content of 2.7% and is poorly supplied with nutrients. The reaction becomes alkaline in depth, where the pH value increases to 8.7 (Table 9).

By conducting the land evaluation work under natural conditions, for the main agricultural crops practiced in the reference area (wheat, barley, corn, sunflower, potatoes, vegetables), it is observed that all the plants studied are best suited to mollic alluvial soil. From Table 10, it is observed that for typical alluvial soil, the land evaluation score for wheat cultivation is 20 points, corresponding to a favorability class IX, while for barley, it is 24 points, which places the soil in favorability class VIII.

High bonitation marks of 72 points, both for wheat and barley, respectively favorability class III, were obtained on mollic alluvial soil. The gleic-saline alluvial soil recorded for the two agricultural crops the lowest bonitation marks, 34 respectively 36, specific to the seventh grade.

Analyzing the favorability of the three soil units in the studied area for corn and sunflower crops (Table 11), it is found that these plants also record the highest values of bonitation marks, and the lowest favorability classes, also on the mollic alluvial soil.

Table 7. Physical properties of gleic-saline alluvial soil

Horizon	Depth (cm)	Size fractions				Texture class	Bulk density (g/cm^3)	Density (g/cm^3)	Total porosity (%)
		Coarse sand, %	Fine sand, %	Silt, %	Clay, %				
Am	0-28	4.8	31.9	17.4	45.9	LA	1.37	2.69	49
AB	28-41	4.5	32.6	15.3	47.6	A	1.43	2.70	47
BGo	41-80	3.1	29.3	17.2	50.4	A	1.49	2.71	45
CGsc	80-130	2.4	31.8	20.6	45.2	LA	1.47	2.71	46

Table 8. Hydro - physical properties of gleic-saline alluvial soil

Horizon	Depth (cm)	HC, %	WP, %	FC, %	AWC, %
Am	0-28	1.,4	18.5	35.1	16.6
AB	28-41	13.1	19.6	35.3	15.7
Bgo	41-80	14.2	21.1	36.6	15.5
CGsc	80-130	11.3	16.5	30.4	13.9

Table 9. Chemical properties of gleic-saline alluvial soil

Horizon	Depth (cm)	Humus (%)	Total nitrogen (%)	Soluble P (mg at 100 g soil)	Soluble K (mg at 100 g soil)	pH in H_2O	CEC	HA	BS	BSD %
							(me at 100 g soil)			
Am	0-28	2.7	0.140	6.9	11.9	7.2	1.9	28.1	30.0	94
AB	28-41	1.3	0.074	6.1	12.3	7.6	0.6	27.9	28.5	98
BGo	41-80	0.7	0.041	4.8	10.8	8.3	-	31.2	31.2	100
CGsc	80-130	0.2	0.011	3.6	10.9	8.7	-	35.4	35.4	100

Table 10. Suitability of soils for wheat and barley

Soil type	Wheat		Barley	
	Bonitation marks	Fertility class	Bonitation marks	Fertility class
typical alluvial soil	20	IX	24	VIII
mollic alluvial soil	72	III	72	III
gleic-saline alluvial soil	34	VII	36	VII

Table 11. Suitability of soils for maize and sunflower

Soil type	Maize		Sunflower	
	Bonitation marks	Fertility class	Bonitation marks	Fertility class
typical alluvial soil	18	IX	22	VIII
mollic alluvial soil	56	V	70	IV
gleic-saline alluvial soil	23	VIII	48	VI

Thus, corn is in the fifth class of favorability (56 points of bonitation mark) and sunflower obtains the fourth class of favorability, with 70 points of bonitation mark. The typical alluvial soil registers for these crops very low values of the bonitation marks, 18 points for corn and 22 points for sunflower, and the gleic-saline alluvial soil falls into the eighth class for the corn crop, which corresponds to 23 points for the bonitation mark and the fourth class for sunflower, with 48 points for the bonitation mark. Analyzing the potato and vegetable crops (Table 12), it can be seen that the bonitation marks and the favorability classes keep the same configuration as the previously analyzed crops, with the difference that on the mollic alluvial soil, the bonitation marks are ower (43) and the favorability classes higher (VIII), for both crops.

Table 12. Suitability of soils for potato and vegetables

Soil type	Potato		Vegetables	
	Bonitation marks	Fertility class	Bonitation marks	Fertility class
typical alluvial soil	20	IX	28	VIII
mollic alluvial soil	43	VI	43	VI
gleic-saline alluvial soil	10	X	29	VIII

On the typical alluvial soil, the potato obtains 20 points in bonitation mark and falls into the ninth class of favorability, and the vegetables have the bonitation marks of 28 points and fall into the eighth class of favorability.

The gleic-saline alluvial soil also registers low values of the bonitation marks for these crops. Potatoes have the lowest bonitation mark and the highest favorability class among all the plants analyzed, and vegetables fall into the eighth grade, with 29 bonitation mark points.

With the help of the bonitation marks and the productions on each point of the bonitation marks, the quantity of products that can be obtained at the main agricultural crops practiced in the reference area, under natural conditions, was estimated (Table 13).

Table 13. The agroproductive potential of the soils in the lower Jiu River floodplain for the main crops.

Cultivated plants	Typical Alluvial soil	Mollic Alluvial soil	Gleic-salinic Alluvial soil
	Estimated yields (kg/ha)		
Wheat	1.200	4.320	2.040
Barley	1.440	4.320	2.160
Maize	1.440	4.480	1.840
Sunflower	704	2.240	1.536
Potato	9.000	19.350	4.500
Vegetables	8.400	12.900	8.700

It is found that the highest agro-productive potential is held by the soft alluvial soil, which has also obtained the highest scores of natural bonitation marks and the lowest classes of favorability.

The lowest agro-productive potential is the gleic-saline alluvial, which obtained the lowest bonitation marks scores and the highest favorability classes.

CONCLUSIONS

The territory under study belongs to the lower floodplain of the Jiu River, south of the city of Craiova. The natural conditions, climate, relief, vegetation, geological substrate and hydrology, have determined the formation and evolution of soils with different profile development. The largest area is occupied by alluvial soils, soils of relatively low age. The alluvial units identified in the area are represented by the typical, mollic and gleic-saline subtypes.

Typical alluvial soils are found in the coastal area of the meadow, through the deposition of coarse alluvial materials, which have determined less intense solification processes. The mollic alluvial soils are found in the central area of the meadow, where the genesis processes are more advanced. The gleic-saline alluvial soils occupy the pre-terrestrial area, where the groundwater is found close to the soil surface, determining gleization and even salinization processes at the base of the soil profile.

The young soils in the Jiu floodplain have a very heterogeneous granulometric composition, ranging from sandy and sandy-loamy to clayey. They have good total porosity at the surface and low porosity in the lower horizons, indicating strong compaction at depth.

The hydrophysical indices are closely correlated with the soil texture and organic matter content, having lower values in typical alluvial soil and higher values in mollic alluvial soil and gleic-saline alluvial soil.

The humus content is low in typical alluvial soil (below 2%) and medium (2-3%) in mollic alluvial soil and gleic-saline alluvial soil, while the nutrient supply is poor for phosphorus and medium for potassium.

The reaction of the soils is neutral or alkaline, the pH value being generally higher than 7.

The fertility of the relatively low age soils in the Jiu meadow is different and is closely correlated with the physical, hydrophysical and chemical properties resulting from laboratory determinations. The best natural fertility is found in mollic alluvial soil, while at the opposite end is gleic-saline alluvial soil. On typical alluvial soil and mollic alluvial soil, all crop slopes are suitable with poor to medium results, whereas on gleic-saline alluvial soil, some plants are excluded from cultivation as they encounter unsuitable conditions for growth and fruiting. This category includes orchards and vineyards.

Estimating the agroproductive potential for the main agricultural crops practiced in the area (wheat, barley, corn, sunflower, potatoes, and vegetables), it was found that they can yield better production on mollic clayey alluvial soil, which also received the highest natural land evaluation scores and the lowest favorability classes. The lowest agroproductive potential is found in gleic-saline alluvial soil, which received the lowest land evaluation scores and the highest favorability classes. In addition to these agricultural plants that lend themselves to the alluvial soils of the Jiu meadow, tobacco benefits from appropriate soil and climate conditions (Iancu et al., 2009b). On all soils, it is recommended to apply fertilizers based on phosphorus, as chemical analyses have shown a poor supply of this element in the soils. The chemical fertilizers used every year, in the conditions of typical alluvial soils, have a positive influence on the plants grown on these soils, as a result of the sandy texture, high aeration porosity, low humification of the residual material and decomposition to mineralization (Iancu et al., 2009a).

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