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Contributions to the Knowledge of Soil Resources of Cuca Plain

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Abstract

The territory to which we refer is located in the geographical area of the Romanian Plain, north-eastern sector, representing a subunit of Plain Covurlui. From the administrative point of view this territory belongs entirely Galaţi County. Since the first review of Cuca Plain territory fragmentation is found in the form of ridges interfluvial oriented northwest-southeast separated by a river system consistent. The provision gives relief peaks ordely character of monotony. Starting from the idea that the soil appears as a product of the interaction of many factors, we can say that the formation of soil cover of Cuca Plain took part relief, parent material, climate, groundwater, vegetation, human activity. Under the influence of environmental factors and pedogenetic processes in the Cuca Plain were differentiated two classes of soils, namely: protisols and cernisols.

Keywords: Cuca Plain, pedogenetic processes, soils, morphology, fertility

1. Introduction

This paper falls into the category of agriculture research studies. It includes the results of our research and documentation of land multiple specialty literature. Cuca Plain is among the regions nature and diversity of natural territorial complex components ensures optimum user to obtain agricultural production and income, the more they are exploited effectively, economically and environmentally existing technologies. A productive agriculture is essential prerequisite for sustainable development of agriculture with multiple objectives, improve livelihoods, with preserving and protecting the natural resource base. All this is not possible without special research, extensive and often lengthy. Closely related to training, development and distribution of land in the territory, was intended at the outset how the appearance of each factor of the complex territorial analyzing on all the structure, dynamics and function of each of them, as their role directly or indirectly in the genesis of soils. The focus is on the soil cover, the Cuca Plain. They are short analyzed the main factors pedogenetic in the context pedogenetic processes that contributed to the formation and evolution of soils present. Soil resources of Cuca Plain was formed on the parent material represented by: loess-like deposits clay-loam, deluvial deposits clay-loam, loess-like deposits sandy-loam, alluvial-proluvial deposits sandy-loam and fluvial deposits loam. In forming the soil cover of Plain Cuca played an important role and pedogenetic processes, among mention: bioaccumulation, argillisation, erosion and gleyzation. It presents a characterization of the soil cover as compared morphological, physical and hydro-chemical and agro under report.

Based on observations obtained during browsing the entire territory investigated, we made a map with the main pedogenetic processes, including soils map preparation, according Romanian System of Soil Taxonomy (SRTS, 2012). Diagnosis field soil was verified through laboratory analysis (Florea et al., 2012; Ispas and Stănilă, 2015).

2. Materials and Methods

Elementary basic unit of content in soils research Cuca Plain was the soil profile, thus allowing the study of morphological characteristics of the soils. As a result, soils were classified based on intrinsic properties, namely the soil profile, taking into account diagnostic horizons and characteristics. In the territory taken in study was applied the ICPA methodology which included a rich land and laboratory, which consisted in exploration the ground cover in large and medium scale, using soil profiles in a network of points with respect to the geological, geomorphologic composition of planning, its hydrography, hydrology and hydrogeology. Also played an important role in vegetation, relief and human activity. The method of parallel routes, located almost at equal distances has been used, to cover more or less uniformly the whole working area (Stănilă and Parichi, 2001).

In the Cuca Plain were open a huge number of profiles (hundreds or even thousands at the major relief units) who studied the number and the thickness of horizons, color, texture, structure, moisture, consistency, plasticity, compactness, adhesion, porosity, degree of gleyzation, soil storage condition, etc. To characterize the physical, chemical and hydro were collected numerous soil samples unmodified and modified settlement on which were performed the determinations in the laboratory.

In modified settings, soil samples of 20 cm thickness were taken in bags, for the chemical characterization to be carried. In natural (unchanged) settings, soil samples were taken using a metal cylinder of known volume (200 cm^3) to characterize the physical and hydro-physical features, as well as the momentary soil moisture.

The morphological description of soil profiles was done according to the Romanian System of Soil Taxonomy (SRTS, 2012), ICPA, Bucharest.

In order to know the depth of the ground water level has been carried out a large number of measurements in both wells and the soil profiles and samples were also collected in order to determine its chemical composition. The analytical methods used for determination of physical and chemical:

Determination of particle size fractions:

- pipette method fraction ≤ 0, 002 mm;

- wet sieving method for fractions 0.002 to 0.2 mm and dried fractions > 0.2 mm. The results are expressed as a percentage of the remaining material after the pretreatment.

Organic matter (humus) determined by volumetric method Walkley - Black wet oxidation after the change Gogoașă (Stoica et al., 1986).

Total Nitrogen (Nt): Kjeldahl method disintegration H_2SO_4 at 350^0C, a catalyst of potassium sulfate and copper sulfate.

Phosphorus accessible (P mobile): method-Riehm-Domingo and dosed with colorimetric molybdenum blue method after Murphy-Riley (reduction with ascorbic acid).

Potassium (K mobile) accessible: after extraction method Egner-Riehm-Domingo and determination by flame photometry.

pH: potenţiometric, determined the combined glass electrode and a calomel, in aqueous suspension the soil/water ratio of 1/2, 5.

The base saturation degree (V%) and total cation exchange capacity (T me/100 g soil), by calculation.

Interpretation of the results has been submitted in accordance with “Methodology developing soil studies”, ICPA, Bucharest, 1987, provided for in current legislation on the subject.

Map making materials were used following map: Romanian soil map, scale 1:200.000, sheet Focsani, Romania geomorphological map, scale 1: 200.000, Geological map of Romania, 1:200.000, sheet Focsani. Thus, those maps were scanned, then the images were vectorized. He data were then processed using ARC/INFO.

For each map, the computer result in a "polygon layer" mapping each polygon representing a territorial unit. Cartographic data validation was done by overlapping polygons layer the source data. Each territorial mapping unit, were entered as attributes: soil genetic unit, the surface texture, the parent material, pedogenetic processes and the relief.

3. Results and Discussion

From geological point of view, Cuca Plain is characterized by a sedimentary layer monoclinal Neogene (Figure 1).

Throughout the territory studied mostly in soils (60%) were formed on loess-like deposits clay-loam and sandy loam. These are characteristic peaks interfluvial and terraces. From a first particle size is characterized by a high clay content (32-35%) and silt (38-40%).

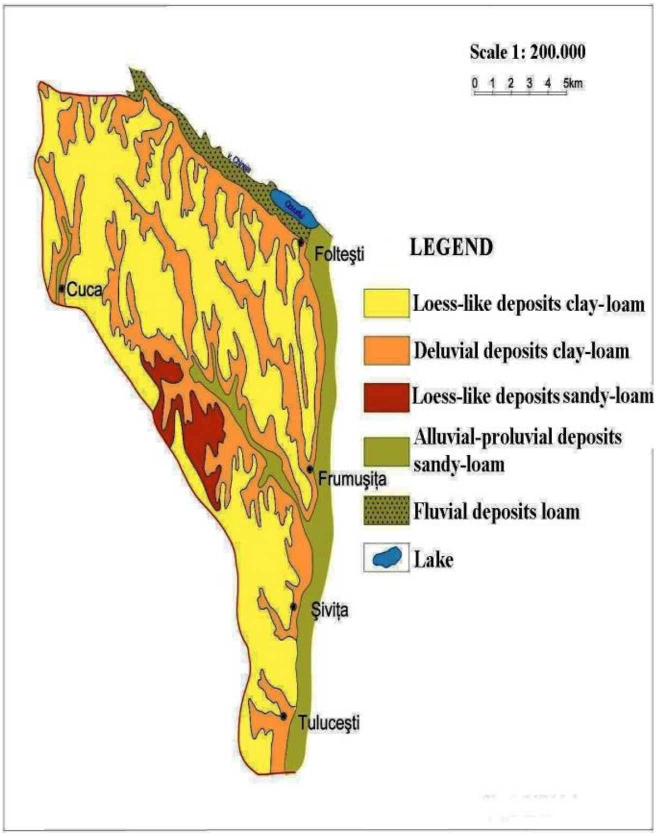

Figure 1. Parent material map of the Cuca Plain.

The territory also appear on slopes deluvial deposits clay-loam, and within the alluvial plains, alluvial-proluvial deposits sandy-loam. In Chineja Floodplain meet fluvial deposits loam.

Actual relief of Cuca Plain entered as a result of the interaction of complex internal factors (facies petrographic, geological structure and tectonics) and external (climate conditions, basins, vegetation cover, the animal world and human society) which proved to be particularly dynamics (Posea and Cruceru, 2005).

It is compose of interfluves relatively flat, slopes from weak to strongly inclined, terraces, floodplains, relief résiduel, alluvial cones, landslides, steeps and collapses (Figure 2).

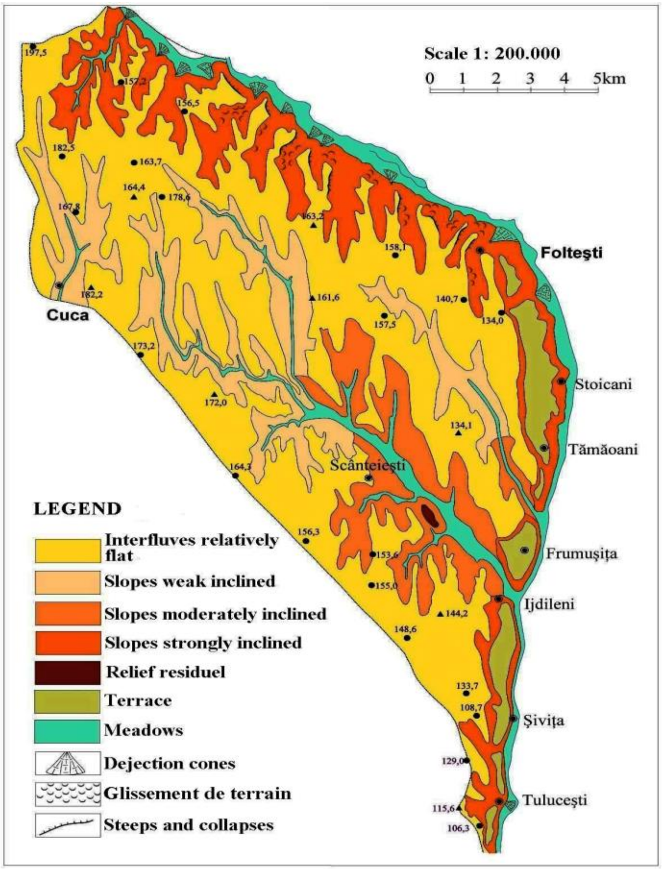

Figure 2. Relief map of the Cuca Plain.

Several factors helped set the pace and pedogeomorfologic processes in Cuca Plain. Among them: the presence of loess-like deposits covering the entire surface of the plain, fragmentation and depth of fragmentation relatively submitted relief, oscillations climate frequent especially in terms of rainfall, all these in addition to the use of land, as some human interventions by arranging the irrigation and works drainage (Ilie, 1996; Parichi and Stănilă, 2008).

Currently *compaction* occurs with reduced intensity, resulting in uneven light aspect saucer. They have a slightly oval shape and depths of 0.5 to 1 m.

Compaction occurs in the territory and as a result of agricultural activities, benefiting from the use of short rotation crops, irrigation uncontrolled and repeated passages with agriculture.

Gullies occur with increased intensity especially in the northern plains where a series of torrents deepened with 10-60 m below the reference field (Photos 1).

The formation and development relief Cuca Plain it had an important role in the hydrographic system. It currently, it consists of valleys permanent, but mostly valleys temporary.

Valleys permanent category only part Chineja Valley. It had originated upstream Măluşteniului Hills. Presents a course north - south to the Târgu Bujor, after heading slightly south - east, as downstream Folteşti to enter a left arm that follows the Prut to Lake Brateş in that flow.

In northern Cuca Plain, Chineja creek flows through a broad valley just over a distance of approximately 15 km course which presents a strong meandered.

Photos 1. Deep erosion in northern Cuca Plain (southwest town Folteşti).

As for the temporary river, this forms a series of meanders, mostly directed towards the Valley Ijdileni and less directly to Chineja creek.

Chineja is the only valley that has permanent drain on the entire length and, after developing terraces, seems to have had a permanent course of the same size on a large part of the Quaternary. On terraces Chineja not written anything yet. You can detach from research conducted with sufficient precision four terraces, connected with those of the Prut (Photos 2).

Photos 2. Chineja Floodplain West of Folteşti.

Pedogenetic processes under the influence of environmental factors that have led to the differentiation of horizons and hence the formation and development of soil cover of Cuca Plain mention: bioaccumulation, argillisation, erosion and gleyzation (Figure 3).

Bioaccumulation, manifested with different intensities in the territory and consisted basically accumulation in the upper layer of soil, a large amount of organic matter in various stages of humification. Therefore it came to separating the surface soil horizon molic (Am) have dark, rich in humus. Particularly intense process of bioaccumulation manifested when chernozems, the soils with the largest spread in the territory. The process of bioaccumulation is also present in other soils associated with the gleyzation (gleyic chernozems).

Argillisation. Usually argillisation occurs in the territory especially if aluviosols, without reaching the outline of a cambic B horizon. Salts are removed, including carbonates and parent material changes color due to alteration and the extra sescviozixi.

Erosion occurs in the region as a destructive process, leading to soil degradation in all cases and at the same time to resume pedogenesis. Due to erosion, some of soils on slopes will soon erodosols and only later, by reaching equilibrium profile will reach the stage of regosol the resumption of soil solification.

Gleyzation. This process became possible only Cuca Plain content areas with shallow ground water, such as alluvial plains inside the plain, and peripheral (Chineja Floodplain, including Prut Floodplain). It is to form the basis of aluviosols a horizon glei reduction characterized by specific colors, purple, gray, blue or yellow rust due to oxidation processes.

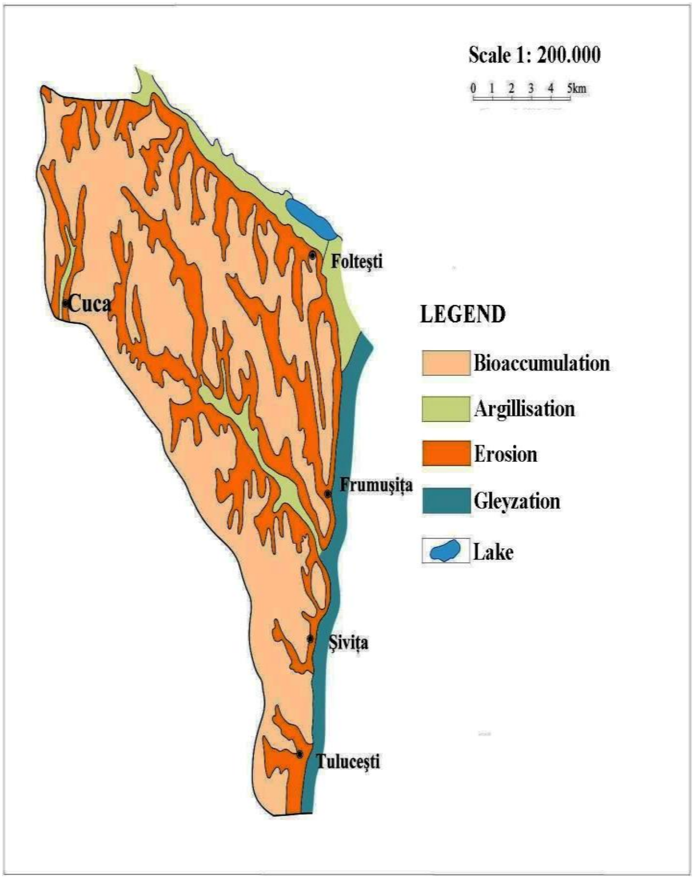

Figure 3. Cuca Plain. Map of pedogenetic processes.

Under the influence of long, simultaneous and uninterrupted pedogenetic factors and pedogenetic processes which we referred in the previous chapter, in Cuca Plain has formed a relatively wide range of soils combined in classes protisols and cernisols (Figure 4).

Protisols. This class includes soils fully developed, young emerging. Have the diagnostic horizons A (weak) followed by parental material or rock. They are represented by entic-gleyic aluviosols and gleyic aluviosols.

3.1. Entic-gleyic aluviosols are spread in the low Chineja Floodplain the soils are at an early stage of development, sediment formed less homogenous and having an horizon Ao below 20 cm thick (Photos 3).

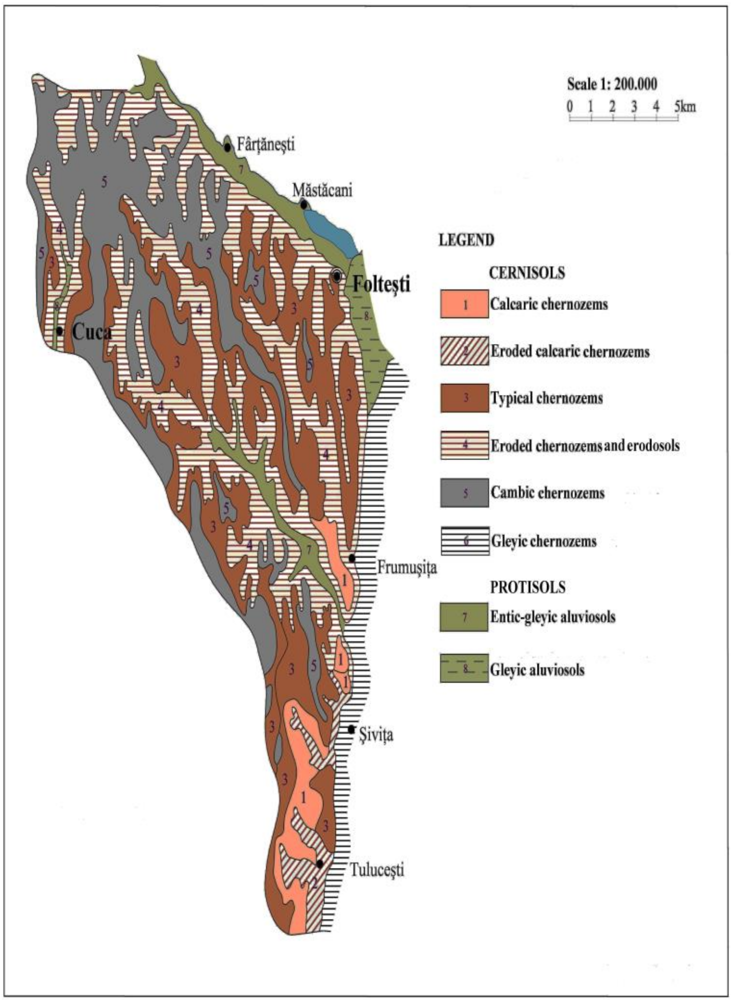

Figure 4. Soils map of the Cuca Plain.

It is characterized by a profile type Ao–AC–CGox-Cn very poorly differentiated. Have a texture ranging, from sandy to clay. The humus content rarely exceeds 1.5% in horizon Ao and decreases sharply at the horizon C. The degree of base saturation show high values (98 to 99%) (Table 1).

Photos 3. Entic-gleyic aluviosol in Chineja Floodplain.

Table 1. Physical and chemical data on entic-gleyic aluviosol

Horizon	Depth (cm)	0,002 mm	0,002- 0,02 mm	0,02 -0,2 mm	0,2- 2,0 mm	Humus %	pH (H_2O)	V %	Total N %	Mobile P ppm	Mobile K ppm
Ao	0-18	28.1	20.2	51.7	0.0	1.56	7.7	98.6	0.083	20.0	56.4
AC	18-32	25.7	22.3	52.1	0.0	1.29	7.8	98.2	0.069	13.5	45.6
CGox	32-43	32.5	27.2	40.3	0.0	0.82	7.9	98.0	0.047	16.5	49.8
Cn1	43-58	23.0	24.3	52.9	0.0	0.20	7.9	98.7	-	-	-
Cn2	58-78	35.8	28.7	35.5	0.0	-	-	-	-	-	-

It has a weak alkaline reaction (7.7 to 7.9).The supply of nutrients is poor nitrogen (0.047 to 0.083%), medium phosphorus (13.5 to 20.0 ppm) and total potassium poor (45 to 56 ppm).

3.2. Gleyic Aluviosols

These soils are most advanced evolutionary stage of aluviosols, being deeply influenced groundwater. Appear spread in the Chineja Floodplain downstream Folteşti, which occupies several hundred hectares.

Unlike entic aluviosols these are defined by a horizon A thicknesses greater than 20 cm, followed by parental material.

Gleyic aluviosols have a morphology type Ao-AC-CGox-Gr. In general, a composition very different size and thus have a texture from sandy to clay as aluviosols entic-gleyic (Table 2). The reaction is usually slightly alkaline pH (7.6-7.9), and the degree of saturation in all cases is high (97 to 99%). The humus content if gleyic aluviosols is very different, in larger amounts observing the horizon Ao (1.3-1.7%). With regard to the supply of nutrients, these soils are poor as nitrogen (0.044 to 0.088 %) and potassium (about 33.0 to 46 %).

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Table 2. Physical and chemical data on gleyic aluviosols

Horizon	Depth (cm)	0,002 mm	0,002- 0,02 mm	0,02- 0,2 mm	0,2-2,0 mm	Humus %	pH (H_2O)	V %	Total N %	Mobile P ppm	Mobile K ppm
Ao	0-18	21.0	15.5	63.5	0.0	1.68	7.64	96.9	0.088	47.0	45.7
AC	18-43	19.6	18.1	62.3	0.0	1.26	7.87	98.5	0.069	26.0	33.0
CGox	43-57	8.0	8.8	83.2	0.0	0.78	7.73	99.3	0.044	14.5	20,7
Gr	60-80	2.4	2.0	95.6	0.0	-	7.61	-	-	-	-

Cernisols. Occupying more than 85% of the territory, cernisols are represented by: typical chernozems, calcaric chernozems, calcaric eroded chernozems, eroded chernozems, cambic chernozems and gleyic chernozems.

3.3. Typical Chernozems

These soils are defined by a horizon molic Am with chrome ≤ 2 material wet and horizon AC having at least in the upper values and chrome <3.5 material all wet. They are widely distributed in the central and southern plains. Appear interfluves backs or on their edges as some terraces. They were formed under a relief plan on loess-like deposits clay-loam.

Typical chernozems profile is characterized by a profile type Am-AC-C or Cca.

The texture typical chernozems varies from loamy-sand to the clay, but not in the profile. The highest quantity of clay appears in the upper horizon Cca2 (36.2%) (Table 3).

Table 3. Physical and chemical data on typical chernozems

Horizon	Depth (cm)	0,002 mm	0,002- 0,02 mm	0,02- 0,2 mm	0,2-2,0 mm	Humus %	pH (H_2O)	V %	Total N %	Mobile P ppm	Mobile K ppm
Ap	0-18	31.7	30.7	37.6	0.0	3.0	8.0	95.6	0.160	35	126
Aph	18-26	31.2	31.1	37.7	0.0	2.7	8.1	96.7	0.156	26	121
Am	26-44	29.9	32.0	38.1	0.0	2.5	8.2	98.0	0.160	14	99
AC	44-70	29.6	34.6	35.8	0.0	1.6	8.2	98.4	0.117	7	113
Cca_1	70-105	28.2	32.5	39.3	0.0	0.7	8.3	100	-	-	-
Cca_2	105-138	24.4	36.2	39.4	0.0	0.5	8.3	100	-	-	-
Cca_3	138-180	20.4	32.2	47.4	0.0	0.2	8.4	100	-	-	-
Cca_4	180-200	20.5	31.5	48.0	0.0	0.2	8.5	100	-	-	-

Humus content ranges from 2.7 to 3.0% we in the upper horizon Am and decreased to 2.5% in the lower part, the horizon AC is maintained about 1.6%, and then decreases gradually until the based on soil profile. Because of carbonates, typical chernozems shows a weak alkaline reaction of the surface (pH 8.0 to 8.4), and the degree of saturation is highly eubazic (95.6 to 100 %).

Supply nutrients nitrogen is average (0.117 to 0.160%), lower-middle-phosphorus (7 to 35 ppm) and low potassium (99 to 126 ppm).

3.4. Calcaric Chernozems

Soils in this category they carbonates in the first 20 cm from the surface (proxicalcaric) and meet in south-eastern Cuca plain and especially on the bridge terraces, where they formed the parent materials loess-like loamy.

Calcaric chernozems is characterized by a profile of type Am-AC-C or Cca. Textural are undifferentiated soils, loamy, permeable, with a low humus content (1.60 to 3.0%), weak alkaline reaction (8.2 to 8.3) and a good supply of nutrients (N, 0.108 to 0.137 %; P, 305 to 340 ppm; K, 227 to 345 ppm).

3.5. Eroded Calcaric Chernozems

Soils are less common in Cuca Plain, the southern extremity of it. Appear on poorly-moderately inclined slopes, parent materials loess-like loamy.

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Morphologically characterized by a profile of type Am-AC-C or Cca less developed that differ from the calcaric chernozems the reduced thickness of the upper horizon. Local horizon that barely exceeds 10 to 12 cm thick. The thinness of the horizon Am, low nutrient content and their location on the slopes give small productions. They are better appreciated when their vine cultivation (Photos 4).

Photos 4. Eroded calcaric chernozems the Tuluceşti.

3.6. Eroded Chernozems

Are characteristic of hill slopes predominantly work in the valley and very frequently with planters. They were formed on parent materials nature delluvial.

From a morphological profile is characterized by a type Am–AC–C or Cca. It frequently horizon erosion is reduced in thickness, that sometimes barely measure a few centimeters. Local is brought up to date even horizon AC of these soils transition, leading to a sharp drop in their fertility levels. As a result agricultural production is reduced by more than half compared to typical chernozems (Photos 5).

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Photos 5. Eroded chernozems on the slopes southwest of Folteşti.

3.7. Cambic Chernozems

As typical chernozems, these soils meet all of interfluves flat on their backs. In northern plain flat surfaces of interfluves total deal, then going south to tighten their center. They were formed on loess-like deposits clay loam as typical chernozems.

Cambic chernozems presents a profile of type Am-AB-Bv-Ck or Cca, moderately deep. They contain around 37-40% clay in the upper horizon and between 33-38% in the horizon Bv. The reaction of these soils is slightly acidic in the upper horizon (6.3 to 6.8), humus content is small (2.4 to 3%) on the surface. The supply of nutrients is small-sized, nitrogen (from 0.138 to 0.180%) and phosphorus (3 to 28 ppm), and lower in terms of potassium (87 to 108 ppm) (Photos 6, Table 4).

Photos 6. Cambic chernozems cultivated with maize north of Cuca.

Table 4. Physical and chemical data on cambic chernozems

Horizon	Depth (cm)	0,002 mm	0,002-0,02 mm	0,02-0,2 mm	0,2-2,0 mm	Humus %	pH (H_2O)	V %	Total N %	Mobile P ppm	Mobile K ppm
Ap	0-18	38.8	33.1	28,1	0.0	3.0	6.3	89.1	0.179	28	98
Aph	18-30	37.8	34.2	28,0	0.0	3.0	6.5	88.7	0.169	14	87
Am	30-45	40.0	33.8	26.2	0.0	2.4	6.8	95.1	0.154	3	108
A/B	45-62	39.8	32.1	28.1	0.0	2.1	7.2	93.4	0.138	3	108
Bv_1	62-82	37.7	32.5	29.8	0.0	1.9	7.2	96.0	-	-	-
Bv_2	82-112	35.3	35.0	29,7	0.0	1.2	7.2	96.3	-	-	-
Bv_3	112-140	32.8	35.0	32.2	0.0	0.9	7.4	97.6	-	-	-
Ck_1	149-170	32.3	33.2	34.5	0.0	0.8	8,1	100	-	-	-
Ck_2	170-200	31.0	29.8	39.2	0.0	0.6	8.2	100	-	-	-

3.8. Gleyic Chernozems

Differ from typical chernozems in that the base presents a gleic horizon gleyic (Gr), formed under the influence of groundwater located at very shallow (1 to 2 m).

They are spread only in the area immediately surrounding the course Chineja, between localities Folteşti and Tuluceşti. They were formed on flat surfaces, shallow ground water, the materials nature as fluvial clay loam.

It is characterized by a profile of type Am-AG-CkGox or CcaGox. Presents a humus content of 2,5 to 2,7%, were weak alkaline reaction (7.0 to 7.6) and a good supply of nutrients (N, 0.32 to 0.48%; P 20 to 25 ppm). Gleyic cernozems use as arable land is restricted due to excess moisture. Predominantly used for pasture. For agriculture requires large land improvement works.

4. Conclusion

The investigated area refers to the plains, called Cuca Plain. Geomorphological space presents clear boundaries and lies wholly in Galaţi County.

As apparent from the relief map, this territory is in turn composed of a series of interfluves, most orientate direction to the north west - south east. They added that some relief steps lower terraces and broad floodplain of Prut and Chineja developed.

Within interfluves slopes have a large development. Predominate relatively planar, then the moderates who added splay strongly inclined slopes. Local they are affected by some current processes such as landslides and crash, which are added gullies occur and alluvia.

From a climatic region belongs to warm dry area - subareas 2 and 4 moderate heat and sub-humid zone, subzone 1, characterized by high levels of thermal and hydro modest, but parameter values of temperature and water stress assessment.

The average annual temperature not exceeding 11 ^{0}C and the average rainfall exceeding 700 mm rarely (450-700 mm).

The main arteries that drain basins are represented throughout the Prut and its tributary Chineja. Supplies from rain and snowmelt and presents less significant debts.

Groundwater is found at shallow depths only within the landscape of floodplain, where ranges between 1 and 3 m.

Geobotany map of Romanian Geological Institute that most researched territory is cultivated. However not lacking forests. They consist of *Quercus pedunculiflora*, *Quercus pubescens* (Photos 7), and the floodplains of northern territory, clearings and glades, grassy steppe vegetation dominates *Festuca valesiaca*, *Agrostis alba*, etc.

Photos 7. Forest *Quercus pedunculiflora* and *Q. pubescens* northeast of Cuca.

Under the influence of several factors and pedogenetic processes in the investigated soils were formed protisols and cernisols class.

In the future, the contents Cuca Plain will continue research on the risks pedogeomorfologic, whereas nearly 50% of the territory is the sloping surfaces, worked perpendicular to the contour, where erosion is amplified from year to year. Increasing amounts of topsoil are detached from rainwater and transported at different distances (Ilie, 1996; Parichi and Stănilă, 2008). Number rill and gullys are growing.

We will also carry out the assessment pedology land after suitability arable, resulting in mapping in connection with the group lands in graded by restrictive factors of agricultural production, according to „Methodology developing soil studies” Volume I and III, ICPA, Bucharest.

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Conflict of Interest

We declare that we have no conflict of interest.

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