

## MORPHOLOGICAL COMPOSITION AND PHYSICAL TRAITS OF SOILS WITH DIFFERENT DEGREE OF EROSION IN THE RECEPTION BASIN "NEGREA" AND THEIR INFLUENCE ON THE EROSION PROCESS

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### Abstract

*In nature of soil research is done using morphological method was initially used only in botany and geology then was adopted upon row of all other natural sciences. The purpose of the study is to evaluate morphological and physical properties of the soils with different degree of erosion in the reception basin "Negrea" (Republic of Moldova) based on the data obtained from six main soil profiles. We made a morphological description of the profiles and developed a soil map at a scale of 1:5000 showing the spatial distribution of soils with different degree of erosion. The diversity of relief forms, rocks and agricultural land use determine the existence of a variable and complex soil cover consisting mainly of common chernozems (83%). Loam, clay-loam and sandy-dusty soil texture, as well as the unsatisfactory hydrostability of the soil structure are contributory factors for erosion spreading processes on agricultural lands. The soils on slopes are affected by denudation and evolve through a denudation-compensation pedogenesis, it means that there is a certain development of the soil in depth during the relatively long period of slow denudation; thereby pedogenesis compensates, at least partially, the denudation. In the case of the anthropogenically accelerated erosion, resulting from inadequate management practices, great soil losses cannot longer be compensated by pedogenesis. A textural particularity of these rocks is high content of fine-medium sand (20-30%), nonspecific from loesses deposits (5-10%). In the process of performing soil studies it was found that soils on the slopes in the reception basin "Negrea" are affected by denudation and evolves through a denudation-compensation pedogenesis, in the sense that the relatively long period, which is going slow denudation has there is also a certain development of the soil in depth, pedogenesis compensates, at least partially is for the denudation (Florea et al., 1987). According to the results of the determination and calculation values of water reserves in the layer 0-100 cm of soils at this time are practically equal, which is explained by their texture homogeneity.*

**Key words:** denudation, eroded soil, physical properties, reception basin, Republic of Moldova.

### INTRODUCTION

According to research conducted it was found that the soil cover of the reception basin "Negrea" is an example of indestructible unit of interaction of soil, vegetation, the environment and a man in a hilly region. The basin is located on the plain Middle Prut within the limits of the estate village Negrea, district of Hancesti, being part of the accumulation basin of rivulet Lapusnita, the left side tributary of the river Prut. The study aimed at the north-east and middle of the agricultural land of the village New Negrea.

Aim of the researches was to highlight genetic peculiarities, negative assessment of changes reception basin characteristics of soils as a result of erosion and the appreciation thereof suitability to different agricultural works. The

relief the basin framework consists of two primary surface heights denudation, with altitude 226 - 227 m, who starts from two elongated ridges ending in the valley rivulet Lapusnita. The inclination of relicts of denudation surface is about 1° (Andries et al., 2003).

The primary surface of denudation is situated flood witnesses - local two heights connected by a saddle from which starts dell of hills. Solification rocks in the reception basin are formed from the mixture loesses deposits of Pleistocene-Holocene with ones alluvial from Pliocene-Pleistocene (Bilinkis 2004; Brindus et al., 1999).

A textural particularity of these rocks is high content of fine-medium sand (20-30%), nonspecific from loesses deposits (5-10%). In the central part of the slope of southwestern

exhibition on the field within a crop rotation located above the warehouse from the center dale, solification rocks are weakly skeletal disorders and contain fragments of sandstone, showing the location at shallow depths of compacted rocks. Soil differs from terms of morphology of rock that was formed by a vertically differentiated structure. Solification in the valley rocks are formed from deposits of proluvial pedolith and glaciates at the foot of the slopes - from delluvial deposits of pedolith, washed down slopes (Brindus et al., 1999; Florea et al., 1987).

## MATERIALS AND METHODS

Reception basin "Negrea" is located in the middle of the hydrographic basin of the rivulet Lapusnita and is typical for the reception basins formed as a result of fragmentation by erosion high terraces of the Prut river and their tributaries left. High terraces of the tributaries of the Prut river and the itself Prut river synchronous were formed in the Pleistocene and represents a unique relief in terms of genesis and lithology rock surface, characteristic of the Middle Prut Plain (Andries et al., 2003).

Description detailed morphological, determination of soils of the reception basin "Negrea" was made based on the data obtained for the six main soil profiles:

**Profile №1.** Ordinary chernozem non eroded;

**Profile №3.** Ordinary chernozem weak eroded;

**Profile №6.** Ordinary chernozem moderately eroded;

**Profile №4.** Ordinary chernozem strong eroded;

**Profile №15.** Chernozem izohumic cumulative;

**Profile №10.** Soil typical cumulative.

Reception basin "Negrea" is situated in the temperate zone and is characterized by a moderate continental climate, warm, semi-humid. The annual amount of precipitation in the investigated area is equal to 500-550 mm, potential evaporation ranges from 850 mm on the crests and to 900 mm at the foot of the slopes. Coefficient values moisture the territory reception basin, calculated from the formula of Ivanov - Vysockij varies between of 0.6 to 0.65.

## RESULTS AND DISCUSSIONS

In the process of performing soil studies it was found that soils on the slopes in this reception basin are affected by denudation and evolves through a denudation – compensation pedogenesis. In the sense that the relatively long period, which is going slow denudation has there is also a certain development of the soil in depth, pedogenesis compensates, at least partially, for the denudation (Florea et al., 1987).

An exception is the case where there is an accelerated erosion of anthropogenic factors, such as inadequate management situation in which the massive loss of soil through erosion cannot be compensated by the pedogenesis. Both cases are present on the reception basin "Negrea".

**First case.** Use of land for perennial plantations and unclog of soils led to the output to the surface horizons underlying weak humiferous of soils initially eroded. Also humiferous surface horizons were buried at a depth of 30-50 cm, thus avoiding the possibility of being further destroyed by erosion. Formation of micro terraces between rows in vineyard plantations and orchards, grassing space between trees in orchards led to diminishing of the erosion processes. As a result, intensified processes of accumulation of organic matter in the former underneath horizons, weak humiferous to the surface by unblocking (Cerbari, 2010).

**Second case.** Vineyards and orchards in the fields of central reception basin were cut by 20 years ago and the lands - in arable included. Under the influence of this action anthropogenic the erosion processes intensified, the losses fertile soil have increased. Therefore, recent grubbing vineyards and orchards old plantations and the passage lands as arable could lead to a suddenly increase of the erosion processes reception basin territory. Ratio between flat and sloping land may serve as an indicator of the degree of manifestation of erosion processes and implicitly of volume of liquid leaks and loss of topsoil and nutrients evacuated from this zone of the river Prut. (Andries et al., 2003; Cerbari, 2010).

Non eroded soils are spread only very weakly inclined surface peaks (approximately

inclination 1°). These soils are used as a standard to determination of the degree of soil erosion on slopes, by comparing the total thickness of the humiferous profile of eroded soils with the thickness humiferous profile of soil – non eroded standard.

The spectrum of ordinary chernozems with full profile, of with different degree of erosion, izohumice cumulative and soil typical cumulative sloppy, spread on the territory reception basin “Negrea” (Figures 1.1.-1.6.).

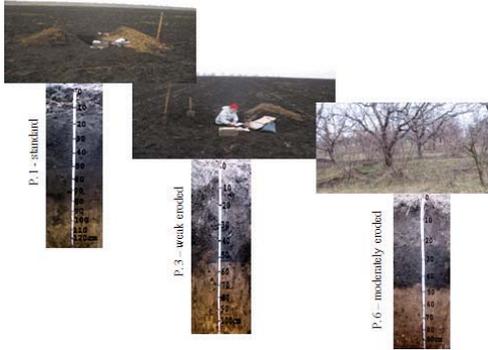


Figure 1.1-1.3. Soil profiles with different degrees of erosion



Figure 1.4-1.6. Soil profiles with different degrees of erosion

**Profile №1:** *Ahp1* → *Ahp2* → *Ahb* → *Bh1* → *Bh2k* → *Bck1* → *Bck2*.

**Profile № 3:** *Ahp1* → *Ahp2* → *Ahb* → *Bck* → *Ck*.

**Profile №6:** *ABhp1* → *ABhb2* → *Bck1* → *Bck2*.

**Profile № 4:** *Bhp1* → *Bhb2* → *Bck1* → *Bck2* → *Bck2*.

**Profile № 15:** *Ahp1* → *Ahp2* → *Ahb* → *Bh1* → *Bh2k* → *Bck*.

**Profile № 10:** *I hp* → *II h* → *III h* → *IV h* → *Ahb* → *ABhb* → *Bhb1* → *Bhb2* → *BC*.

After physical clay content on the sector reception basin predominate clayey- loam soils

Exceptions are cumulative soils and partly strong and very highly eroded soils horizons or layers above which have the loam texture. Small areas of loam soils are shown on the map of soils in the north-west of the basin atop the near the village (Cerbari, 2010; Canarache, 1990; Puiu, 1980). Information on the particularities of granulometric composition of ordinary chernozems investigated of the territory of reception basin "Negrea" are presented as graphs below (Figure 1.7 (a, b)).

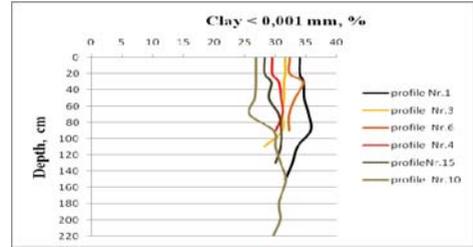


Figure 1.7(a). Clay %, on profile of ordinary chernozems not eroded with different degrees of erosion and cumulative

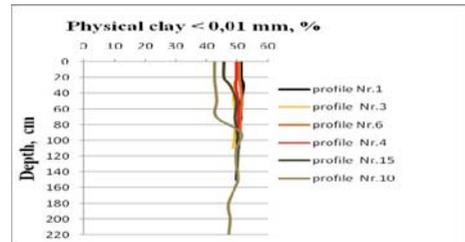


Figure 1.7 (b). Physical clay %, on profile of ordinary chernozems not eroded with different degrees of erosion and cumulative

High total content of medium sand, fine and coarse dust in recent conditions of chernozems arable layer ensures for plain soils of the Middle Prut physical and physical-mechanical properties compared favorable (Krupenikov et al., 1987; Canarache, 1990).

The corresponding humidity physical maturity these soils are working compared easily which ensures the ability to create a favorable germinating bed for crops. Vegetation has a special role in the stabilization the processes of leakage on the slopes. A specific feature of the investigated soils texture is medium and high content of fine sand. This confirms the formation of these rocks parental synchronous from a mixture of loess and alluvial deposits of wind. The highest content of fine and medium sand is characteristic of non eroded ordinary chernozem, located in the upper the basin on

the former primary surface denudation of Pliocene age (Bilinkis 2004; Brindus et al., 1999). The high content of fine and medium sand in combination with not too high clay content (mostly 28-31%) ensures cohesion middle between elementary particles of soil that, as a result determines small water stability of the structural elements and a medium resistance of erosion of soils. On the other hand, in terms of texture, these soils are very suitable for vine plantations and orchards what concomitantly with favorable weather conditions led to unclog soils and total land use under the these cultures (Florea et al., 1987; Puiu, 1980; Zaslavskiy, 1966).

Field research was conducted in early spring after rain and soil moisture practically corresponds with researched field water capacity (CC). Aeration porosity values at CC genetic soil horizons in the following is ranked in: arable layers - large aeration porosity; the former arable layers (20-35 cm) - small aeration porosity; underlying layers under the former arable - very low aeration porosity for the strongly eroded soil and low for all other soils (Cerbari, 2010; Canarache, 1990).

In the process researches pedological in the period April 10 to 15 was determined and humidity in the layer 0-100 cm of soil principal profiles. According to the results of the determination and calculation values of water reserves in the layer 0-100 cm of soils at this time are practically equal, this is explained by their texture homogeneity. Density values with depth increases from 2.63 to 2.64 in the earth's surface horizons up to 2.68-2.72 in the underlying horizons. The bulk density for weak humifiable horizons of reception basin soils varies between 1.40-1.55 g/cm<sup>3</sup>, specific values chernozems (Figure 1.8).

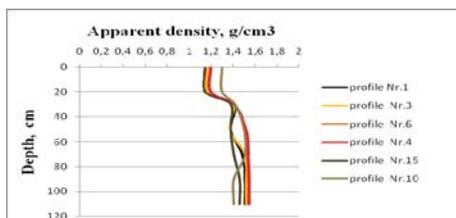


Figure 1.8. Bulk density (g/cm<sup>3</sup>), on profile of ordinary chernozems not eroded with different degrees of erosion and cumulative

Database on characteristics of soils investigated will enable to plan and implement the

necessary measures for the protection, sustainable use and increasing soil fertility exposed erosion process (Cerbari, 2010).

## CONCLUSIONS

The diversity of relief forms, rocks and agricultural use conditional existence on the territory reception basin "Negrea" with complex cover of soils, in which the predominant component ordinary chernozems with varying degrees of erosion (83%).

The texture of loam and clayey-loam, sandy-dusty, unsatisfactory hydro stabilities of the structure are factors that contribute to the spread of the erosion processes of soil on agricultural land of the reception basin.

The soil cover of the reception basin „Negrea” is an exemplification of indestructible unit between the interaction of soil, vegetation (life), environment and human in a hilly region. Soils on the slopes are affected by denudation and evolve through a denudation-compensation of the pedogenesis.

Antierosional works within the reception basin should be made based on a scientific project reasoned that provides a systematic approach to this problem. It is necessary to extend the herbaceous vegetation areas to evacuate rainwater and reduce soil losses as a result of erosion.

## REFERENCES

- Andrieș S. et al., 2003. Programul de conservare a solului din bazinul hidrografic al râului Lăpușna pentru reducerea poluării cu nutrienți a resurselor de apă. Chișinău, 60.
- Bilinkis G., 2004. Geodinamika krajnego ūgo-zapada Vostočno-Evropejskoj platformy v ěpohu morfogeneza. „Biznes-ělita”, „Lextoria”, Kišinev, 184.
- Brănduș C. et al., 1998. Dicționar de termeni fizico-geografici. "Chemarea", Iași, 438.
- Canarache A., 1990. Fizica solurilor agricole. Ceres, București, 268.
- Cerbari V., 2010. Monitoringul calității solurilor Republicii Moldova. Pontos, Chișinau, 475.
- Florea N. et al., 1987. Metodologia elaborării studiilor pedologice. Partea III-a, București, 226.
- Krupenikov I., Podymov B., 1987. Klassifikaciã i sistematiceskij spisok pocv Moldavii. Štiinca, Kišinev, 157.
- Puiu S., 1980. Pedologie. Ceres, București, 394.
- Zaslavskij M., 1966. Ęrozia pocv I zemledelie na sklonah. Kišinev, 494.