THE MULTIFUNCTIONAL ROLE OF PROTECTIVE FOREST STRIPS AROUND AND INSIDE AGRICULTURAL FIELDS

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„Tu, pământ al țării noastre, pătimaș cuprins în palmă,
Pe sălbatica ta față cu lungi riduri brune, parcă
Greu blestem, ursind făptura-ți să nu poată să întoarcă
Dragostea pe care omul necăjit ți-o închina.”
Nicolae LABIȘ

Abstract. *The experience of international research demonstrates the high efficiency of protective forest strips around arable land (Current et al., 1995; Hillbrand et al., 2017). However, in our country, the problem of the economic substantiation of the effectiveness of these measures prevents their development and the reason is the low attractiveness for the owners of the agricultural lands that are prone to the erosion process, despite their major importance. To save such an agro-ecosystem, provision should be made for the establishment of protective forest strips on arable land. The purpose of the study is to analyze the effectiveness of protective forest strips in the rehabilitation of arable land, as an effective stimulus in sustainable development, environmental security in the agricultural sector and the reduction of agricultural land degradation. For sloping arable land, the study shows that the parameters of the properties of the agroecosystems protected by the forest strips, regulate the dynamic values of soil water reserves and maintain its quality. The action of main indicators of the effectiveness of anti-erosion measures depend on the area, the slope of the arable land, the danger of erosion, and the characteristics of the investigated soil.*
Keywords: *agroforestry systems, agricultural crops, Copăceni commune, economic effectiveness, key polygon, soil moisture and physico-chemical properties.*
JEL: *O13, P32, Q16, Q23, Q24, Q57*
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Introduction. Agroecology, barely recognized a decade ago in official circles, has now taken center stage in global discussions of the food system, environment and development. In particular, agroecology is gaining new relevance in the reconstruction of agriculture. Agroecological practices such as crop diversification, intercropping, agroforestry, mixed cropping and livestock systems, soil management measures and farmer-to-farmer networks have been reported to have positive outcomes in food security and nutrition. For example, agroforestry systems frame crops, shrubs and trees of different heights and shapes at different levels or layers, facilitating vertical layers with different habitat and resources for biodiversity, climate mitigation and productivity. Agroforestry is a dynamic, environment-based natural resource management system that, by integrating trees into farm households and agroecosystems, diversifies and sustains production and contributes to more resilient rural livelihoods. Time-tested practices such as agroforestry systems, which rely on conservation agriculture and trees to improve soil health and increase and sustain crop productivity, are a good example of the widespread application of the concept of agroecology (Nair & Garrity, 2012). The ability of vegetative buffer strips to reduce surface transport of agrochemical pollutants is the main premise of the water quality problem, while the biodiversity conservation attributes of these systems derive from species diversity and complexity. These integrated land use systems and their social values have been ignored in our modern agricultural development efforts. We treat agriculture and forestry separately, although these sectors are often intertwined in the same landscape and share many common goals (Nair et al., 2010).

Literature review. Investing in the conservation, protection and use of agrobiodiversity in the field is an urgent need in the Republic of Moldova, to enable and facilitate agroecological transitions and production systems that provide nutritious food and ecosystem services. Native farming communities in all of our country's agroecosystems are particularly vulnerable to weather uncertainties and climate change. And agricultural innovations respond better to local challenges when they are co-created through participatory processes.

The conversion of grasslands and forests to agricultural land is not sustainable if the conversion occurs on land unsuitable for agricultural production and if rates of soil loss exceed rates of soil formation (Oldeman, 1994). Erosion is intensified when the vegetation cover is destroyed by cultivation. The resulting erosion can reduce productivity by structurally degrading the soil, as well as by reducing water-holding capacity, runoff of water and nutrients, and by altering other soil properties. Susceptibility to soil erosion and the rate of soil loss are controlled by a number of variables, including atmospheric, terrain, soil and vegetation factors (Lipiec et al., 2006; Reitsma et al., 2015). During periods of rapid land conversion, for example the early 1990^{s}, grasslands and mass deforestation are often converted to agricultural land. Land use change can also affect water retention at field capacity in the soil. The sustainability of cropping systems requires focused attention for soil quality monitoring due to growing concern about declining soil productivity and soil organic carbon depletion caused by intensive agricultural practices (BAERM).

Many scientific studies have established that the greatest amount of moisture in natural chernozems, as a rule, occurs in the spring, after the snow melts. During the growing season, plants absorb moisture from the upper layer up to 1 meter, where the maximum seasonal change in moisture is observed. Summer rainfall usually moistens the soil to a depth of 20–30 cm. In arable chernozems in the first half of the growing season, the change in humidity is quite close to natural conditions. The difference is noticeable in the second half of summer. During this period, vegetation continues on natural lands, as a result of which they absorb moisture, and on arable lands, moisture consumption ceases to be significant and is lost from the soil due to physical evaporation (Erëmin & Šahova, 2010). According to scientific studies carried out in various countries, the existence of forest strips leads to an average harvest increase of 15% (FFRIPCA). The effectiveness of forest strips in reducing off-site sediment transport is known to vary with the ratio of runoff area to strip area, as well as the involvement of other factors, including soil type, topography, soil-water management, land use, rainfall intensity and humidity conditions (Arora et al., 2003). Some scientists believe that the microbiological activity of the soil under winter wheat increases as it approaches the protective forest strip. Studies have shown that forest strips in combination with soil protection technologies contribute to winter wheat productivity by 10-15%. Other researchers define the main role of protective forest strips in the physical protection of crops against the wind and, consequently, the reduction of moisture evaporation. The lack of water in the soil damages its agrophysical properties, suppresses biological and chemical processes that reduce the amount of available nutrients. They help reduce wind speed, retain and evenly distribute snow on the field (as a result, protect crops from frost), reduce surface runoff of atmospheric precipitation, increase soil moisture and reduce moisture evaporation, prevent deflation, improve the general and hydrological microclimate, the regime territory, increase the effectiveness of agronomic measures and increase crop yields (Abakumov, 1986).

Research methodology. Research was carried out in the field regarding the agropedological study of the soils in the Copăceni commune and the effectiveness of the protective forest strips on their quality in the years 2021-2022. The source materials were collected during field expeditions. The properties of soils in agrocenoses were studied on different agricultural lands. Thus, within the agroecosystems, 2 key polygons were identified and located for the comparative evaluation, being divided into fields. Polygon-key No. 1 consists of 4 fields with agricultural crops protected by forest strips, having a total area of 193.8 ha. Polygon-key No. 2 consists of 3 fields with agricultural crops not protected by forest strips, having a total area of 19.7 ha. Applied research methods include: selecting the location of soil profiles; using the drill to take soil samples from a depth of up to 60 cm in aluminum ampoules (preventively weighed) to determine the values of moisture reserves within the key polygons, in three consecutive repetitions in spring-summer and autumn; digging profiles for morphological description; taking soil samples for laboratory analysis of physico-chemical properties.

Main results. Copăceni commune (*Figure 1*), being a commune in Sîngerei district, in the North of the Republic of Moldova, was selected as a research object. It consists of the villages of Copăceni (as a village-residence), Antonovca, Evghenievca, Gavrilovca, Petrovca and Vladimireuca.

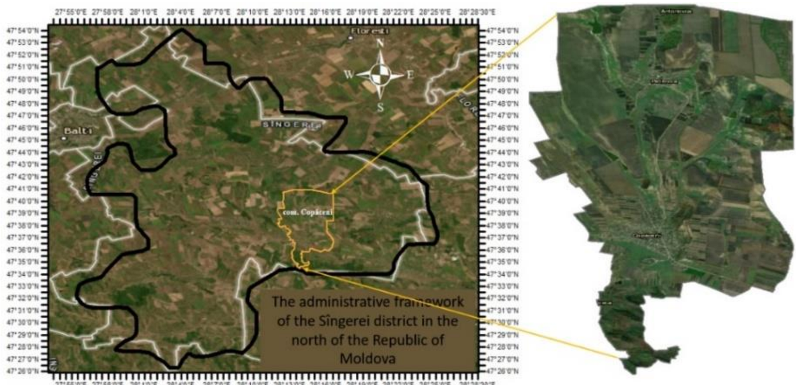

Figure 1. **Geospatial data with reference to the location of Copăceni commune, Sîngerei district**
Source: Created by the authors using GIS software

The Hydrothermal Coefficient (CHT) based on detailed analysis by years, to identify climate change trends during the vegetation period of plants, is 1.1-0.8. According to the main agrometeorological indices, the Copăceni commune is characterized by sufficient humidity, favorable for the development of agricultural crops.

According to the agropedological division of the territory of the Republic of Moldova, the territory of the Copăceni commune is part of the sub-district (3a), consisting of typical and usual chernozems with patches of solonets, phreatic-moist salty chernozems of the hilly steppe of Ciuluc (Ursu et al., 2010).

According to the agrosilvoameliorative districting of the Republic of Moldova, the territory of the Copăceni commune (*Figure 2*), Sîngerei district is part of the agrosilvoameliorative District II - of the northern steppe with the Balţi Plain from Răut River to Prut River (Galupa & Talmaci, 2021, pp.40).

Figure 2. **The aspect of the delimitation of Copăceni commune**
Source: Created by the authors using GIS software

As a result of the investigations carried out in the Copăceni commune, we find that, at the present moment, human activity in agriculture has intensified, transforming the efficiency of agroecosystems. Deforestation and excessive use of arable soils on the slopes caused the intensification of soil erosion processes and landslides. The overgrazing of the previous years led to the complete degradation of the meadows, both on the slopes and in the meadow. As a result of land privatization, in some sectors, the content of fertile elements in the soil was reduced without the application of fertilizers, thus decreasing their fertility. The anthropic factor in combination with natural conditions determines both the intensity and the process of solification, as well as the degree of evolution of the degradation processes of the soil cover of the municipality.

The investigations within the Copăceni commune were carried out on 2 key polygons in three consecutive repetitions (*Figures 3-4*). First of all, the dynamics of soil moisture values and apparent density in agrocenoses were determined, soil samples were taken in spring-summer and autumn in the years 2021-2022 on the lands near the forest curtains (Polygon-key No. 1) and the lands without the protective forest curtains (Polygon-key No. 2).

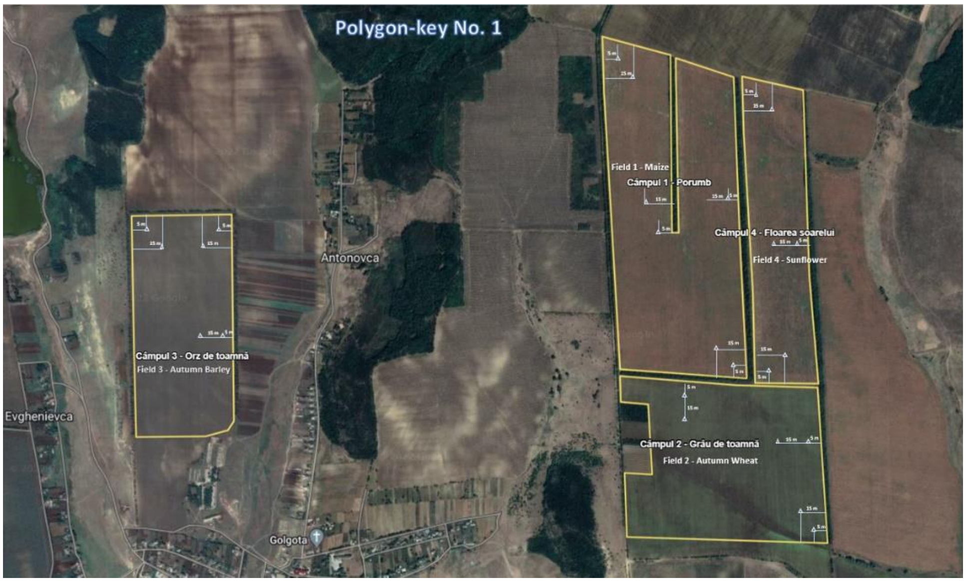

Figure 3. **Sampling of soil samples from Polygon-key No. 1**
Source: Created by the authors using data from the National Geospatial Data Fund

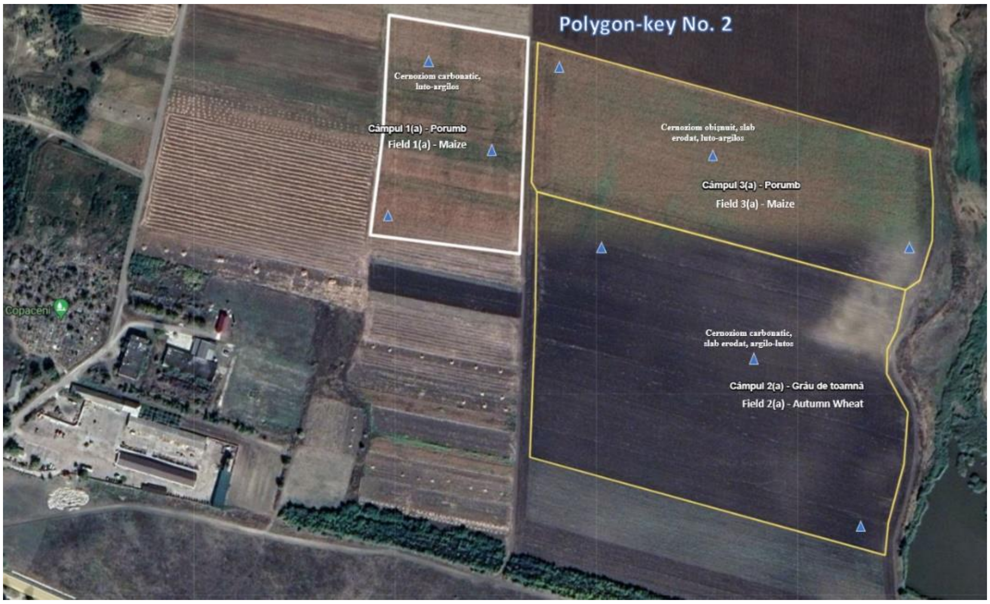

Figure 4. **Sampling of soil samples from Polygon-key No. 2**
Source: Created by the authors using data from the National Geospatial Data Fund

Soil moisture determinations in the field were carried out in three repetitions on Field 1 – Maize, preceded by Autumn Wheat with the surface of 70.7 ha; Field 2 - Autumn wheat, preceding Sunflower with an area of 52.0 ha; Field 3 - Autumn Barley, preceded by Maize with an area of 39.0 ha; Field 4 - Sunflower, preceding Autumn wheat with the area of 31.9 ha protected by the forest curtains (*Figures 5-6*).

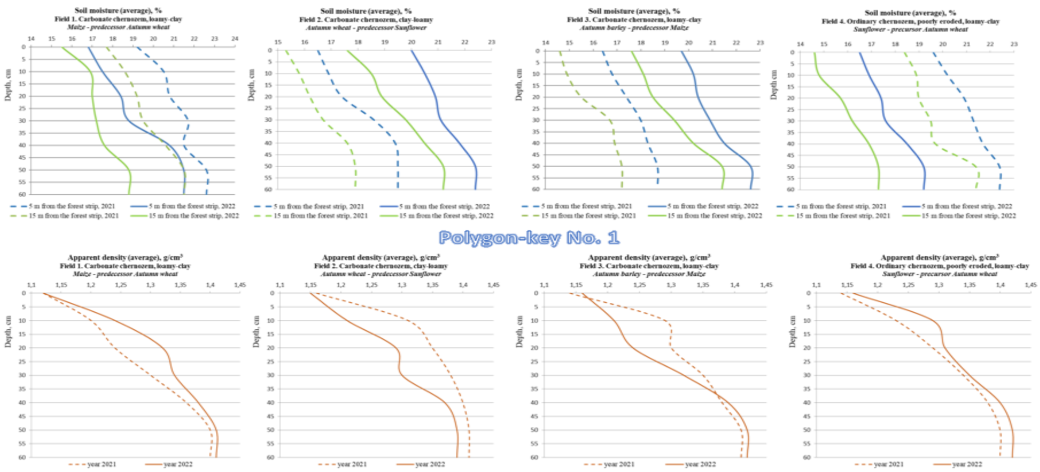

Figure 5. **Average values of soil moisture (%) and bulk density (g/cm^3) within Polygon-key No. 1**
Source: Created by authors

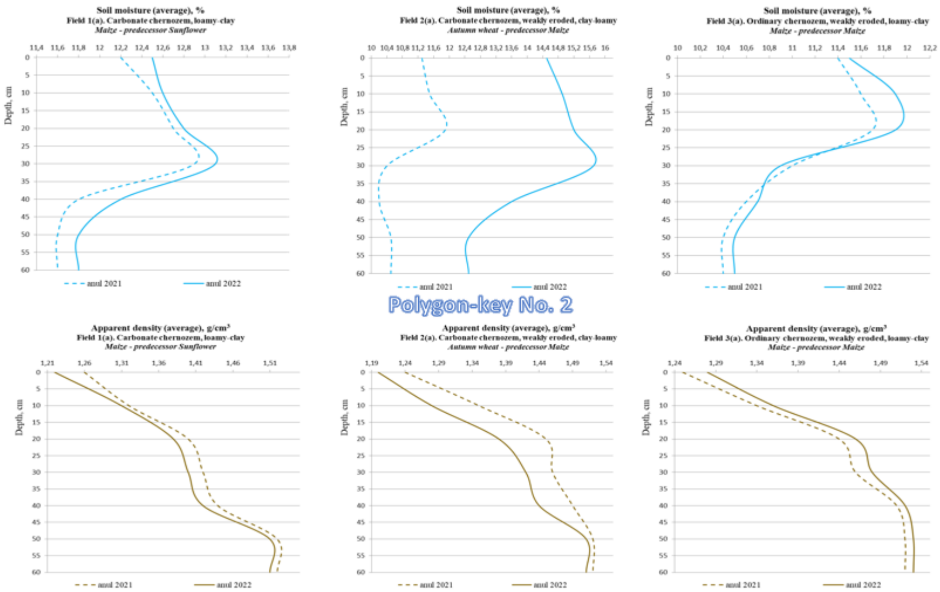

Figure 6. **Average values of soil moisture (%) and bulk density (g/cm^3) within Polygon-key No. 2**

Source: Created by authors

Also, on the lands without the protection of forest curtains: Field 1(a) – Maize, preceding Sunflower with the surface of 3.3 ha; Field 2(a) - Autumn Wheat, preceding Maize with an area of 10.3 ha; Field 3(a) – Maize, preceding Maize with an area of 6.1 ha. In order to determine the influence of forest protection strips on soil moisture in the field, samples were taken at different distances (5 m and 15 m) from the forest strip. The largest reserves were 19.2-22.4% on Fields 1 and 4 - occupied with Autumn Wheat in 2021, and respectively 19.7-22.6% on Field 2 and Field 3 - occupied with Autumn Wheat and Autumn Barley in the year 2022, taken from 5 m from the forest strip. The lowest soil moisture values (compared to those near the forest strips) were highlighted on the lands without protective forest strips: Field 2(a) and Field 3(a) - occupied with Maize in 2021, and in 2022 on Field 3(a) - occupied with Maize.

Apparent density values were also determined in the same terms as humidity, which range from 1.12-1.16 g/cm^3 in the superficial horizons (0-10 cm) to 1.24-1.35 g/cm^3 in the depth 20-30 cm and 1.39-1.42 g/cm^3 at the depth of 50-60 cm. The influence of agricultural crops on the apparent density parameters was non-essential on Fields 1 and 3 - on a loamy-clay carbonate chernozem; Field 2 - on a clay-loamy carbonate chernozem; Field 4 – on a poorly eroded, loamy-clay ordinary chernozem.

What we cannot say in comparison with the values obtained on Fields 1(a) – on a loamy-clay carbonate chernozem; 2(a) – on a carbonate chernozem, weakly eroded, clay-loamy and 3(a) – on an ordinary chernozem, weakly eroded, clay-loamy: in the superficial horizons 0-10 cm being 1.20-1.28 g/cm^3 up to 1.38-1.46 g/cm^3 in the depth of 20-30 cm where a weak settlement of the soil already begins towards more pronounced settlement at the depth of 50-60 cm with values higher than 1.50 g/cm^3, which creates unfavorable conditions for plant growth and leads to the deterioration of soil quality.

In the period before the agrarian reform, the soils were plowed to a depth of 35 cm. Their minimal work at present with the disc harrow to a depth of 10-12 cm or with the plow to a depth of 20 cm has led to the compaction of the adjacent unworked part, which explains the data obtained.

It is recommended, on the slopes of the agricultural lands within the Copăceni commune, the planting of protective forest strips on the degraded upper section of the agricultural lands subject to the erosion process, in order to improve soil fertility and maintain the productivity of agricultural crops, increase carbon stocks, water balance by reducing surface runoff and improving soil water infiltration, reducing soil water evaporation and soil compaction.

The cultivation of the soil without protective forest strips and the modification of some of its properties under the influence of the anthropic factor, led to the deterioration of the soil.

In this way, we can see that the protective forest strips contribute to the spatial distribution of soil moisture on the fields of the crop rotation, accumulating greater reserves near them.

The incorrect use of soil, being one of the non-renewable resources involved in human activities, affects the long-term sustainability of ecosystems and agro-ecosystems, therefore some species of trees and shrubs are recommended for the creation of protective forest curtains.

During the selection of the key polygons and the identification of the location of the soil profiles within the Copăceni commune (*Figures 3-4*), with the sampling of samples for analysis, different subtypes of chernozem were identified.

For their comparative evaluation, according to the qualitative aspect and the criterion of submission to degradation through the erosion process, the standard profiles were selected first. Thus, in the following we present their description and morphological composition in the field and the data obtained as a result of laboratory analyses.

The ordinary chernozem, strong deep (standard) was identified on the flat top of the slope near the forest, 167 m from Field 1 provided in the research (Polygon-key No. 1). These soils are spread in the hilly steppe area of the Copăceni commune estate. Predominantly loessoid deposits with clay-loamy, loamy-clay texture was formed under steppe vegetation under temperate continental climate conditions. Common chernozem differs from the other subtypes by lower humus content, the presence of carbonates in the form of efflorescences, pseudomycelia, bieloglasca in the humiferous layer. They have an undifferentiated texture on the profile, which can vary from loamy to clay. The structure is glomerular-granular, and in the arable layer often lumpy.

The ordinary chernozem, strongly deeply researched, is characterized at great depth by an increased content of humus. The thickness of the humiferous profile is 90 cm.

According to the morphological characteristic, the profile has the following type: *Ahp-Ah-ABhk-Bhk-BChk-Ck*.

Ahp (0-15 cm) – dark gray color with brown spots, arable layer, glomerular structure, clay-loamy, dry, porous with fine and medium pores, root remains, slow passage.

Ah (15-40 cm) – gray color with brown spots, post-arable layer, livid, glomerular-granular structure, clay-loamy, porous with fine and medium pores, rare roots, clear transition.

ABhk (40-70 cm) – gray color with a dark brown shade that passes in depth to a grayish-yellowish color, reed, granular-glomerular structure, loamy-clay, very rarely roots, weakly compacted, porous, small and medium pores, at 65 cm carbonate concretions appear in the form of efflorescences, pseudomycelia, clear passage.

Bhk (70-90 cm) – has a grayish-yellowish color with dark shades, dry, micro-glomerular structure, loamy-clay, compacted, small and fine pores, carbonates in the form of whitewash, slow passing.

BChk (90-110 cm) – light gray color with yellowish shades, dry, compacted, loamy-clay, clear transition.

Ck (110-160 cm) – with different color of yellowish shade, dry, compact, very small pores, carbonates present in the form of concretions, bioeloglas, astructured.

According to the results of the physico-chemical properties, the ordinary chernozem, strongly deep is characterized by the following indices: the humus content in the Ahp horizon ranges from 3.41% to 3.15%, with depth the content decreases to 1.17% in horizon BChk. The content of carbonates in the surface layers is missing, and with the appearance of the Bhk horizon in the underlying layer their content varies from 2.4% to 16.8% as a maximum accumulation in the Ck horizon. The reaction of the soil on the surface (pH=7.5-7.6) and in the underlying layers (pH=7.9-8.4) is moderately alkaline. In the soil profile, Ca^{2+} cations predominate (24.6-25.2 me/100 g of soil), compared to Mg^{2+} (3.5-4.1 me/100 g of soil). According to the granulometric composition, it is clay-clay with values between 49.40% - 57.48%. Hygroscopic water content values do not vary significantly along the profile, ranging from 4.93% - 4.60% in the Ah, Bhk, and BChk horizons and slightly decreasing to 4.27% in the Ck horizon.

Ordinary chernozem, poorly eroded, loamy-clay: as a result of the erosion process, the soil particles of half of the Ah horizon are washed away. The thickness of the humiferous profile is 75 cm.

Ahp (0-25 cm) - dark gray color with brown spots, arable layer, glomerular structure, loamy-clay, dry, porous with fine and medium pores, root remains, slow passage.

ABhk (25-55 cm) – gray color with a dark brown shade that passes in depth to grayish-yellowish color, dry, granular-glomerular structure, loamy-clay, rarely rooted, poorly compacted, porous, small and medium pores, concretions appear of carbonates in the form of efflorescences, pseudomycelia, clear passage.

Bhk (55-75 cm) – has a greyish-yellowish color with dark shades, dry, micro-glomerular structure, loamy-clayey, compacted, very small pores, carbonates in the form of whitewash, slow passing.

BChk (75-95 cm) – light gray color with yellowish shades, dry, compacted, loamy-clayey, carbonates in the form of whitewash, clear transition.

Ck (95-115 cm) – yellowish color, dry, compact, very small pores, carbonates present in the form of concretions, bioeloglasc, astructured.

According to the results of the physico-chemical properties, the usual, strongly deep chernozem is characterized by the following indices: the humus content in the Ahp horizon ranges from 2.12% to 1.91% in the ABhk horizon, with depth the content decreases to 0, 83% in the BChk horizon. The carbonate content in the surface layer is missing, and with the appearance of the Bhk horizon their content varies from 4.8% to 13.4% as a maximum accumulation in the Ck horizon. The soil reaction on the surface and in the BChk horizon (pH=7.9-8.3) is moderately alkaline, and in the Ck horizon (pH=8.5) – strongly alkaline. In the soil profile, Ca^{2+} cations predominate (24.4-23.2 me/100 g of soil), compared to Mg^{2+} (4.9-5.0 me/100 g of soil). According to the granulometric composition, it is clay-clay with values between 53.78% - 56.91%. The hygroscopic water content values do not vary in the Ahp horizon and the Bhk horizon being from 5.97%-5.04%, and in the BChk horizon and the Ck horizon it decreases slightly from 4.82% to 4.71%.

Carbonate chernozem, strongly deep (standard), loamy-clay, was identified on Field 3 (key polygon no. 1). This subtype is spread over different landforms. Loessoid clays on alluvial-delluvial deposits serve as solidifying rocks. The diagnostic criterion of these soils is the appearance of effervescence on the surface, or in the upper part of the Ahkp horizon. Carbonates appear in the form of inflorescence, mycelium, bieloglasca. The secondary argillization of the upper part of the profile takes place, which is why a higher content of physical clay is observed compared to the lower horizons and the parent rock.

It has the profile consisting of the following layers: *Ahkp-Ahk-Bhk1-Bhk2-BChk1-BChk2-Ck.*

Ahkp (0-30 cm) – recently arable humus-cumulative horizon, reed, gray color with a slight brown shade, loamy-clay, poorly developed glomerular-bulky structure, porous, medium and small pores, many roots and plant remain, clear transition.

Ahk (30-50 cm) – the continuation of the horizon of humus accumulation, the lower part of this horizon unchanged by plowing, reaming, dark gray color, loamy-clayey, glomerular-granular structure, very porous, medium pores, worm and insect holes, frequent thin roots, slow transition.

Bhk1 (50-70 cm) – the first transitional horizon, continuation of the humiferous profile, gray color with a brown tint, livid, loamy-clay, glomerular structure – granular, porous, corresponding large and medium aggregates, thin roots, pits, wormholes, gradual transition.

Bhk2 (70-100 cm) – the continuation of the humiferous profile, the second transitional horizon, dry, brown, loamy-clay, poorly developed glomerular structure, rarely thin roots, porous, small and fine pores, gradual transition.

BChk1 (100-120 cm) – parent rock significantly modified by the solification process, light brown color with a yellow tinge, dry, loamy-clay, carbonates in the form of pseudomycelia, poorly compacted, black-walled, porous, pores fine and small, clear transition.

BChk2 (120-160 cm) – parent rock very little modified by the pedogenesis process, yellow color with white patches of white buff and concretions (buff and concretions are concentrated in the BChk2 horizon), bush root holes with black walls, a crotovine, porous, fine pores, gradual transition.

Ck (160-200 cm) – loessoid deposits, yellow color, dry, silt-clay, compacted, porous, carbonates only in the form of vines, root holes, a crotovine at the beginning of the horizon.

Data on the characteristics of carbonate chernozem: the content of the physical clay fraction <0.01 mm varies from 55-58% in the Ahk, Bhk BChk horizon and up to 69% in the Ck horizon. The clay fraction <0.001 mm in the Ahk, Bhk horizon constitutes 45-43%, and in the lower ones – 42-41%. The comparatively high content of clay in the upper horizons indicates that this subtype of chernozem is prone to compaction processes, especially since the amount of humus is reduced in the upper horizons (2.9-2.5%) and continues to decrease until 0.63% in the Ck horizon. However, due to the fairly high content of dust and fine sand, this soil, at the humidity corresponding to physical maturity, crumbles satisfactorily during work, being favorable for the development of agricultural crops.

The arable layer of the carbonaceous chernozem, strongly deep (standard), loamy-clay studied is characterized by an artificial structure formed by tillage. The upper part of the arable layer (depth 0-18 cm), being cultivated during the growing season of agricultural crops, is characterized by a good artificial structure. The lower part of the Ahk horizon not modified by plowing is characterized by excellent natural glomerular-granular structure. The destruction of the arable layer occurred as a result of inadequate soil work and the negative humus balance. The correction of the situation can only be carried out by regular introduction of organic fertilizers into the soil, compliance with crop rotations and the implementation of the system of soil conservation works.

It was established that mineral fertilizers do not negatively influence the quality of the structure of the investigated soils. Hygroscopic water in the carbonate chernozem profile, strongly deep, loamy-clay constitutes 5.6-5.3% in the arable layer with a decrease to 5.2% in the parent rock. In general, the investigated soil is characterized by good physical properties for plant growth. The carbonate content in the Ahk horizon is between 1.5%-2.9%, and with depth it increases from 7.5% to 10.6% in the Ck horizon. The soil reaction is practically homogeneous over the entire profile (pH=8.2-8.4) being moderately alkaline.

Carbonate chernozem, strongly deep (standard), clay-loamy is basically characterized by the same aspects as carbonate chernozem, strongly deep, loamy-clayey. However, the granulometric composition of the soil particles changes with values between 61.55-74.36%. Hygroscopic water in the profile constitutes 5.32% in the Ahk horizon and 4.42-4.38% in the Bhk horizon and the BChk horizon. Comparatively, the humus content is lower, with values ranging from 2.37% in the

Ahk horizon, which decreases with depth to 0.71% in the BChk horizon. The carbonate content is much more matte from the surface with values of 8.2%, which reaches up to 14.2% in the Bhk horizon and decreases to 9.8% in the C horizon. In the soil profile, Ca^{2+} cations predominate (25.9-25.2 me/100 g of soil), compared to Mg^{2+} (3.8-4.6 me/100 g of soil).

The carbonate chernozem, poorly eroded, loamy-clay researched, is characterized by the washing of half of the Ahk horizon, due to the degradation caused by the erosion process, and has a thickness of the humiferous profile (A+B) of 70 cm. Thus, the profile structure is unstable glomerular, granular-glomerular, granular, microgranular-glomerular. The structure of the profile in the upper part is loosely compacted, and with the depth it becomes weakly compacted, due to inadequate agricultural works of the soil. Thus, for this subtype the results of the physico-chemical properties indicate the following data: the humus content in the arable layer is 2.47% to 2.07%, and with depth the humus content considerably decreases from 1.35% to 0 .92%.

Carbonates appear from the surface with values of 1.4% in the Ahk horizon, but with depth their content increases considerably from 3.6% to 13.2%, the maximum being in the Ck horizon. The content of cation exchange cations in or. Ahk is 28.0 me/100 g of soil, and in the ABhk horizon 29.3 me/100 g of soil, Ca^{2+} cations being predominant compared to Mg^{2+} (2.7-3.0 me/100 g of soil). The soil reaction is moderately alkaline throughout the profile (pH=7.9-8.4). Hygroscopic water on the profile has values between 4.82-4.49%. The granulometric composition of the soil particles on the investigated profile has values between 50.77-58.06%.

Discussion and conclusions. According to the agrosilvoameliorative districting of the Republic of Moldova, the territory of Copăceni commune, Sîngerei district is part of the agrosilvoameliorative District II - of the northern steppe with the Bălți Plain from the Răut River to the Prut River.

We can see that the protective forest strips contribute to the spatial distribution of soil moisture on the fields with the rotation of agricultural crops, accumulating greater reserves near them (Polygon-key No. 1). It is recommended, on the slopes of the agricultural lands within the Copăceni commune, to plant protective forest strips on the degraded upper section of the lands subject to the erosion process, in order to improve soil fertility and maintain the productivity of agricultural crops, increase carbon stocks, water balance by reducing runoff surface area and improving soil water infiltration, reducing soil water evaporation and soil compaction.

The erosion produced by runoff during the torrential rains on the agricultural lands of the Copăceni commune, leads to the pulverization of the fertile particles of these agricultural soils, on most of the fields that are not protected by forest strips (Polygon-key No. 2), which leads to the decrease of the fertility of the soils in the agroecosystems.

But for the soils subject to the erosion process, the existing agricultural management system has led to the deterioration of the quality of the chernozems in the agroecosystems. The multi-year use of soils in the agricultural circuit leads to a considerable decrease in their fertility over time. Loamy-clay soils are moderately resistant to erosion, and clay-loamy and clay soils are resistant to erosion.

In anti-erosion crop rotations on these soils, the share of protective crops must be increased by 20-30 percent. Sowing on sloping land is carried out in the general direction of contour lines with sowing rates 10-20 percent higher than those recommended.

The organization and anti-erosion planning of the lands is a unitary system of technical, economic-organizational and legal measures in order to integrate the land fund as optimally as possible into the agro-ecosystem specific to each hilly landscape. Lands with active or only temporarily stabilized landslides are capitalized differently, in relation to the degree of damage and the landscaping works performed. We recommend, in the case of very disturbed (damaged) lands, as a result of landslides and on which modeling has not been applied, their valorization is done only through afforestation.

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