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CHERNOZEMS STAGNIC FROM MOLDOVA - RESULT OF COMBINATION BETWEEN LITOGENESIS AND SOLIFICATION PROCESSES OF PLIOCEN AND QUATERNARY SOIL FORMATION

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Abstract

It was shown up that stagnic chernozems' genesis is conditioned by the clayey compound of Pliocene's sedimentary rock where they were formed. The profile of humus of the soils came into being as a result of a combination of contemporary and relict processes of soil formation.

INTRODUCTION

The soil research at the 1:10000 scale, conducted by the “Nicolae Dimo” Institute of Pedology, Agrochemistry and Soil Protection in the years 1996-2005 showed on the interfluvial plain, at the absolute altitude 200-290 m in auto morph conditions of pedogenesis, the original soil (endemic), gley in the bottom of the profile, called chernozems stagnic [5]. In the previous system of Moldova’s soils classification [2] and large-scale soil maps, these soils are not shown. The name "chernozems stagnic" are the names of analogous soils from the systems FAO UNESCO soil classification [4] and the World Reference Base for soil resources 2006 [7]. The main purpose of the research was to study the conditions of stagnic chernozems soil formation, genesis, area of distribution, characteristics, classification at lower level, soil rating, and recommendation system for sustainable use.

MATERIAL AND METHODS

The information on distribution, genesis and characteristics the deep gley chernozems stagnic was obtained based on data from field research carried out in field, laboratory and office. In the field there were studied the profiles of chernozems stagnic and parallel of the area of nearby zonal soils to compare values and determine the characteristics of their potential agricultural production. Research was conducted on key polygons representing a virtual square with sides of 50 m. In the polygon 5 soil profiles were placed, the main one in the center and four on a virtual square tops. Soil samples and laboratory work were performed according to the classic methods. The office phase research results have been collected, processed statistically and presented as tables, diagrams, maps. To determine the level of productivity of the soils on micro- polygons located near the soil profiles was made relying harvest crops sheaves method - evidence.

RESULTS AND DISCUSSION

In Moldova, special research to assess genesis, nomenclature and classification of soils with deep gley horizons has not been performed. These soils are not placed in the existing classification system and soil rating, their genetic and production features are studied. On soil maps developed by the Institute for Land Management, the areas within chernozems stagnic were included in zonal soil areas. There is no evidence this soil taxon in the Romanian system of soil taxonomy [6].

The gley properties of chernozems, formed as a result of the stagnation nature of wetting, are used as diagnostic indices into the FAO UNESCO soil classification [4] and the World Reference Base for soil resources 2006 [7]. These properties concerns at the soil material continuously or periodically, are saturated with water and show signs rain account of the reduction and segregation of iron and have a specific color of gley stagnation – marble of structural aggregates surface.

Pedogenesis of chernozems stagnic is largely determined by the texture of the rock parental clay [5]. According to the geological research at the end of Pliocene, territory of central and southern Moldova continental climate regime is established; the alluvial plain is formed of sedimentary rocks that consist largely of altered clay deposits of lakes and marshes with low water.

In late Pliocene and early Pleistocene gradual lifting of the territory is noted, either the river dividing the two major classes. The Pleistocene tectonic movements are amplified, they form the Central Moldavian Plateau, incurred the hydrographic contemporary [1]. As a result, alluvial deposits - the Pliocene lake are preserved today only on the highest areas of relief to absolute altitude 200-290 m [3].

These rocks are compact clay, have composition chlorito-montmorillonito-hydromicaceous and are situated directly on Sarmatia deposits, formed of limestone material altered. Properties of soils investigated stagnic condition is correlated with soil water saturation in one or more layers (horizons) in the first 200 cm of land area. Saturation zone consists of water suspended from a relatively impermeable layer of clay Pliocene and present events gley processes.

In the field, in most cases, chernozems areas are adjacent to areas stagnate clay chernozems may coarse textured area - clay or clay-sand, located at higher altitudes than the elements of relief as banks. This data the origin of alluvial-lake deposits that formed this land.

Physical characteristics. The most common profile type of chernozems stagnic is characterized by Ahp-Ah-ABh-Bhkg-Gk-Cgk-CRgk. The average data on the soil texture investigated are shown in Table 1.

Table 1

Physical characteristics of chernozems stagnic on arable polygon

Horizon and depth, cm	Fractions		Hygroscopicity coefficient	Density	Bulk density	Total porosity
	<0.001 mm	<0.01 mm	% g/g	g/cm^3		%v/v
Ahp 0-10	51.9	77.3	11.9	2.63	1.14	56.7
Ahp 10-30	51.9	77.3	11.9	2.63	1.28	51.3
Ahk 30-52	51.9	79.1	12.1	2.66	1.36	48.6
ABh 52-74	52.9	80.1	11.3	2.68	1.47	45.2
Bhkg 74-96	53.8	80.7	10.4	2.71	1.53	43.6
Gk 96-106	55.9	81.7	9.8	2.72	1.61	41.0
Ckg 106-180	56.8	79.0	10.1	2.73	1.54	43.6
CRkg180-200	20.6	30.8	4.3	2.74	1.42	48.2

The data confirms that the natural clay content in soils investigated range from 77% to 82% and clay - from 52% to 56%. The parent material with such high percentage of clay can be formed only if its underwater alteration in the climate warm.

The granulometric composition of parent material confirms its origin alluvial-lake in late Pliocene. It is necessary to attribute warned clay observed in field in the cutting of profiles. The boulders of clay removed from the wet land area, the drying under the action of sunlight is covered with cracks and crumbles into small aggregates.

Acquiring parental material to auto crumb contrasting temperature conditions and wetting ensure spring glomerular structure with small aggregates and a fluffy state of arable layer of chernozems stalled.

Literature [3, 4] often indicates that soils with high clay soils are compact. Case studies show that not all processes can be assessed by compaction high clay content in soil. According to Table 1 chernozems stagnic, as clay, is characterized by high levels of hygroscopic coefficient within 10-12%. So, in the soil, water reserves are largely inaccessible for plants.

The density of the soil material varies from 2.63-2.68 g/cm³ in humus horizons to 2.71-2.73 g/cm³ in deep gley clay stratum. Low density compared surface horizons of these soils is due to high humus content.

An integrated index of soil physical quality condition is bulk density. The values of this indicator for soil profiles investigated early spring ranges from 1.00-1.15 g/cm³ in 0-10 cm layer of arable chernozems stagnic to 1.50-1.55 g/cm³ gley parental rock. Total porosity, while, in early spring is very high for arable layer of these soils and underlying small gley layers. The arable layer of chernozems stagnic is characterized by favorable natural features and horizon gley underlying – with adverse physical features. In early spring, this soil layer can be found as too awful and so, after a seed is necessary to roller the soil requires easy.

Chemical characteristics. Data on chemical characteristics of soils are presented in Table 2. The soils studied are characterized by neutral reaction from the surface horizons (pH 7.1-7.3) and underlying horizons weak alkali (pH 7.8 to 8.3). In gley horizons there is a trend towards a slightly more alkaline reaction than in adjacent horizons.

Table 2

Chemical characteristics of chernozems stagnic on arable polygon

Horizon and depth, cm	pH	$CaCO_3$	Humus	N total	C:N	P_2O_5	K_2O
		%				g/100 g soil	
Ahp 0-30	7.0	0	4.56	0.265	10.0	2.0	38
Ahk 30-52	7.5	4.7	3.78	0.202	10.8	0.9	22
ABh 52-74	7.8	7.6	2.94	-	-	-	-
Bhgk 74-96	8.0	13.5	1.67	-	-	-	-
Gk 96-106	8.2	22.0	0.76	-	-	-	-
Cg k 106-180	8.0	7.4	0.33	-	-	-	-
CRkg 180-200	7.8	32.2	0.07	-	-	-	-

Horizons of the area are stagnate chernozems non carbonate or weak carbonate. The maximum contents of carbon gley characteristic horizons of altered rocks and rolling limestone, clay outlined below. The investigated soils are rich in mobile potassium (30-60 mg/100 g soil) and total phosphorus poor (0.09-0.11% in the arable layer and the rock parental 0.05-0.06%) and mobile forms (0.9 to 2.0 mg/100 g soil). The content of humus in chernozems stagnic is equal to 4-5% in Ahp, 3-4% in Ah non arable, 2-3% in Bh1 and 1-2% in Bh2.

Profile humus ends rather abruptly, but in practice the horizon below non humus meets black humus "languages", formats the result of mechanical flow of humus material on cracks in horizons above. Humus horizons aggregates are characterized by a characteristic gloss anthracite coal. Report C:N in the humus layer is 10-11 for arable and 12-14 for the middle of the humus profile. Increase value ratio C:N shows the carbonization of humus in the middle of humus profiles, which is probably underwater ancient origin.

Generally chernozems stall is characterized by chemical features favorable for plant growth.

The formation of excess moisture in the bottom of the profile chernozems stagnic, as mentioned, is subject to their texture. The cold period of the year rose loamy soil moisture profile gradually approaches or reaches its full capacity of water. In hot water by the evaporative loss in clay soils are not high.

Following low speed of movement of water to the surface profile fine-textured soils, evaporation leads to loss of water only from their upper (0-50 cm). Drying clay leads to the emergence of large cracks (3-7 cm). Fissures have a great importance in the genesis and fluid regime of chernozems stalled. In summer, during heavy rains, water flows through cracks in the surface, which favors maintaining permanent excess water at the bottom of their profile. Also the cracks (especially in dry years, the fissures s are wide and deep) at the bottom of soil profile penetrates (stream) humus material at the top, leading to the formation of a transitional horizon glossaries tongue humus mass parent gley material. So, but in recent precipitation and temperature conditions of Moldova's heavy clay soils permeable, located on the flat and slopes, is characterized by a stagnant fluid system at the bottom of the profile.

CONCLUSIONS

1. Pedogenesis chernozems stagnic is determined by texture chernozems clay alluvial deposits-lake formed in the late Pliocene, which were currently stored only on the highest areas altitude relief (200-290 m).
2. Diagnostic horizons in profile of chernozems stagnogleic is formed in the bio accumulative layer in an environment where the soil conditions much of the year are saturated and stagnant water accumulated from precipitation.
3. Stagnogleic horizon is pronounced and is characterized by a massive accumulation of carbonates as bieloglasca, greenish-yellow in the Pliocene clay horizon is weaker gley and situated on limestone rocks eluvia compact.
4. In the analysis of the morph-metric indices and profiles investigated was established that humus horizon thickness of these soils vary within very large 40-60 cm to 90-150 cm and differ by a characteristic bright black anthracite given faces aggregates.
5. Chernozems have a fertility potential, but not always give adequate results due to faulty aero-hydro regime in years because of rainfall or problem with their work in autumn dry years (arable layer structure in blocks). Tillage is recommended to chernozems stagnic out only to soil moisture adequate physical maturity.

6. In years when these soils are dry in spring, as a result of high water field capacity, is drought tolerant, but if drought is prolonged in summer, as well spring crop harvest may be lost.
7. In terms of risk, chernozems stagnic are suitable: first, the perennial herbs, apple and plum orchards if gley horizon is located deeper than 70-80cm, secondly - for winter cereals, in the third-hoeing crops.
8. In years when the harvest regime hydro-technical normal crops on such land at least is different from the soil zone and is only 10-15 per cent or less.
9. Note average creditworthiness of chernozems stagnate, their level of productivity as determined by the method sheaves-sample is about 85 points.

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