GLEY STAGNIC CHERNOZEMS – GENESIS, PROPERTIES AND AGRICULTURAL SUITABILITY

CERNOZIOMURILE STAGNICE GLEICE – GENEZA, PROPRIETĂŢILE ŞI PRETABILITATEA AGRICOLĂ

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Abstract. *Research carried out in Central part of Moldova. Gley stagnic chernozems are distribute on the draining surfaces of wide watershed of spaces, on the plane surface of contemporary watershed, which in Pliocene period was a part of extensive alluvial plain. These soils differ essentially from environmental area in the soil profile structure. By distinctive character of their structure - the presence in its bottom part, under humus layer, a strong carbonated gley horizon formed without participation of ground waters. The chernozems stagnic have favorable physical and chemical properties for growth and development of plants and have increased potential of fertility, but per damp years in their structure increase the anaerobic condition and there is an essential decrease the crop of agricultural cultures. The chernozems stagnic came into being a combination of contemporary and relict processes of soils' formation.*

Key words: chernozem, stagnogleic, genesis, Pliocene

Rezumat. *Cercetările au fost efectuate în partea Centrală a Moldovei. Cernoziomurile stagnice gleice sunt răspândite pe suprafeţele uniforme (orizontale) sau slab neuniforme ale culmilor intrafluviale, substratul litologic fiind reprezentat de argile. Se deosebesc de cele tipice zonale prin prezenţa unui orizont gleic în partea inferioară a stratului bioacumulativ, textură argiloasă, capacitate de schimb cationic mare, conţinut de humus ridicat. Gleizarea în profil se evidenţiază la adâncimea 50-100 cm de la suprafaţă. Procesele de gleizare se produc ca urmare a excesului de umiditate provenit din apele pluviale şi conduc la acumularea compuşilor liberi de fier în orizontul gleic. Cernoziomurile stagnogleice au proprietăţi fizice şi chimice favorabile pentru creşterea şi dezvoltarea plantelor. În anii cu umiditate sporită creşte potenţialul de fertilitate a solurilor stagnice, dar se intensifică condiţiile anaerobe, care conduc la scăderea esenţială a productivităţii culturilor. Cernoziomurile stagnogleice sunt rezultatul combinării procesului contemporan şi relict de geneză a solurilor.*

Cuvinte cheie: cernoziom, stagnogleic, geneza, Pliocen

INTRODUCTION

Stagnation of water in soil is a continuing phenomenon in soil or ground surface has an excess of water from precipitation, now above a waterproof layer that is usually a soil horizon. In Moldova, special research to assess genesis, nomenclature and classification stagnate chernozems gley in depth were not made. The horizontal well-drained soils occupy areas on local and draining

surfaces of wide watershed*;* their gley presents a paradox often-incomprehensible depth research. As a result, stagnic chernozems outlined in the existing system of classification and soil rating, their genetic and production are not studied. On previous maps, stagnic chernozems areas had incorrectly placed in areas within the zonal soils. Simultaneously the soil rating had performed incorrectly and their suitability for different agricultural issues have not appreciates. Non-evidence be explained by these chernozems that the classification of Russian naturalist, used in the country, soils are presented stagnate. A gley deep layer of soil and subsoil are relicts and is determinate by geological processes as soon as soil. Soils with gley properties are separate at the stagnosoil type as the class of Hydrosoils in the Romanian system of soil taxonomy. Of those exposed is a clear need to study processes in stagnogleic soils of Moldova.

MATERIAL AND METHOD

The object of research is chernozems stagnogleic in deep from Central Moldova (Răut river basin) located at altitudes of 250-290 m. The analogue soils meet in other parts of the Moldova, but the most common spread of stagnic chernozems that is characteristic for the territory. The purpose of the paper is studying the genetic particularities, characteristics, classification at lower level, soil rating, and assessment, recommendation system of sustainable use of gley stagnic chernozems.

RESULTS AND DISCUSSIONS

The relief is primary areas denudation that the outcome alpine lifts the occupied territories today absolute altitude 250-290 m. Pedogenesis chernozems stagnic in large part are determined by the texture of the rock parental clay. Clay on plateaus differs from high clay appearing on the slopes. Origin of clay is possible lack of salinization or alluvial lake. Information on the geological structure of territory within the catchment of basin Răut, where soil samples collected for research is very limited. According to geological research at the end of Pliocene territory of central and southern Moldova continental climate regime is established, alluvial plain is formed, the sedimentary deposits which have been preserved today only on the highest areas altimetry relief. Sediment surface smoothing is particularly of clay-altered deposits of lakes and lagoons with low water. The composition of clays mainly dominated montmorillonit. Most are dense clay and rock composition *chlorito-montmorillonito-hydromicaceous* (Geomorfologia Moldavii, 1978). Training is performing on the contemporary relief plains of Pliocene-lake, which served as the original surface. In Moldova, alluvial-delta plain middle Pliocene is marine deposits of Sarmatia. The composition of deposits indicated in a few fragmented landscapes. Morphogenesis of middle Pliocene and Pleistocene is characterizing by periodic changes of cold and warm climate cycles. Also, be initiated formation of a river delta with high-flow high and wide meadows associated lakes, state. The Pleistocene tectonic movements are amplified, they form small mountains with

altitudes of Codri, incurred the hydrographic contemporary (Geomorfologia Moldavii, 1978; Bilinchis G. M., 2004). Meanwhile Nistrean Plateau formation occurs, the ramifications of which are watershed areas, which placed soil profiles studied. The profiles of stagnogleic chernozems showed in fig. 1.

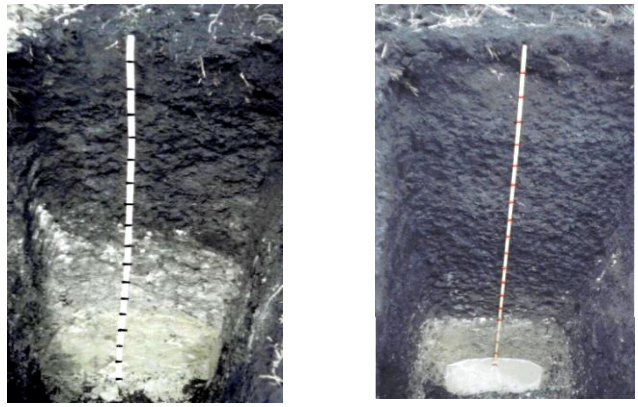

Fig. 1. Chernozems stagnogleic with thick and very thick humus horizons

Pedogenesis of chernozems stagnogleys is due to clay texture of parental rock. The data confirm that natural clay content in soils investigated range from 70% to 80% and clay - from 48% to 57%. The fine texture is characteristic of the parental rock. Physical clay content in the underlying horizons of this profile is 76-79% and clay - 53-57%. Increased percentage of clay in the parent material is a special phenomenon that can only be formed when underwater rock alteration in the climate warm. The size composition of parent material that are formed chernozems stagnate confirmed alluvial origin from late Pliocene, established Prospecting (Pokatilov B.P. 1983; Bilinchis G. M., 2004) The following is required warned in an attribute of the clays, observed in the field in the cutting of profiles. When are removed from the wet land area, under the action of strong sunlight clay rocks are covered with a dense network of cracks and crumble into small aggregates. In years with normal hydrothermal system in early spring glomerular structure with small aggregates and fluffy status of arable layer of stagnate chernozems ensure the possibility of soil material to auto crumb contrasting temperature conditions and wetting. In literature (Atlas Moldavscoi SSR, 1978; Krupenicov I. A., 1990; Cerbari V. V., 2007) often, indicate that soils with high clay soils are compaction. Case studies show that not all processes can be assesses by compacted with high clay content in soil. Chernozems typical survey, located on the same lot as chernozems stagnate, characterized by clay texture. As a result of frost and thaw arable layer is structured, giving the opportunity to accumulate large reserves of water in the soil and create a favorable germinate bed crops in spring. However, these soils are resistant to drought spring, common in Moldova. In the ending of summer and dry autumn, because of the structure into blocks, clay stagnate chernozems working very hard, plowing on these soils is very

rough, creating a favorable germinate bed is impossible both for winter and spring crops. In years with rainfall when soils have a high water field capacity, the soils dries hard and slowly reach a state of physical maturity. As a result, the agricultural tillage is impossible with adverse consequences for crop yields.

Average statistical data confirms that chernozems stagnogleys, characterized by high levels of hygroscopicity coefficient within 7-12%. Therefore, in the soil water reserves are also inaccessible for plants. Statistical values of the average density of soil material ranges from 2,62-2,65 in humus horizons up to 2.70 to 2.75 in the underlying gley layers. A full index of physical quality of soil condition is the apparent density. The values of this indicator for soil profiles investigated range from 1,20-1,30 g / cm ³ in the arable layer of chernozems stagnate until 1,50-1,60 g / cm ³ of parental gley rock. Total porosity, while it is great for arable layer of these soils and underlying gley stratum is very small. Bulk density values for arable layer within 1,1-1,3 g / cm ³ to calculate optimal. So but the arable layer chernozems stagnogleic is characterized by physical attributes than positive and underlying gley layers - with adverse physical proprieties.

Generally, in terms of texture and physical characteristics, chernozems stagnogleic is a difficulties object for use in arable both in dry years and in years with abundant rainfall. In the normal hydrothermal regime of arable layer in early spring chernozems stagnate in some extent can be found as too loose and then, after sowing requires an easy roller. In the autumn drought is difficult to work with these soils and arable layer grinding to create a favorable germinate bed. In years when rainfall during the growing danger in the soil formation of a weak aerobic system. Long-term preservation of the status favorable physical quality of chernozems stagnogleic is possible through measures that would help to ensure continuous flow of organic matter in arable layer thereof to form a valuable agronomic structure.

The soils studied characterized by neutral reaction from the surface horizons (pH 6.9-7.3) and low alkali underlying horizons (pH 7.8 to 8.3). For gley horizons, there is a tendency to react slightly more alkaline than adjacent horizons. Horizons of the area are stagnate chernozems non-carbonated or weak carbonate. A maximum content of carbonates is characteristic for horizons material altered the limestone rocks, shown in clay. Investigated soils are poor in phosphorus. Total phosphorus content of their profile in the arable layer range from 0,10-0,11 to 0,05-0,06% in rock parent. Humus content (statistical average) in chernozems stagnogleic is 4,5-4,6%. Humus profiles ends rather abruptly, but below the horizon, almost non-humificate, meet black humifer languages, formats the result of mechanical flow of material humifer on cracks in horizons above. Humifer profile is black, area aggregates humifer profile is characterize by a characteristic gloss anthracite color. Report C:N in the humus layer and underlying arable is 10-13.The observed increase in the value ratio C:N in the underlying horizon, indicating the carbonated substance underlying organic horizons of these soils. Investigated soils are rich in mobile potassium (30-40

mg/100 g soil) and poor in mobile phosphorus and consist 2,0-2,5 mg/100 g soil (table 1).

Table 1

Chemical properties of Gley Stagnic Chernozems on arable

Horizon and depth, cm	pH	$CaCO_3$	Humus	N total	C : N	Ca^{++}	Mg^{++}
		%				me/100 g soil	
Ahp 0-30	7,0	0	4,56	0,265	10,0	38,6	4,6
Ahk 30-52	7,5	4,7	3,78	0,202	10,8	35,6	5,0
ABh 52-74	7,8	7,6	2,94	-	-	32,1	5,5
Bhgk 74-96	8,0	13,5	1,67	-	-	25,4	6,0
Gk 96-106	8,2	22,0	0,76	-	-	22,7	6,6
Cg k 106-180	8,0	7,4	0,33	-	-	18,0	6,0
CRkg 180-200	7,8	32,2	0,07	-	-	14,2	6,5

The chemical proprieties characterize stagnic chernozems favorable for plant growth. Chernozems typical parallel researched, located on the same plot, are moderately humous (humus content in arable layer varies within 3.0-3.5%) and characterized by less cation exchange capacity. However, because have more favorable texture, these soils are more easily to tillage, together by creating arrangements for crop plant growth and more favorable as a result; yields on these soils are higher than on stagnogleic chernozems.

Productivity level of stagnic chernozem in the drought conditions of 2007 was determined by the method of knock-sample on the surface of 1m ² plots with winter wheat and 10 hectares for maize. In parallel, the same methods used to determine harvest chernozems typical spatial spread on the same sole. This made it possible to compare the productivity of agricultural crops both chernozems typical and stagnate of area with agricultural technique analogous conditions.

Peculiarities of agriculture were dry autumn (2006), warm winter deficient rainfall, dry spring, dry summer. Soils were showing fall, but winter drought has given way to work and to prepare quality the soil and germinate favorable crops, particularly on land with chernozems stagnate clay, which for autumn became arable layer structure blocks. The results of measurements in five repetitions on plots with area 1 meters was established that the winter wheat harvest is 27.4 q / ha for stagnic chernozems and for the same typical chernozems sola - 32 q / ha, with 14 - 15 to percent higher.

CONCLUSIONS

1. Pedogenesis of chernozems stagnic determined by texture of clay alluvial deposits - lake formed in the late Pliocene, which were currently stored only on the highest areas altitude relief (200-290 m). The diagnostic horizons in profile of

chernozems stagnogleic is formed in the bioaccumulative layer in an environment where soil conditions much of the year is saturated and stagnant water accumulated from precipitation. Stagnogleic horizon is pronounced and 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.

2. In the analysis of morphometric 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.

3. Chernozems stagnogleic have a fertility potential, but not always give adequate results due to faulty aerohydro regime in years because of rainfall or problem with their work in autumn dry years (arable layer structure in blocks). The tillage recommended to chernozems stagnic out only to soil moisture adequate of physical maturity.

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

REFERENCES

1. **Bilinchis G. M., 2004** – *Geodinamica crainego iugo-zapada Vostocino-Evropeiscoi platformi v epohu morfogeneza*. «Busness-elita», «Lextoria», Kishinev;
2. **Cerbari V. V. 2007** – *Stroenie profilia, sostav n svoictva cernozemov stagnicovih – rezulitat socetania sovremenogo I reliktogo protzesov pocivoobrazovania I vivetrivania.* Problemi istorii, metodologii I filosofii pocivobedenia. Organizatzia pocivehhih system. 2 T, Pushcino;
3. **Krupenicov I. A., 1990** – *Slitie pocivi Moldavii литые*. Stiinta, Kishinev;
4. **Pokatilov B.P. 1983** – *Geologo-litologiceschie I structurno-geologiceschie factori, opredeliaiuscie inginerno-geologiceschie uslovia Severnoi Moldavii*. Geologia cetverticinih otlojenii Moldavii. Stiinta, Kishinev;
5. *****, 1978** - **Atlas Moldavscoi SSR,** Znanie, Moscva;
6. *****, 1978 - Geomorfologia Moldavii.** Stiintza, Kishinev.