ENVIRONMENTAL STATE OF REGRADED CHERNOZEM UNDER VARIOUS AGRICULTURAL USE

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Abstract. *The article provides an assessment of the environmental sustainability of regraded chernozem, which is degraded in terms of its fertility. It was established, that the dominant fraction in all soil layers is a fraction of large dust, the content of which varies from 40.7% in the rock to 51.6% in the transition horizons, and the content of physical clay is 34.1–37.8%, which gives grounds to classify the soil according to the Kachinsky classification to medium loamy. An environmental sustainability of chernozem on the capacity of the humus layer on all variants is estimated as high, and on the content of humus – as an average. The ecological stability is also high, and according to the physicochemical indices of chernozem regradated, except for the variant with intensive fertilizer system. The anti-erosion resistance of the air-dry aggregates for the organic fertilizer system was 73.9%, for the intensive system – 51.0% and is estimated as average, while under the virgin land – 88.2%. The bulk density was within the optimum range from 1.12 g/cm^3 to the fraction to 1.25 g/cm^3 for mineral fertilizer system. In general, for the most part, the environmental sustainability of the chernozem regradated is high and the soil is suitable for growing the majority crops.*

Key words: *the environmental sustainability, structural-aggregate composition, humus, soil fertility, anti-erosion stability, chernozems.*

The relevance of the topic of research. Intensive use of soils in farming has led to reducing of chernozem fertility. At the present time, there is an urgent need for monitoring and environmental assessment of cultivated soils [1]. For assessment of Environmental state of chernozem parameters are used which change very slowly over a long period of time, namely soil texture, humus content and thickness of the humus layer, the sum of absorbed bases, the degree of saturation of the soil-ward complex with exchange bases, the reaction of the soil, the bulk density and the anti-erosion resistance of the soil [2].

Analysis of recent publications. In conditions of modern agriculture, the manure and the high cost of mineral fertilizers are increasingly used in the production of crop production as an organic fertilizer, which is a source of carbon and nitrogen, as well as ash nutrients entering the soil after mineralization of organic residues [3] Positive influence of the use of plant residues of crop production as phytomeliration on the physical and chemical properties of chernozem typical of medium and low-humus is justified in the work of O.V. Demidenko [4]. It should be noted that the introduction of organic residues as fertilizers contributes to the improvement of the physical properties of chernozems and their anti-erosion resistance [5]. Growth of

environmental state of typical chernozem of the Forest-Steppe for the introduction of organic fertilizers was also noted in the work of M.F. Berezhniak with coauthors [6].

The aim of the research was to study and evaluate the effect of short crop rotation and various fertilizer systems on fertility and environmental state of chernozem regenerated.

Materials and methods of research. The research was conducted during 2016-2017 in the stationary field experiment of the Cherkassy State Agricultural Research Station NSC "Institute of Agriculture of NAAS", which was founded in 2010. Soil is regradated Chernozem with low-humus content. The soil texture – sandy-coarse medium loam on loess.

The experiment investigates short-breeding five-grain grains-crop rotation with such crops: peas-wheat of winter-corn-soybean-barley yarrow. Another factor of research is the different fertilizer systems.

In order to compare the changes in the fertility index of regraded chernozem for agricultural use, appropriate investigations were also carried out on a parcel site located next to the experimental field and not cultivated for more than 40 years.

The research tasks included studying the following issues: morphological and genetic analysis of regraded chernozem in the field and study of the parameters of environmental sustainability of the soil.

Investigation of the parameters which determining the environmental state of the soil was carried out using the following methods: soil texture – in the genetic horizons by Kachinsky method with chemical preparation of small earth with sodium pyrophosphate; structural and aggregate composition – by the Savinov method; soil bulk density by the method of cutting ring according to Kachinsky; humus content - by the Tyurin method in the Simakov modification; the sum of exchange bases – by the method of Kappen-Gilkovitsa; hydrolytic acidity – by Kappen method; pH of the salt extract – by potentiometric. An assessment of the environmental sustainability of the soil was carried out in accordance with the "Agroecological monitoring and certification of agricultural land", edited by V.P. Patika, O.G. Tarariko, 2002 [2].

Research results and their discussion. The analysis of the mechanical composition on the soil profile showed that the dominant fraction in all layers of the soil is coarse, the content of which varied from 40.7% in the parent material to 51.6% in the transition horizons. The content of physical clay was within the range of 34.1–37.8%, which gives grounds to classify this soil with the main name of Kachinsky to the medium loam.

Morphological and genetic studies of the thickness of the humus layer of regraded chernozem was in the range of 82–76 cm and is characterized as high, the content of humus in 0-30 cm layer on the options of the experiment was at the level

of 3.53–3.17% and is estimated, as the average environmental sustainability (within 4–2%).

The physical and chemical properties of the soil were favorable for the cultivation of crops, the reaction to the variant with an intensive fertilizer system (pH 5.48) was low acidic. The sum of exchange bases, it was high (over 20 mg equivalents / 100 g), due to the medium-grained mechanical composition and sufficient humus content.

Investigation of physical parameters of ecological stability of chernozem showed that the content of agronomic-valuable aggregates was the highest on lands with grass 88.2%. After using intensive fertilizer system this content was 51.0%. This is due to the apparent dispersion of mineral fertilizers on granular aggregates [4], which split into smaller fractions, and then their smearing under the influence of rain, and mainly agricultural machineries. The bulk density was within the optimum range – 1.10–1.30 g/cm^3.

Conclusions. 1. Experimental analysis of the parameters of environmental state of regraded chernozem testifies that the mechanical composition, the capacity of the humus horizon, pH $_{KCl}$, the sum of absorbed bases, the degree of soil saturation with the exchange bases and the bulk density is high, and on the content of humus and air-dry aggregates – the average.

2. Application rotation of organic fertilizer system had a positive effect on the humus content and improve soil physical properties compared to intensive system that allows us to recommend it for implementation in production.

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