ECOLOGICAL SIGNIFICANCE AND HUMUS CONTENT IN SOILS OF IRRIGATED AREAS

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Abstract: *The article states that in samples taken from the soil of the experimental plot, the nitrogen content in the arable layer varied from 0.066% to 0.046%, phosphorusfrom 0.136% to 0.104%, and potassiumfrom 0.49% to 0.30%. It is also noted that the mobile forms of nitrogen range from 24.9 mg/kg to 8.5 mg/kg, the mobile forms of phosphorusfrom 19.0 mg/kg to 8.0 mg/kg, and the exchangeable forms of potassiumfrom 337.1 mg/kg to 240.8 mg/kg. A comparison of these results with data from other studies also indicates insufficient nutrient enrichment of the soils of the Hunger Steppe. These aspects underscore the importance of soil ecology research for more effective management and conservation of the region's natural resources. Keywords: soil, arable layer, nitrogen, phosphorus, potassium, mobile forms, exchangeable forms.*

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INTRODUCTION

The soils of irrigated lands in the Hungry Steppe play a key role in the agriculture and ecosystems of this region. However, despite their importance, they face a serious problem: the reduction of humus content.

Humus, a vital component of soil, enriches soils with nutrients, helps retain moisture, and maintains ecosystem stability. Studying the humus content in the soils of irrigated lands in the Hungry Steppe and the causes of its decrease is a relevant topic in agricultural and ecological research.

This literature review presents works that examine this issue using the Jizzakh region of the Republic of Uzbekistan as an example. The authors of this article analyzed the current state of humus content in the soils of irrigated lands in the Hungry Steppe of the Republic of Uzbekistan.

They studied various factors influencing the level of humus in soils and proposed measures for its preservation and restoration (6).

The authors have thoroughly studied the problem of declining humus content in the irrigated soils of the Jizzakh region and identified the main causes of this phenomenon.

Special attention has been given to the analysis of anthropogenic and natural factors(7). In this study, the authors investigated the impact of climate change on the state of humus in the soils of the Hungry Steppe.

They analyze climate changes in the region and their consequences for the humus level in the soils.(8).

In the article "Problems of Soil Salinization and Land Reclamation in Uzbekistan (on the Example of the Hungry Steppe)" (Akhmedov A.U., Nomozov Kh.K., Kholboev B.E., Toshpulatov S.I., Korakhonov A.Kh., 2017), the issues of soil salinization in Uzbekistan, especially in the Hungry Steppe, are discussed. The authors examined how increasing soil salinity affects the region and proposed methods for soil improvement. We decided to study how agrotechnologies on slightly saline soils affect the physical properties and organic content of the soil, as well as how previous crops influence the yield of cotton.

Research object: The Paxtakor district of the Jizzakh region is characterized by meadow-serozem soils with a low level of salinity, which are light sandy loam in their mechanical composition.

The filtration water is located at a depth of 2.0–2.5 m. The experiment included 18 variants and was conducted in triplicate. The area of each variant was 72 m^2 and arranged in three tiers.

The total experimental area was 0.40 hectares. During the research, genetic-geographic, profile-geochemical, stationary-field, and chemical-analytical methods were employed.

The research was conducted using the following methodology: General chemical and physicochemical soil preparation was carried out according to standard methodologies developed by E.V. Arinushkin (1970) (1), as well as using other methods adopted at SOYUZNIKHI (UzNIIKH-(1977)) (2).

Results Obtained and Their Analysis: Humus is a complex dynamic compound of organic substances formed during the decomposition and humification of organic residues [3, 4].

The amount of humus in soils is determined by the conditions and nature of soil formation. Humus-rich soils are relatively richer in the upper horizons and tend to decrease sharply or gradually as they move down to the lower horizons.

The study of humus in the soils of the experimental plot showed interesting changes. In the upper layer, the humus content ranged from 0.870% to 0.654%.

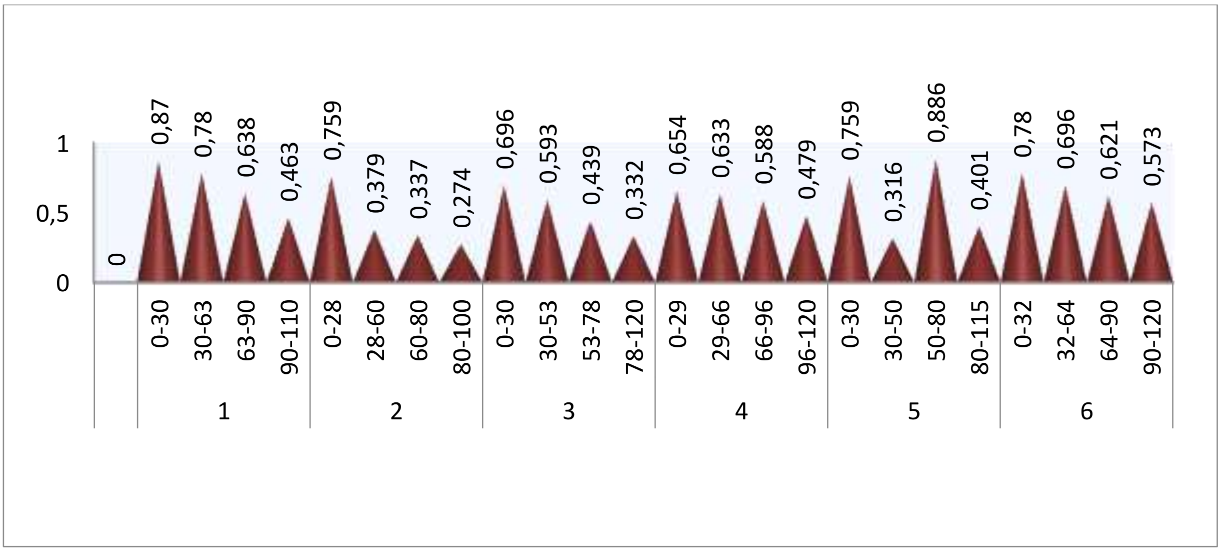
However, below this layer, the concentration decreased to 0.780%–0.316%. In the deeper layers, the humus level continued to drop, reaching its minimum in the lowest layers, where the humus content was only 0.573% - 0.274%.

These data highlight the importance of maintaining and restoring humus levels in the soils of the Hungry Steppe to ensure their future fertility and sustainability.

Comparing with the results of Tashkuziev [5] (more than 5% - extremely high, 3-5% - very high, 2-3% - high, 1.5-2% - above average, 1.0-1.5% - average, 0.5-1.0% - low, less than 0.5% - very low), where the humus content in the upper layers of serozem-meadow soils ranged from 0.870% to 0.654%, it can be concluded that the main layer of irrigated soils has an insufficient humus content (1-diagram).

The assessment of humus in the soils of irrigated areas showed insufficient enrichment. However, it should be noted that the accumulation of humus in soils is a complex process dependent on many factors, such as soil formation conditions, mechanical composition of soil layers, irrigation period, type of agricultural crops, and degree of soil salinity.

1-diagram. The total humus content in the soil by sections (%)



Nitrogen enters the body through phosphatides, nucleic acids, chlorophyll, and nitrogen-rich organic materials. The amount of nitrogen in the soil is linked to the level of organic matter and initial humus content. Loamy soils contain a large amount of nitrogen. When organic matter decomposes, ammonia and nitrogen salts, such as nitrates and nitrites, are formed.

Nitrites are almost insoluble in organic solvents. Therefore, the nitrogen compounds formed during oxidation are called ammonium and nitrogen nitrates. The table shows the nitrogen levels in the soils from different areas. In the topsoil layer, the nitrogen content ranged from 0.066% to 0.046%, and its mobility ranged from 24.9 mg/kg to 8.5 mg/kg. In the deeper layer, the nitrogen level changed from 0.056% to 0.021%, and the mobility ranged from 27.7 mg/kg to 10 mg/kg, which was higher than that in the surface layer.

In even deeper layers, the nitrogen content and mobility continued to decrease. In the lowest layers, nitrogen decreased from 0.039% to 0.021%, and mobility from 28.3 mg/kg to 7.185 mg/kg.

These data show the complex distribution of nitrogen across different soil layers. They highlight the importance of studying mobile forms of nitrogen to understand their accessibility to plants and ecosystems. Compared to the standards for mobile nitrogen content in irrigated soils (50.1-60.0 mg/kg - high, 30.1-50.0 mg/kg - medium, 20.1-30.0 mg/kg - low, less than 20 mg/kg - very low), the nitrogen content in serozem-meadow soils is very low.

This significant observation points to issues with the natural supply of nutrients to plants in this region, which impacts the ecological conditions of the soil and ecosystem. Finding more effective methods for maintaining soil and preserving mobile forms of nitrogen is an important task for environmental protection and agriculture in this region of China. Phosphorus is a vital element for soils and the entire biosphere.

It plays a key role in the life of organisms and constitutes a substantial part of a plant's dry matter.

Without phosphorus, organisms cannot exist, underscoring its importance in the food chain and natural cycling of elements. In soils, phosphorus exists in various forms, including minerals and organics. Phosphates are the main source of phosphorus for plants. They provide plants with essential nutrients, which are crucial for agriculture and natural ecosystems. Plants absorb organic phosphorus compounds after mineralization, which helps the phosphorus cycle.

Phosphorus ($P2O5$) accumulates in the upper layers of the soil and is actively absorbed by plants. This affects the condition of the soil ecosystem and helps to maintain nutrient balance. Phosphorus is a key element for soil stability and fertility. This is important for both nature and agriculture. Data on phosphorus content in soils reveal significant ecological implications. Phosphorus plays an important role in the soil nutrient cycle, influencing the health and productivity of ecosystems. The phosphorus content in soil ranges from 0.136% to 0.104%, which impacts plant nutrition and growth, as well as ecosystem diversity. The level of available phosphorus is also important, varying from 19.0 mg/kg to 8.0 mg/kg (Figure 2). This demonstrates how soil retains and provides phosphorus to plants and microorganisms. In the sub-arable layer, the phosphorus content ranged from 0.155% to 0.092%, with available phosphorus ranging from 16.0 mg/kg to 7.0 mg/kg. This may indicate changes in soil density and structure at different depths related to environmental factors such as soil degradation and farming practices.

It is important to note that both the quantity and mobility of phosphorus decreased in the deeper soil layers. This may indicate that phosphorus is lost or becomes unavailable to plants and microorganisms. This is important for understanding soil system resilience.

Analyzing phosphorus in soils helps assess their ecological status and develop measures for improvement. This supports ecosystem health and agricultural sustainability in the region. The phosphorus ($P2O5$) level in irrigated soils, determined by the Machigin method, was evaluated as follows: over 60 mg/kg was very high, 60.0–45.1 mg/kg was high, 45.0–30.1 mg/kg was medium, 30.0–15.1 mg/kg was low, and less than 15 mg/kg was very low. Compared to experimental sierozem-meadow soils, the level of available phosphorus in the studied soils can be considered low.

Assessing the content of mobile phosphorus in soil is important for understanding environmental conditions. This highlights the need for careful soil management and restoration to maintain a healthy ecosystem. Potassium is important not only for the life of organisms but also for soil ecology. Its total content in soils can be high, but balance is crucial, especially in heavy soils, where potassium can exceed 2%. In light soils, potassium levels may be lower. Most of the potassium in the soil is unavailable to plants, as it is contained in the crystalline structure of minerals. This affects the availability of potassium for plants and the condition of the soil. Plants require available potassium that they can absorb. As plants cannot replenish potassium losses, the sustainability of soils depends on maintaining its levels. The balance of potassium in soil is important for ecology and soil fertility. In the plow layer, soils contained between 0.49% and 0.30% potassium, and in exchangeable form, from 337.1 mg/kg to 240.8 mg/kg. In the sub-plow layer, potassium ranged from 0.60% to 0.24%, and in exchangeable form, it ranged from 276.9 mg/kg to 158.9 mg/kg. In the lower layers, the potassium content decreased to 0.40%–0.18%, and in the exchangeable form, it decreased to 219.8 mg/kg–106 mg/kg. Potassium analysis in soils is related to ecology. The potassium level is important for ecosystem health and agriculture. This affects plant growth and yield. Potassium reduction can indicate negative factors such as improper farming practices and pollution. Therefore, it is important to monitor potassium levels to maintain ecological balance. Comparing the content of exchangeable potassium in serozem-meadow soils using the Machigin method, it can be said that the test soil has a medium potassium level in the upper layer of the soil. Potassium levels according to the Machigin method were classified as follows: very high (> 401 mg/kg), high (400–301 mg/kg), medium (300–201 mg/kg), low (200–101 mg/kg), and very low (less than 100 mg/kg).

Conclusions. An analysis of the soils of the Hunger Steppe showed that the topsoil contains a lot of humus, nitrogen, phosphorus, and potassium. However, these elements were less abundant in deeper soil layers. This means that it is necessary to maintain and restore the levels of humus and nutrients to keep the soil fertile and sustainable. A comparison with existing standards and data indicates that the content of humus, nitrogen, phosphorus, and potassium is generally average or low. This suggests that the soils of the Hunger Steppe do not provide the necessary nutrients for healthy plant growth or ecosystem sustainability. Therefore, the balance of humus and nutrients in the soil is important for ecology and affects the state of the regional ecosystem. Further research and efforts to restore soil biological activity are needed to maintain stability and biodiversity in the Hunger Steppe.

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