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Transformation of Carbon and Humus in Irrigated Meadow Soils of Deserts

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Abstract:
Accumulation of soil carbonates in the soil profile occurs mainly during the evaporation of mineralized groundwater in the modern hydromorphic stage of soil formation, and not during soil formation. assortment of plant residues. The increase in organic carbon in irrigated soils is associated with an increase in the recency of development and cultivation.

Keywords: pedogen, carbon, lithogen, humus, organic carbon, mineral carbon, conservative, soil cover, accumulation.

Introduction

The study of carbon in irrigated soils is one of the main theoretical issues in the chemistry and biogeochemistry of soils. Understanding the laws of formation and distribution of soils, the processes of development of soil profile and cover, as well as fertility in general depends on the depth of its solution.

Soil carbon, especially organic carbon, is a marker by which one can judge the type of soil and genesis, stages of development, etc.

In turn, soil carbonates, which are the basis of mineral carbon, are an important morphological and chemical feature of arid soils, from the form of occurrence and content of which depends on the properties of the latter.

There is quite a lot of research in the literature regarding organic carbon and carbonates, but the issues related to the inheritance of humus have not been fully studied tons of parent rock, the ratio of mineral and organic carbon in irrigated soils. Changes that are influenced by natural and anthropogenic factors, and also manifested in regional changes in the properties and characteristics of soils in the desert zone of the Fergana Valley are defined demonstrate the relevance of this work.

In order to study the above, we established 17 full-profile soil plots in the field soil and laboratory studies carried out in 2014-2016. resov.

Selection, preparation and chemical analysis of soil samples were carried out in accordance with generally accepted methods (1,2). The determination of the volumetric weight of the soil and field moisture was carried out in accordance with the method of Vadyunin and Korchagin (3). Carbonates in arid regions according to Schlesinger (4) belong to paleohydromorphic, calcareous desert crust weathered. Based on the data obtained, he estimated the total mass of calcium carbonates in the deserts of the world to be on average 800 • 1012 - 900 • 1012 kg.

These are values of the same order of magnitude as the reserves of organic carbon in the soils of the world. Below are the results of analyzes and calculations, as well as the ratio of the masses of organic (Corg..) and inorganic (Scarb.) carbon in newly minted and newly

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mined, old shaved meadow soils of the desert zone of Central Fergana. 17 samples and results were included in the processing of materials. Determination of carbonates and organic carbon as well as humus in these soils was carried out to a depth of 150 cm.

A short review of the work of recent years devoted to the study of the quantitative composition of organic and mineral carbon and their ratio in soils and their changes in the process of development soils under the influence of anthropogenic and natural factors, the profile of soils was studied by Schlesinger (4), Glazovskaya (5), Vernadsky (6), Alexandrova (7), Lewine Stewart (8), Stewart (9).

Carbon in soils and soil-forming rocks is included in the composition of both organic and mineral and organo-mineral compounds.

It is part of an organic substance, found in specific compounds characteristic of soils: humic acids, fulvic acids, hematomelanic acids, humin. In non-specific compounds: lignin, carbohydrates, amino acids, alcohols, aldehydes, etc. Mineral carbon compounds are represented by carbonates, the main part of which is calcium and magnesium carbonates, partially iron and sodium. In the gas phases of soils, carbon is presented in the form of CO2, CH4, etc.

Starting with the appearance of rocks and minerals on the surface of the earth, their weathering begins at the same time. Vegetation and microorganisms appear that enhance this process, and sorting, accumulation, and differentiation of chemical elements, including carbon, begin. So gradually, the soil develops. The stages of its development constitute an evolutionary cycle, leading to a rise in the energy state of the soil climax. Some factors, such as migration and accumulation of chemical elements, especially pedogenic and lithogenic carbon, disrupt the consistency of the evolutionary process.

Each type, subtype, genus of soil has properties characteristic only of this taxonomic series. These properties, in turn, are related to the accumulation and content of pedogenic and lithogenic carbon, the quantity and quality of humus, and carbonates.

These chemical properties, in turn, affect the energy state of the soil. Thus, over time, the properties of the developing soil come into balance with natural conditions and are separated from the chemical, physical and other properties of rocks.

In soil development department Certain soil-forming factors and processes contribute to the distance of the soil from the state of natural equilibrium. Such factors include sudden or gradual human intervention in the course of evolution. These factors lead to imbalance and may lead to changes in organic and mineral carbon.

Organic and mineral carbon is included in the composition of soils and soil-forming rocks. In the process of evolution, changes in organic carbon occur in the following sequence: the intensity of accumulation of pedogenic organic carbon in the initial stages soil cultivation is less than its mineral carbon. An increase in the intensity of humus accumulation, strong mineralization, where an increase in the content of organic carbon is observed. The intensity of accumulation and mineralization is almost equal, the soil is in a quasi-equilibrium mature state. At the same time, the hydrogenic accumulation of carbonates changes over time.

The initial stage of pedolithogenesis is considered to be the formation of a fraction of highly polymerized humus during the humification of organic residues of plant and animal origin.

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The evolution of irrigated soils and its humic state associated with organic carbons is determined by agrotechnological and hydromeliorative farming methods. In the context of the use of resource-saving agricultural technologies, aimed at the effective use and expanded reproduction of soil fertility, with long-term soil Soil units turn into old soil and oasis, where stabilization of the humic state and pedogenic, lithogenic carbon is observed, and an improvement in properties is observed compared to original In Europe, such soils are currently systematically included in a special class of anthroposols. The amount of pedogenic and lithogenic carbon during the evolution of soils differs sharply from the rock, less different from the parent rock, and the concentration gradient in the soil varies with age aet. During the first 10-15 years after development, changes in the properties of newly developed both automorphic and hydromorphic soils occur at a relatively accelerated pace and during this time the initial the humus content in newly developed soils is reduced by 12-20% of the original level. With a gradual transition from newly developed groups to newly cultivated and old cultivated as well as oasis soil properties gradually, with increasing age of cultivation, initially increases, and then stabilizes, passes over a certain period of time into a climax state. As a result, a more fertile arable layer, a more compacted subarable layer, is constantly formed.

In modern soils formed on alluvial-proluvial deposits in deep horizons with a mono- and polygenetic structure of soil thickness, a change in humicity is detected ca, organic and mineral carbon, as well as the group composition of organic humic substances.

In our case, there is a meadow type, soil formation and evolution is characterized by a combination of the process of humus accumulation, the development of gleyization, as well as hydrogenic accumulation of carbon calcium, water-soluble salts, gypsum, iron oxides, neutral and slightly alkaline reaction. The studied area of Central Fergana is characterized by a flat type of terrain where wind erosion occurs. A characteristic feature of the climate is desertion, the amount of precipitation is 80-120 mm. The parent rocks are represented by alluvial-proluvial deposits. The natural vegetation of the areas is desert. In irrigated areas, cotton seeds are sown annually and raw cotton is grown. In the key areas, the level of groundwater pressure is at a depth of 165 cm. Calcium, magnesium, sulfate and chloride anions dominate among the cations. The studied soils are generally moderately saline, groundwater mineralization is 5.5-6.2 g/l. As for the change in humus content, the results of the analysis show that relatively high humus contents are found in the arable and subarable horizons of the studied soils, where it fluctuates between 1.27-1.44% in arable horizons 0.98-1.20% in subarable horizons . At the same time, an increase in the amount of humus is observed, both in the arable and subarable soil horizons with increasing recency of development and irrigation.

Relatively high humus levels are characteristic of old soils. In addition, with increasing age of cultivation, a decrease in the inheritance of humus from the maternal breed is observed. No major changes are observed in the amount of carbonates; its amount varies within 6.1-6.2% in arable horizons, and in subarable horizons these values fluctuate in the range of 10.10-15 .33%.

Calculations of average carbon contents of organic substances and carbonates in newly developed, newly cultivated and old soils are given in the table. In irrigated meadow soils,

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the content of organic carbon in the 0-150 cm layer increases, and decreases from depth. As for mineral, that is, carbonate carbon, there is no significant difference between the studied soils. To the depths Now 30-50 cm this type of carbon grows and reaches 3.85 - 4.14%.

Within the parent breed, the numbers are of the same order, that is, 3.1%.

The absolute accumulation of carbonates in the active horizons of the studied soils is almost the same and has a zonal character with their redistribution in the soil profile, indicating their lithogenic and partially biopedogenic nature.

In the studied soils, the maximum content of carbonate is located in the layer of 80-120 cm and 120-150 cm, which means that the main carbon reserves of carbonates are concentrated in the lower layers of soil and soil wintering rocks, where the share of carbonates is 90-98% of the total carbonates.

At the same time, the ratio Scarb. and Corg. in the studied soils it grows from top to bottom. High ratio indicators correspond to newly developed soils (0.76-61.8), low indicators correspond to old soils, where this indicator varies within 0.67-28%. Newly cultivated soils occupy an intermediate position in this regard.

Determining the content of mineral and organic carbon in the soil cover and profile can serve as one of the diagnostic indicators of soil processes.

The carbonate distribution depth of 80-120 and 120-150 cm can be called a conservative zone, where a uniformly relatively high carbonate content is observed within 1 1.3-11.4%.

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