MORPHOGENETIC CONFIGURATION OF IRRIGATED SOILS OF THE SOKH ALLUVIAL FAN

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ABSTRACT

The article presents data on the formation and morphogenetic configuration of irrigated illuvial, meadow-swamp and meadow-alluvial soils distributed in the upper, middle and lower part of the Sokh alluvial fan. Agricultural-irrigation layer of meadow-swamp soils of new irrigation is characterized by smaller thickness, sometimes thicker than the arable layer (tilth-top soil). Soils are saline, slightly saline and moderately saline. Formation of brushwood and branches was revealed in middle and lower layers of irrigated meadow-swamp soils. Illuvial soils of old irrigation are widespread in the southwest fan. Texture is heavy, medium to light loamy. Slightly saline, occasionally mixed with gravel, subject to moderate to weak washing.

KEYWORDS: *Sokh Alluvial Fan, Illuvial Soils, Meadow-Swamp, Meadow-Alluvial, Medium Loamy, Salinities.*

INTRODUCTION

Enforcement of the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 841 of 20 October 2018 "On measures to implement the national sustainable development goals for the period until 2030" and the Resolution of the President of the Republic of Uzbekistan No. PP-277 dated June 10, 2022 "On measures to create an effective system to land erosion control", as well as implementation of tasks established by other laws and regulations aimed at improving the conditions of reclamation of irrigated soils and increasing of soil fertility.

Target of Research: Irrigated illuvial, meadow-swamp, meadow-alluvial soils formed in the upper, middle and lower parts of the Sokh alluvial fan.

Target of Research and Implementation Methods: They include the land plots of separately selected irrigated farms located in different geomorphologic areas of the Sokh alluvial fan of mountain rivers, in the southern Fergana Valley. The methodological basis of the research conducted is the works published in our republic [1;2], as well as methods of geochemical, comparative-geographical, laboratory-analytical analysis. During the research period, chemical test of soil and water samples, as well as research studies [3] were carried out in accordance with the methods developed at the institute and generally accepted in the republic.

Research Results and their Discussion: Scientific research was carried out on selected reference farms located in elevation and azimuth: on irrigated soil cover of farms A. Bozorboshi and Sokhibkor of Uzbekistan district, Dustlik and Pakhtakor of Bagdad district, Oksuv of Uchkuprik district, Kokand of Furkat district, Naymancha and Mulkobod of Dangara district, named after Alikulov of Buvayda district. Soils of the studied reference farms include soils of the Sokh alluvial fan flowing from the mountain.

It is covered on the basis of morphogenetic characteristics of irrigated soils of characteristic (specific) reference farms, located in the selected directions of trunks from the Sokh alluvial fan areas and having basic groups of soils formed in geomorphologic areas of distribution, data of field, laboratory and chamber studies performed on soil samples drawn from genetic layers of soils.

Alikulov massif of Buvayda district. Extreme part of the Sokh alluvial fan, meadow alluvial soils of new irrigation, consisting of alluvial deposits, medium loamy, slightly saline, moderately cultivated soils. The agricultural-irrigation layer is formed 60 centimeters thick. 200 meters east of the asphalted road is an area with planted cotton, flat field, and continuous north-west gradient.

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Ahk 0-25 cm. Gray, dry soil surface, with high humidity towards the bottom, heavy loamy, loosely packed, fine-grained, traces of plant roots and subterranean insects occur, transition to the next layer by precise texture and density.

Aho 25-57 cm. Gray, in weakly moistened, moderately loamy, grainy granular structure, moderately packed, occasionally small salt crystals, as well as plant roots, almost rotten root remains and traces of subterranean insects occur, transition to the next layer by precise texture and density.

B_1 57-72 cm. Light-gray, moderately moistened, sandy, granular texture, moderately packed, rotten root remnants and traces of insects occur, transition to the next layer by precise texture and density.

B_2 72-105 cm. Light-gray, moderately moistened, medium loamy, fine-sulfur structure, closely packed, few traces of almost rotten roots and insects, sometimes salt crystals are found in the layer, transition to the next layer by precise texture and density.

B_3 105-150 cm. Light-gray, spouty, slightly loamy, closely packed, salt crystals occur mixed with rust spots. From 150 cm, outflow of groundwater.

Meadow-swamp soils of new irrigation are spread in the area of ancient alluvial plains of the Syr-Darya River, by texture they consist of medium and light loams. Such soils are

morphologically gray, with well-formed humus layer, differing in color, in the lower parts of the soil profile are found in the form of light loams, loams and sand layers.

On meadow-swamp soils of new irrigation the agricultural-irrigation layer is characterized by smaller thickness, sometimes thicker than arable layer. According to salinity, such soils are differentiated into saline, slightly saline and moderately saline soils. During the period of field studies, formation of brushwood and branches in the middle and lower layers of irrigated meadow-swamp soils was revealed. Irrigation water saturation combined with groundwater occurs, resulting in anaerobic conditions, this, in its turn, resulted in a decrease in humus in the lower layers of the section. Such soils are also poorly supplied with nutrients (Figure 1). Below are layers of alluvial-proluvial sediments. [4; 5; 6].

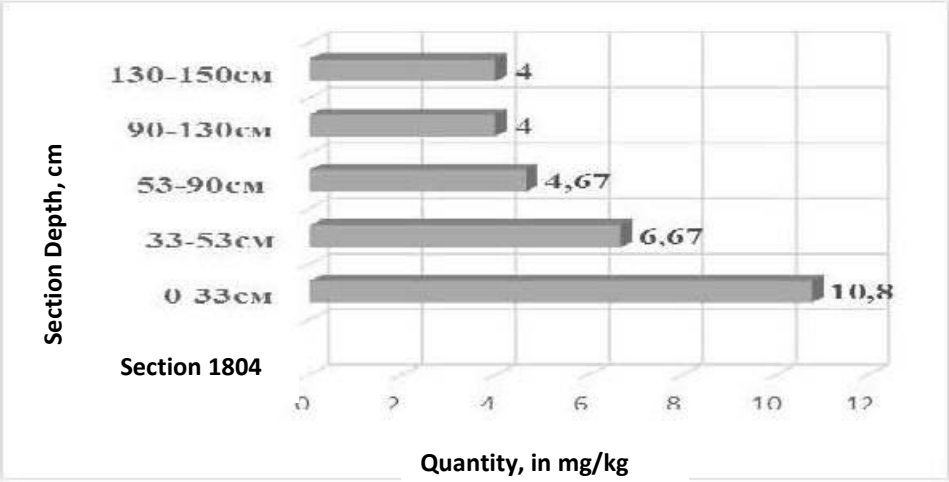

Figure 1. Labile phosphorus content in meadow-swamp soils of old irrigation of the lower part of the alluvial fan

Relatively high humus content is observed in these soils, and irrigated meadow-swamp soils are constantly moistened by groundwater that is good for only soil formation, but also decay of plant residues captured by soil. According to M.A. Pankov, it is explained that hydromorphic soils of the extreme parts of the Sokh alluvial fan compared to the middle parts of the alluvial fan show changes in the texture of soils, humus level, salinity, caused by the relief structure, i.e. soils with light texture, weakly saline and with low humus content are found on the upland parts of the relief [7].

However, because of land forming in subsequent years, such large differences in relief become less noticeable, and such condition is less noticeable in the domain of impact on the soil cover of the irrigated area. Irrigation farming, in turn, has played a big role in the formation of meadow (grassland) soils, that is, because of irrigation, continuous agro-technical treatments, application of additional organic and mineral fertilizers, large changes in water-air regime, properties, structural framework, and hydrology and soil improvement are observed in the morphogenetic texture of soils. In the field studies, it was observed that such morphogenetic changes still persist in the soil layer irrigated by the reference farm. In the studies completed, it was observed that agricultural soil tillage (soil turning, inter-row tillage, etc.) promotes faster rotting and

propagation of crop residues therein. One of the negative aspects of the swamp regime was that in this regime, groundwater approach to the ground surface was observed and because of temperature rise in the soil, brushwood and branches were also formed. Such conditions were formed in the lower layers of swamp regime soils distributed in Buvayda, Bagdad and Furqat districts [8;9;10].

Illuvial soils distributed within the territories of the farm named after Bozorboshi of Uzbekistan district apparently have different directions of interaction of relief, hydrogeological and edaphic-climatic conditions, as well as soil formation processes. In the farm territory located at a height of 800 meters above sea level, there are gravel deposits of large thickness as parent rock materials, on the surface of which illuvial soils were formed. Illuvial soils are artificially man-made soils by sludge wasting on the surface of stony-gravel deposits.

Irrigated illuvial soils of the Sokh alluvial fan are spread in the territories of farms named after Bozorboshi of Uzbekistan district, Oksuv and Bagdad of Uchkuprik district, and Duslik of Bagdad district. Studies have shown that stony-gravel deposits in the Sokh alluvial fan have reduced thickness from top to bottom, but in some districts they are 70-80 m thick (Mukimiy farm of Uzbekistan district). The morphological view of irrigated illuvial soils in terms of the farm named after A. Bozorboshi of Uzbekistan district is given below.

Section 30. U.Kh. Mamajanova, A.J. Ismonov. A. Bozorboshi massif of Uzbekistan district. The upper part of the Sokh alluvial fan consists of alluvial-proluvial deposits, illuvial medium-textured loamy, weakly saline, medium-cultivated soils of old irrigation. 900 m north of the paved road is a field sown with wheat, flat field, occasional smooth gravel up to 5 cm in diameter, continuous west gradient $1\text{-}2^0$, 618 m above sea level.

A_{hk} 0-33 cm. Gray color, dry surface, moist from below, medium loamy, loosely packed, granular texture, fine-grained stones up to 1-3 cm in diameter, almost rotten cotton roots and earthworms, and small plant roots and traces of subterranean insects, transition to the next layer exactly by moisture and density.

A_{hok} 33-55 cm. Gray color, weakly moistened, medium loamy, fine-grained texture, moderately packed, smooth gravel up to 5 cm in diameter occurs, small plant roots, traces of subterranean insects occur, transition to the next layer exactly by moisture and density.

B_1 55-81 cm. Gray color, weakly moistened, loosely packed, medium loamy, fine-grained with mixed structure, subterranean insect, treated roots and traces of insects occur, smooth gravel up to 5 cm in diameter, transition to the next layer exactly by moisture and density.

B_2 81-110 cm. Gray color, sometimes rust spots occur, moderately moistened, medium loamy, fine-grained texture, loosely packed, with few roots and traces of insects, sometime light lumps and carbonate spots occur in the layer, pebbles of 3-5 centimeters in diameter occur in the lower part of layer.

Illuvial soils of new irrigation are widespread in the southwest farm, where 20-30 years have passed since the reclamation. Now subsoil layers are formed on these soils, gravel is mixed in arable layer. It is heavy, medium to lightly clayey in texture. Slightly saline (Figure 2), slightly mixed with gravel, subject to moderate to weak degree of washing. External morphological structure of illuvial soils of new irrigation stretches to the side of soils of old irrigation, but in the

soil profile there are clods of brown shade, giving the soil light gray shade, such pieces of clods are characteristic for soils of the upper zone (area of dark and typical gray soils), they are brought by mudflow waters.

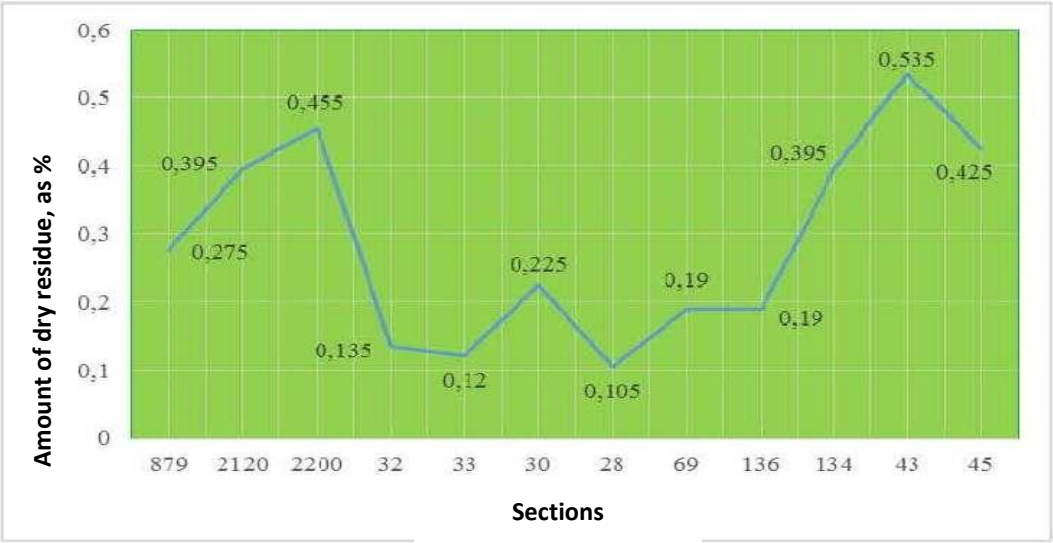

Figure 2. Amount of dry residues in the illuvial irrigated soils (arable layer), as %

Recently developed illuvial soils occupied small areas in the farm. Such soils have an arable layer of 10-15 cm. There are a lot of stones and small gravel in the soil layer. Texture is heavy loamy, slightly saline and moderately stony. In our opinion, the reason why the texture of such soils was heavy or medium loamy was that the Sokh River flowed continuously and its silt-rich waters and soft deposits in it were deposited on the mother rocks on the surface of the field, forming the soil. One of the distinctive features of external morphological characters of soils is their coloration, i.e. soils look light brown in the soil profile. Such condition is caused by more solar radiation, less penetration of plant residues into the soil, color and rotting of shoots. Due to the increased irrigation and tillage, with the course of later periods such soils acquire grayish shade, as well as soils of old irrigation [11; 12].

Irrigated meadow alluvial soils. Irrigated meadow alluvial soils formed in the steppe zone of the Fergana Valley, in the area of ancient alluvial plains of the Fergana Valley and in the lower and extreme parts of the Sokh alluvial fan are spread and formed in the territories of farms of Kokand Furkat district, Mulkobod and Naymancha of Dangara district, Pakhtakor and Dustlik of Bagdad district, and Sokhibkor of Uzbekistan district. Soil cover of these farms consists of alluvial-proluvial deposits, located in the geomorphologic areas of the middle and lower reaches of the Sokh alluvial fan. Due to the influence of edaphic-climatic conditions of farms and natural-man-made factors, mainly irrigated hydromorphic soils were formed [13].

Irrigated meadow-alluvial soils occupy the outer part of the Sokh alluvial fan flowing from the south, lands adjacent to ancient alluvial plains. Morphogenetic characters of meadow-alluvial soils of old irrigation are specified below in terms of soils of Section 23 of Kokand farm.

Section 23. Outer part of the Sokh alluvial fan, newly irrigated meadow, consisting of alluvial-proluvial deposits, alluvial soils, slightly loamy, moderately saline and poorly cultivated. There is a leveled area with planted cotton 350 meters east of the large paved road.

A_h 0-32 cm. Dark gray, weakly moist surface, slightly loamy, loosely packed, finely distributed, lumpy, large and small cotton roots and traces of subterranean insect occur, traces of insects are sometimes distorted, the transition texture to the next layer is clear by the structure color.

A_{ho} 32-61 cm. Gray sand, weakly moist, fine sand of loose structure, loosely packed, with formation of salt crystals, gypsum crystals and plant roots, almost rotten roots and traces of small subterranean insects, transition to the next layer is noticeable in density.

B_1 61-100 cm. There are gray, sandy, rusty and gray (swamp-colored) spots, weakly moist, moderately packed, pieces of gypsum scattered in crumbs, there are almost rotten roots, sometimes salt crystals, transition to the next layer is noticeable in density and moisture.

B_2 100-160 cm. Gray, sandy, waterlogged, uncompacted porous-loose, with admixture of rusty spots formed by gypsum crystals and salt crystals, high-humidity groundwater opened from 160 centimeters.

These soils were formed under conditions when groundwater was located at the upper 1-2 meters. Irrigated meadow-alluvial soils according to their texture vary from various light loams to heavy loams, more medium loamy soils are common. Low period of irrigation with turbid water resulted in low formation of agricultural-irrigation layers, layer thickness reaches 50-65 cm depending on dehkan culture. These irrigated soils were covered with alluvial (river) sands starting from under arable land.

CONCLUSION

Climatic conditions, irrigation, water-bearing (loamy) rocks and natural processes played a big role in the morphogenetic structure of irrigated soils formed in the Sokh alluvial fan. It is noted that in the genetic and ameliorative evolution of soil covers of the Sokh alluvial fan, the downward differentiation of the texture, that is, the weighting of the texture as it moves away from the mountains, in hydrogeological conditions, groundwater spreads, deepens or approaches the surface, there is increased mineralization of groundwater towards the extreme areas of the alluvial fan, the pattern of origin is seen.

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