ISSN 2063-5346

PROPERTIES AND QUALITY ASSESSMENT OF HYDROMORPHIC SOILS OF MIRZACHOL OASIS

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Article History: Received: 01.02.2023 Revised: 07.03.2023 Accepted: 10.04.2023

Abstract

The article provides information on the formation of hydromorphic soils of the Mirzachol oasis, their properties and characteristics. The properties of soils located in one massif, but located on different terraces of the river, were compared. The credit score of massive soil fractions is determined. For soil quality assessment, mechanical composition is taken as the main scale, and correction coefficients for other properties are included. Soil quality assessment materials are used for crop placement, yield planning and tax rate determination.

Keywords: water level, gray soil, meadow-gray soil, meadow soil, soil salinity, soil mechanical composition, soil differences, quality assessment, humus, phosphorus, potassium.

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DOI:10.31838/ecb/2023.12.s1-B.392

Introduction.

The main part of the Mirzachol oasis consists of hydromorphic soils, its formation, properties and characteristics are unique, and there is a need to study these soils separately. Also, the factors affecting the quality assessment of these soils are also different.

Information on soil quality assessment has been sufficiently studied. We can see their explanation in the following analysis. However, there is not enough information about the properties of the hydromorphic soils of the Mirzachol oasis, their quality assessment, and the factors affecting it.

According to A.R. Akbirova [1], aroecological factors are important in determining soil quality assessment. In particular, the agro-ecological factor should be taken into account in the conditions of complex topography, climate, vegetation cover, hydrology, and soil-forming rocks in the soil quality assessment. The components of soil (technological, physical, chemical and biological) and agroclimate (sum of atmospheric precipitation, hydrothermal coefficient, sum of effective temperatures) are inextricably linked and have a direct impact on soil quality.

Yu.V. Aksenova and others [2] also suggested the use of the soil ecological index in the assessment of soil quality. Experiments were conducted in three zones: southern-taiga forest, forest-steppe (northern, central and southern) and steppe zones. Accordingly, the quality assessment of the soils of this zone was also different.

According to V.A. Rassypnov, E.M. Sovrikova [3] the materials of soil inspection form the basis of the land cadastre. The theoretical foundations of soil testing have been created and practical methods of soil quality assessment have been developed for different zones according to soil climate conditions.

M.V. Redko [4] suggested the use of ecological indicators such as their contamination with heavy metals in determining soil quality assessment. Soils contaminated with heavy metals were also less productive. Agricultural land closer to urban areas had higher heavy metal contamination and correspondingly lower soil quality scores.

D. De la Ros, R. Sobral [5] expressed their opinions on the methods of determining soil quality assessment. Land price and land price are different from each other. When evaluating land, its biological properties are not taken into account. In general, it is believed that the use of agroecological indicators in soil evaluation gives good results.

According to V.V.Khusnutdinova and others [6], although the work on soil monitoring has been carried out sporadically, the criteria and scale of full soil monitoring have not yet been completed. Hydrophysical (soil density, specific gravity, porosity, water permeability) properties were used by these researchers to determine soil quality assessment. A correlative relationship between soil hydrophysical properties and humus content has been determined. The calculated credit scores are inextricably linked with the productivity of grain and leguminous crops.

G.B. Tesfahunegn [7] conducted research on the degraded soils of the Mai-Negus region in the north of Ethiopia. 80 percent of these areas are occupied by the teff (Eragrostis tef) plant belonging to the family of cereals. The characteristics of this crop were taken into account when determining the soil quality assessment.

Different criteria are used to determine the soil quality assessment in different regions [8-15]. Because the factors affecting soil quality assessment may be different according to soil-climate conditions. In addition, according to the biological characteristics of plants, the criteria of soil inspection may also change.

Scientific works on the evaluation of the properties, evolution and quality of the soils of the Mirzachol oasis have been published [16-20]. In these works, information on the mechanisms of formation of hydromorphic soils of the Mirzachol oasis from automorphic soils, changes as a result of irrigation are presented. Also, the principles of determining soil quality assessment, the results of soil monitoring for various crops are described. However, information on the quality assessment of hydromorphic soils is poorly covered.

Research methods

Special experiments were carried out to study the properties of Mirzachol oasis hydromorphic soils, to study their quality assessment. Soil sections were laid to study the properties of irrigated gray-meadow, meadow and swamp-meadow soils located on different terraces of the Syrdarya River. The generally accepted methods of the Institute of Soil Science and Agrochemical Research were used for placing soil sections, taking samples, and recording morphological characteristics. Soil mechanical composition, agrochemical properties and water absorption were analyzed. The “Boyovut” massif in Gulistan district was calculated for the credit scores of the soil differences, and the average score was calculated for the massif. The main factor affecting the soil quality assessment was determined. A quality assessment map of massif soils was created.

Results and discussions

The level of seepage water has a great influence on the evolution and quality assessment of the soils of the Mirzachol oasis. As a result of the low natural drainage of the Mirzachol zone, it is difficult for seepage waters to escape. As a result, there was an increase in flood waters, and the transition of soils from automorphic mode to hydromorphic mode took place. At first, semi-hydromorphic, then the formation of hydromorphic soils is observed. In the Mirzachol oasis, irrigated light gray soils have been preserved in very few areas.

After the Mirzachol oasis soils were irrigated, gray-meadow, meadow-gray soils began to form. As a result of the further rise of the Sizot waters, irrigated meadow soils, and later meadow-swamp and swamp soils also began to appear.

We want to provide information about the properties of soils located in the same massif, but located on different terraces of the river, and about the quality assessment of the soils of the massif. Cross-section 1 is located on the III-cair terrace and consists of old irrigated gray-meadow soils. Cross-section 2 is located on the II-cair terrace and consists of old irrigated grassland soils. Section 3 consists of newly irrigated swamp-meadow soils located on the upper terrace I.

Soil mechanical composition is one of the important indicators of soil productivity. In fact, soils with a heavy mechanical structure contain a lot of nutrients and water, and most importantly, they have a high holding capacity. At the same time, it is poorly permeable to water and air, has a high resistance to tillage, on the contrary, light soils have low nutrient and water content, high filtration capacity, aeration and easy tillage.

In the conditions of transition to intensive irrigated agriculture, all soil processes are activated, many properties of the soil are changing in a short time, not constant. For this reason, the soil evaluation criteria specify the evaluation of soils with low variability, genetic groups of soils, types and types, moisture series and mechanical composition.

The difference in the order of moisture and nutrition in different mechanical composition is reflected in the productivity of agricultural crops. Therefore, many researchers show that there is an inextricable relationship between the yield of agricultural crops and the “physical clay" in the soil, that is, the granulometric composition. Its optimal amount is different for different agricultural crops, it is determined by the biological characteristics of the plants, resistance to lack or excess of moisture, water, air and nutrient requirements.

Table 1 presents data on the mechanical composition of the soil, and we can observe the predominance of "large dust" (0.05-0.01 mm) particles characteristic of all gray soils. Its amount is from 28 percent to 52 percent. The mechanical composition of the soil consists mainly of sandy soils, and it is possible to meet light sandy, medium and heavy sandy soils. In the 0-30 and 30-50 cm layer of section 2, the mechanical composition of the soil consists of heavy sand. In the 30-50 cm layer of section 3, light sands were found.

1-Table.

Mechanical composition of the research object

Layer depth, in cm	Mechanical composition of fractions, relative to the absolute dry mass of the soil, in percent							
	1-0,25	0,25-0,1	0,1-0,05	0,05-0,01	0,01-0,005	0,005-0,001	<0,001	Physical clay aggregate
III-Top terrace. Formerly irrigated gray-meadow soil								
0-30	2,7	6,4	10,7	28,6	10,3	21,5	19,9	51,7
30-50	1,7	5,1	14,5	42,1	7,2	15,1	14,3	36,6
II- Upper terrace. Formerly irrigated grassland.								
0-30	0,9	1,2	11,3	38,2	10,3	19,9	18,3	48,5
30-50	0,4	0,9	11,3	37,4	11,1	20,3	18,7	50,1
I- Upper terrace. Freshly irrigated swamp-meadow soil								
0-30	0,7	1,3	17,0	40,5	10,3	15,9	14,3	40,5
30-50	0,2	0,9	19,5	52,5	7,2	10,7	9,1	27,0

The mechanical composition of the soil is considered one of the important properties, and it is one of the main indicators in determining the norms of soil cultivation, irrigation and salt washing.

The amount of mobile nutrients in the soil is important in the scientifically differentiated use of fertilizers. Agrochemical indicators of the soil are one of the main criteria for determining the rate of fertilizers and planting crops. The amount of humus in the soils of the research area is high compared to other gray soils of Mirzachol (Table 2). This is directly related to the process of soil grazing. As the moisture level increases, the intensity of decomposition of organic matter decreases, the accumulation of organic matter improves.

Looking at the table data, we can see that the humus content of the soil is higher in the 0-30 cm layer in all three sections. Unlike other pale gray soils, the amount of humus in the arable layer did not decrease sharply in these soils..

2-table

Agrochemical indicators of the research object and level of supply

№ cross section	**Layers, cm**	**Humm us, %**	**Level of supply**	**P_2O_5, mg/kg**	**Provided level**	**K_2O, mg/kg**	**Level of supply**
1	0-30	1,182	Average	16,0	Few	207,1	Average
	30-50	0,612	Few	10,2	Very little	139,7	Few
2	0-30	1,498	More	31,0	Average	228,8	Average
	30-50	1,245	More	12,0	Very little	216,7	Average
3	0-30	2,005	More	56,0	More	240,8	Average
	30-50	0,802	Few	14,0	Very little	178,2	Few

The amount of humus in the arable layer of newly irrigated marsh-meadow soils reached 2%. This indicates that these soils are rich in organic matter. The amount of humus in the 0-30 cm layer of sections 1 and 2 is higher than 1 percent. The amount of mobile phosphorus has a high indicator in the arable layer, which is suitable for soils with low, average, more supply. The amount of exchangeable potassium is also high in the plowed layer. Its highest amount was in the 0-30 cm layer of section 2 and was 228 mg/kg. In general, in most cases, the level of exchangeable potassium supply corresponds to the “average’ amount.

It is possible to differentiate the application rate of fertilizers according to the level of availability of mobile nutrients in the soil.

According to the analysis of the results of soil water absorption, the amount of dry residue in the soil is low. Its amount is around 0.1%, and the amount of NSO3-carbonates is around 0.03%, indicating weak alkalinity. The amount of chlorine in the plowed and subsoil layer of the three sections is below the toxic level. It reached 0.021% only in the 0-30 cm layer of section 2.

One of the factors affecting the quality of the soil is the level of soil salinity. According to Table 3, the amount of dry residue does not exceed 0.3 percent in all soil sections. In section 1, the amount of dry residue does not reach 1%, taking into account the amount of chlorine and sulfates in the soil, we can see that these soils belong to weakly saline soils. The amount of carbonates is almost uniformly distributed in all sections and depths, its amount is from 0.020 to 0.034 percent. The amount of sulfates was distributed almost uniformly in all sections and was 0.042 percent. If attention is paid to the amount of sodium, it can be seen that it has a slightly higher index than other irrigated gray soils.

3-table

Soil water absorption analysis results

Section no	Depth, cm	Dry residue, %	HCO_3	Cl	SO_4	Ca	Mg	Na	Anion-cation	The sum of components
III-Top terrace. Formerly irrigated gray-meadow soil										
1	0-30	0,108	0,032[1]	0,007	0,042	0,013	0,004	0,015	1,59	0,096
			0,52[2]	0,20	0,87	0,65	0,30	0,65	0,943	
	0-30	0,110	0,033	0,007	0,045	0,014	0,004	0,014	1,67	0,101
			0,54	0,20	0,94	0,070	0,30	0,63	1,04	
II- Upper terrace. Formerly irrigated grassland.										
2	0-30	0,125	0,024	0,021	0,043	0,025	0,006	0,003	1,88	0,110
			0,39	0,59	0,90	1,25	0,49	0,14	1,74	
	0-30	0,095	0,024	0,007	0,043	0,020	0,006	0,002	1,59	0,090
			0,39	0,20	0,90	1,00	0,49	0,10	1,49	
I- Upper terrace. Freshly irrigated swamp-meadow soil.										
3	0-30	0,106	0,034	0,007	0,042	0,013	0,004	0,016	1,63	0,098
			0,56	0,20	0,87	0,65	0,30	0,69	0,94	
	0-30	0,098	0,035	0,005	0,036	0,012	0,004	0,013	1,48	0,088
			0,58	0,15	0,75	0,60	0,30	0,58	0,90	

Note [1] in percent, [2] in mg/eq

Based on the obtained results and collected data, we calculate the credit score of the "Boyovut" array. This massif is divided into 19 soil differences, of which there are 2 soil differences in terrace III, 12 soil differences in terrace II, and 5 soil differences in terrace I (Table 4).

4- table

Calculation of credit score of "Boyovut" massif soil differences.

The difference number	The main scale of mechanical content	Amount of humus %	Salinity level	Clay layer	Special banitet ball
III - roof terrace. Formerly irrigated gray-meadow soil.					
1	100	0.70	0.85	1.0	60
2	100	0.80	0.85	1.0	68
II - roof terrace. Formerly irrigated grassland.					
3	80	0.85	1.0	1.0	68
4	80	0.70	0.85	1.0	47.6

5	80	0.80	0.85	1.0	54.4
6	100	0.70	0.85	1.0	59.5
7	100	0.70	0.85	1.0	59.5
8	100	0.70	1.0	0.85	59.5
9	100	0.80	0.85	1.0	68
10	100	0.70	0.60	1.0	42
11	95	0.80	1.0	1.0	76
12	95	0.70	0.85	1.0	56.5
13	95	0.70	1.0	1.0	66.5
14	95	0.70	0.85	0.85	48
I-bar terrace. Freshly irrigated meadow alluvial soil.					
15	100	0.70	0.85	1.0	59.5
16	80	0.70	1.0	1.0	56
17	80	0.70	0.85	1.0	48
I-bar terrace. Freshly irrigated swamp-meadow soil.					
18	75	0.80	1.0	1.0	60
19	95	0.70	0.85	1.0	56.5

Mechanical content was taken as the main scale of soil evaluation, and the score was around 75-100. Correction coefficients are included for soil humus content, salinity level and depth of clay layer. The average credit score of the farm was calculated based on the scores of soil differences. The average credit score for the array was 59.7.

Although the type, mechanical composition, salinity level, dry residue, leaching level and character of the layers are the same, the amount of humus, the amount of mobile phosphorus and potassium are different, and the credit score is also high. The 10th soil difference has a score of 42. This is due to the low content of humus and mobile phosphorus in the arable layer, as well as the high content of water-soluble sulfate and chlorine anions and dry residue. Also, soil fertility depends on the depth of the clay layer. Due to the location of the gley layer at 80 cm in the 14th soil difference, the credit score is also low.

Hydromorphic soil productivity depends on the depth of the clay layer, the higher it is located, the lower the productivity. In the 17th soil division, the mechanical composition of the layer consists of sandy loam and heavy sand, so it deteriorates the physical, physical-mechanical, and water properties of the soil, and the soil is poorly supplied with humus and mobile potassium and phosphorus. Nevertheless, salinity does not occur in this area, and we can increase soil fertility by using proper agrotechnical measures and fertilizers.

Based on the obtained data, the coefficients of productivity of soil differences were calculated for the massif (Table 5). For this, the credit score obtained by each soil division is divided by the average credit score calculated for the array. Determines how much the yield coefficients of soil differences differ from the array average credit score.

Soil difference №	Credit score	Efficiency coefficient	Soil difference№	Credit score	Efficiency coefficient
1	60	1,01	11	76	1,27
2	68	1,14	12	56,5	0,95
3	68	1,14	13	66,5	1,11
4	47,6	0,80	14	56,5	0,95
5	54,4	0,91	15	59,5	1,00
6	59,5	1,00	16	56	0,94
7	59,5	1,00	17	48	0,80
8	70	1,17	18	60	1,01
9	68	1,14	19	56,5	0,95
10	42	0,70			

Conclusions

Factors affecting soil quality assessment are different in different regions. It depends on the soil-climatic conditions of the regions and the type of crop. The soils of the "Boyovut" massif are located in three geomorphological conditions. Accordingly, soil properties are also different. The main factor affecting the soil quality assessment is the soil salinity level and the depth of the clay layer. The calculated credit score serves as a basis for planning the productivity of agricultural crops, rational placement of crops, determining the economic value of land and the amount of taxes.

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