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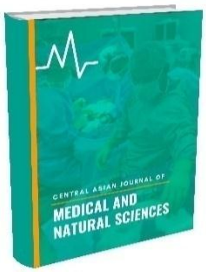

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Properties and Fertility Status of Meadow-Alluvial Soils in Vobkent District

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Abstract: In the irrigated lands of Vobkent district, cotton and grain are grown mainly. Cultivation of the same crops for many years has resulted in salinization of the soil in large areas, the rise of groundwater, and in some regions, in conditions of water scarcity, agricultural crops in large areas are ground. It was observed that irrigation with its waters decreased the level of seepage water and led to the transformation of meadow soils. When we compare data from previous years of soil monitoring in the districts of the Bukhara region, we can see that soil fertility indicators have been decreasing year by year in recent years.

Key words: Soil, agricultural, salinity, irrigated meadow-alluvial.

Introduction. The area of the administrative border of the Bukhara region is 4183.1 thousand hectares, of which irrigated land for agriculture is 226.6 thousand hectares, that is, 5.42% of the total land [1].

The territory of the province is located in the south-western part of our Republic; it borders the Navoi region from the north, the Kashkadarya region from the east, the Republic of Turkmenistan from the south, and the Khorezm region and the Republic of Karakalpakstan from the west. The main part of the total irrigated land in the territory of the Bukhara region, i.e., 69.1%, is meadow alluvial soil, 9.5% is brownish-brown and brownish-brown meadow soil, 7.9 percent is barren-meadow and meadow-barren, 3.7 percent are barren soils, and the remaining 9.8 percent are sandy-desert, desert, steppe-desert, and marsh-meadow soils [2].

The Bukhara region is mostly made up of irrigated land. It is distributed in the lower reaches of the Zarafshan River, the Bukhara and Karakol deltas, as well as the ancient prolluvial -alluvial plains and Tertiary Kyzylkum plateau, which are partially adjacent to them.

Materials and methods. The object of research is the irrigated meadow-alluvial soils formed in different soil-climatic conditions in Vobkent district of the Bukhara region. As of January 1, 2023, the total land area of Vobkent district in Bukhara region is 39446.0 hectares. Of this, there are 18,865.0 hectares of arable land, 1,090.0 hectares of perennial trees, and 65.0 hectares of fallow land.

Research methods are generally accepted standard methods in soil science in preparatory, field, laboratory and chamber conditions according, geographical, genetic, natural-historical, comparative, lithological-geomorphological, chemical-analytical and profile methods were used in the research. Research preparation, field, and camera methods were performed based on relevant guidelines and manuals [3, 4].

1:100,000 scale maps of the area were used for conducting soil research. A list of the names of the soils in the research area was compiled. The order of research sites, the field direction, the approximate number of soil sections, the places where soil-physical properties are studied, and the number of samples to be analyzed in the laboratory were determined.

Irrigated meadow-alluvial soils account for 83.01 percent of the irrigated area, meadow-desert soils for 14.55%, meadow-swamp soils for 0.78%, and sandy-desert soils for 1 percent, or 66 percent. Also, 10% of the studied soils are sandy and loamy, 15% are light sandy, 47% are medium sandy, and 28% are heavy sandy.

Results and discussion. The soils of Vobkent district are located on the plains in terms of relief and are mainly developed on alluvial deposits. The crossing of the district by the Zarafshan river has created conditions for farming in these lands since ancient times. At the same time, the distance of the district's administrative border from the sandy desert pastures, as well as the fact that it is bordered by the districts of Gijduvan, Shofirkon, Peshku, Bukhara, and Kogon—helps to some extent to prevent the harmsel, which is considered dangerous for crops in summer. Low productivity of cotton, cereals, vegetables, and other crops in irrigated lands is due to salinity.

This indicates that there are areas with different levels of salinity in the district. Depending on the season, salinity levels are observed to change during different periods of the growing season.

Irrigated meadow-alluvial soils are hydromorphic soils and make up 83.1 percent of the total irrigated lands in the district. These soils form the main irrigated and cultivated areas of the district.

Since these soils have been cultivated for several centuries, an agro-irrigation layer of 0.7–1.2 m has been formed. This causes the soil to be sufficiently supplied with nutrients. In the areas where these soils are scattered, seepage water is located at a depth of 2.0–2.3 m. According to the analysis of soil samples, the amount of physical clay (0.01 mm) in the soil profile is 14.48–19.24 percent in sandy loams, 21.3-29.08 percent in light sands, and 31.08 percent in medium sands. 41.06 percent, 45.52–57.81 percent is observed in heavy sands, and the amount of large dust particles (0.05–0.01 mm) is 22.54–48.76 percent (Table 1).

These soils have a thick agro-irrigation layer, characteristic of grassland soils of the desert region, and a mechanical composition with various characteristics and deposits. The mechanical composition of meadow-alluvial soils distributed in the district consists mainly of medium and heavy sands in the arable layer and light sands and loams in some areas (Fig. 1).

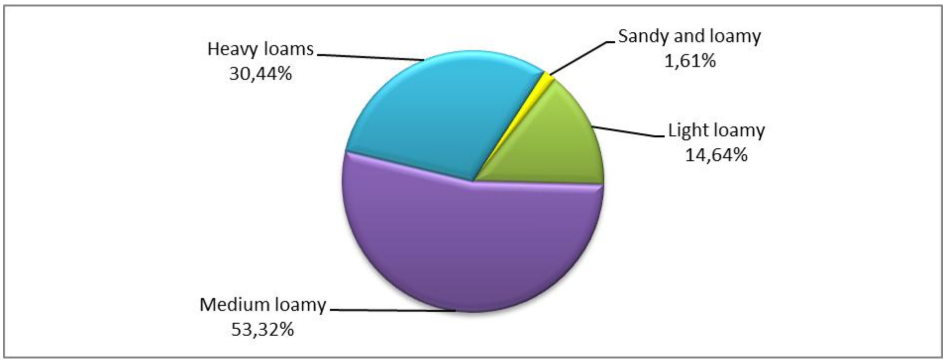

Figure 1. Description of irrigated meadow-alluvial soils by mechanical composition (percentage)

In the deep layers of these soils, which are spread on the river terraces and ridges, iron oxides and gliding processes are observed and are found at different levels, from weakly saline areas to strongly saline areas. It is observed that the amount of dry residue in the composition of water absorption changes depending on the properties and characteristics of the soil. In the upper horizons, the type of salinity is mainly chloride-sulfate and, in some cases, sulfate, and the amount of dry residue in the soil profile is up to 0.166–1.387 percent in chloride-sulfate salinity type soils and 0.086–0.213 percent in sulfate salinity type soils. changes. The ratio of chlorine to sulfate is 0.21-0.48 in the chloride-sulfate salinity type, and in the type of sulfate salinity, it fluctuates between 0.14-0.20.

These soils have varying degrees of salinity and are in the plow layer. The amount of Cl- is 0.035–0.038 percent in weakly saline soils of the chloride-sulfate salinity type, 0.059–0.084 percent in moderately saline soils, and 0.241 percent in strongly saline soils. And in non-saline (washed) soils of sulfate salinity type, it is 0.007-0.009 percent (Table 1).

All factors that determine the salinity regime of the soil (the level of seepage water, the level of mineralization and chemical composition, the salinity of the soil solution, the regime of irrigation, the quality of saline washing and irrigation water, the properties of the soil, the state of hydromelioration systems, the natural and artificial drainage of the place, lithological-geomorphological and climatic conditions, etc.) are closely related, and the change of one of them leads to a significant change of the others at the same time. The period of maximum accumulation of salts in soil layers corresponds to September–October. According to the results of the study [5], non-saline (washed) land is 4.58 percent, moderately saline land is 2.45 percent, strongly saline land is 5.92 percent, and very strongly saline land is 2 , decreased by 87 percent, it was found that weakly saline lands increased by 15.86 percent (Figure 2). Most of the strong and very strong salinity areas are found in medium to heavy sandy soils, where the seepage water is close to the surface around the ditch.

The absorption capacity of these soils differs from that of other hydromorphic soils in the desert region. Due to the high content of magnesium in the impregnated bases, in some sources, the soils distributed in this area are also referred to as "magnesian province" soils[6].

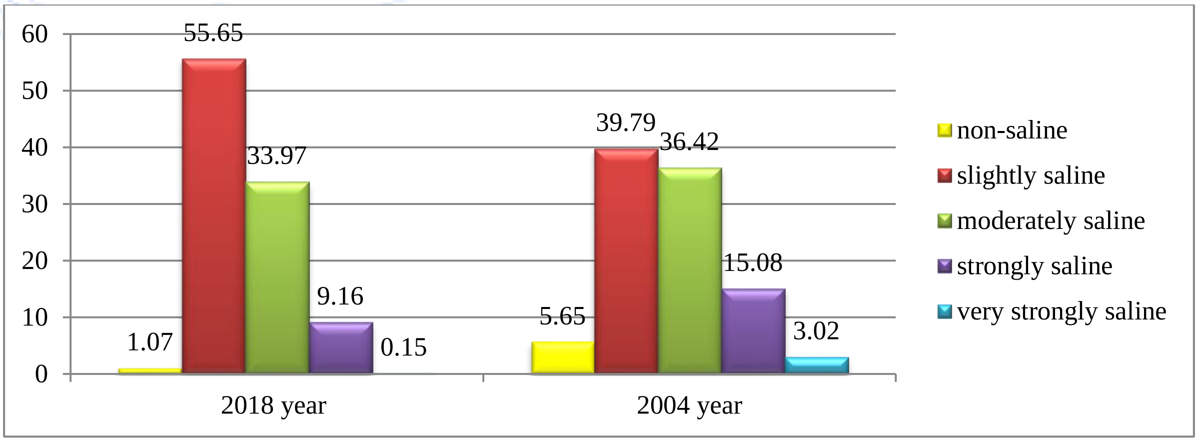

Figure 2. Dynamics of salinity level of irrigated meadow-alluvial soils in 2004-2018 (in percentage terms)

The amount of bases absorbed by the soil profile is 10.26-13.80 mg-equiv per 100 g of soil. observed until the absorbed cations contain calcium (44.92–54.58 percent), magnesium (38.99–50.0 percent), potassium (1.72–3.92 percent), and sodium (1.03–3.51 percent) (Table 1).

The humus content is slightly higher in these soils compared to other soils distributed in the district. Humus is 0.930–1.120 percent, total nitrogen content is 0.044–0.083 percent, phosphorus is 0.21–0.36

percent, and potassium is observed in the tillage layers of these soils up to 1.75–2.10 percent. The C:N ratio fluctuates between 7.85 and 8.57. Soils with low and very low phosphorus contents in the tillage layer are considered to be in mobile form. Phosphorus content in very poor soils is 8.6–14.8 mg/kg, and in poor soils it is 15.0–16.8 mg/kg (Table 1).

According to the results of comparison with previous years, in 2004, humus reserves in the 0–30 cm layer were 42.3 t/ha, total nitrogen was 3.11 t/ha, total phosphorus was 12.46 t/ha, and potassium reserves were 82.24 t/ha. By 2018, the reserve of humus in the 0–30 cm layer averaged 39.24 t/ha, total nitrogen was 2.79 t/ha, total phosphorus was 10.41 t/ha, and potassium was 79.73 t/ha.

Table 1. Mechanical, chemical and water absorption composition of irrigated meadow-alluvial soils

Section no	Layer depth, cm	amount of physical sand and clay, %		Total, %				C:N	CO2 carbonate, %	Absorption capacity, mg-eq	Amount of salts, %			Salinity	
		>0.01 mm	<0.01 mm	hummus	nitrogen	phosphorus	potassium				Dry residue	Cl-	SO42-	level	type
NM-1	0-34	73.8	26.2	0.98	0.068	0.23	1,856	8.34	9.6	13.1	0.539	0.084	0.254	2	xs
	34-59	74.62	25,38	0.713	0.056	0.166	1,941	7.37	8.6	12.38	0.273	0.035	0.136	1	xs
	59-100	81.24	18.76	0.325	0.022	0.154	1.82	8.55	7.8	11.52	0.247	0.028	0.125	1	xs
	100-123	80.76	19,24	0.22	0.014	0.117	1.13	9.1	6.6	12,16	0.225	0.024	0.113	1	xs
	123-186	78.7	21.3	0.132	0.009	0.086	0.603	8.49	5.4	11	0.182	0.02	0.094	1	xs
QM-35	0-35	73.98	26.02	0.65	0.044	0.214	1,755	8.57	9.4	12.28	1,387	0.241	0.685	3	xs
	35-75	71.4	28.6	0.456	0.033	0.191	1.64	8.01	8	11.52	0.85	0.14	0.425	2	xs
	75-115	85.52	14.48	0.314	0.024	0.134	1,337	7.59	7.4	11.27	0.451	0.073	0.221	2	xs
	115-160	91,92	8.08	0.2	0.014	0.113	0.874	8.29	6	10.26	0.283	0.038	0.139	1	xs
ZR-77	0-41	45.5	54.5	0.92	0.068	0.245	2,054	7.85	9.5	13.67	0.64	0.08	0.34	2	xs
	41-79	51.36	48.64	0.755	0.054	0.21	1,866	8,11	8.2	12.87	0.42	0.063	0.206	2	xs
	79-105	53,52	46,48	0.523	0.041	0.187	1,642	7.4	8.8	13,14	0.28	0.038	0.139	1	xs
	105-172	64.5	35.5	0.3	0.018	0.114	1,715	9.65	6.6	12.68	0.226	0.024	0.115	1	xs
AB-70	0-35	51.96	48.04	1.05	0.072	0.195	1,784	8.44	8.7	12.61	0.285	0.038	0.134	1	xs
	35-48	65,76	34,24	0.87	0.058	0.178	1,856	8.69	8.2	11.71	0.267	0.031	0.13	1	xs
	48-83	54.48	45,52	0.52	0.042	0.156	1,647	7.17	7	11.32	0.24	0.028	0.121	1	xs
	83-117	62.38	37.62	0.346	0.023	0.124	1,565	8.71	7.4	12.34	0.216	0.024	0.108	1	xs
	117-201	66,28	33.72	0.215	0.013	0.11	1,239	9.58	6.4	12.42	0.205	0.021	0.097	1	xs
NV-43	0-32	61,72	38,28	1,075	0.078	0.24	2.21	7.98	8.8	13.8	0.386	0.059	0.182	2	xs
	32-60	59,58	40,42	0.85	0.066	0.215	2,058	7.46	7	13.52	0.259	0.031	0.13	1	xs
	60-116	58.94	41.06	0.533	0.038	0.196	1,866	8,12	6.6	12,14	0.22	0.024	0.115	1	xs
	116-150	47.08	52.92	0.37	0.023	0.208	1,574	9.31	5.6	11.9	0.213	0.017	0.118	1	s
	150-193	45,26	54.74	0.208	0.014	0.184	1,382	8.6	5.8	11.72	0.152	0.009	0.087	0	s

From these data, during the past period, the humus reserve decreased by 3.14 t/ha, the total nitrogen by 0.32 t/ha, the total phosphorus by 2.05 t/ha, and the total potassium reserve by 2.51 t/ha. It was also determined that the amounts of phosphorus and potassium in mobile form in this layer are 58.38 kg/ha and 797.75 kg/ha, respectively. According to the results of the analysis, the average reserve of nutrients in the 0-100 cm layer is the following: humus 97.96 t/ha; gross nitrogen 7.09 t/ha; total phosphorus is 29.79 t/ha and potassium is 247.06 t/ha; mobile phosphorus is 163.93 kg/ha, and potassium is 2123.16 kg/ha [5].

A large amount of total phosphorus in the soil layers is a result of biological accumulation and the introduction of phosphorus mineral fertilizers. Phosphorus in a mobile form is found in sufficient quantities only in the soil and subsoil layers. As you go to the lower layers, its amount is sharply reduced, and it is observed in a hard-to-dissolve form. The same situation is repeated with potassium, i.e., soil layers are rich in total potassium but little or moderately supplied in the exchangeable form. This situation can be explained by the removal of potassium by agricultural crops and water. For example, in the 1950s of the last century, up to 9–12% of potassium was detected in the impregnated bases of these soils [6], but now it is observed that its amount has decreased by 5–6 times. It also does not have good indicators of nutrient reserves in the soil. The main reasons for this are the failure to establish a crop rotation system, placing the same crops in certain fields for many years, not using mineral fertilizers wisely, not introducing organic fertilizers, irrigation not following the rules, and several other natural and artificial factors [7]. In order to maintain and increase the productivity of the soil in the district and to use the land effectively and rationally, it is advisable to introduce measures that enrich the soil with nutrients and improve its water-physical, chemical, and biological properties, for example, scientifically based crop rotation. In this case, it is necessary to take into account the natural climatic conditions of the region, the condition of the soil, labor resources, and the needs of the population [8].

Irrigated meadow-alluvial soils spread over 16,783.6 hectares of the district; according to the soil zoning map [2], these areas are located in the Central Asian desert province, Lower Zarafshan district, and Bukhara-Karakol soil geographical district. In these soils, field research and camera work were carried out in the above order, and a soil explanation was prepared based on the data of chemical analysis. According to it, these soils were divided into a total of 183 soil fractions according to their properties, using the appropriate productivity limiting coefficients. was calculated. According to him:

Group 2 (III-IV class): lands with 21–40 points, which are below average in terms of quality, make up 7.78% of the total irrigated lands;

Group 3 (classes V-VI): soils with an average quality of 41–60 points make up 52.65 percent;

Group 4 (VII-VIII class): good-quality lands with 61-80 points make up 39.09% of the total irrigated lands;

Group 5 (classes IX-X): lands with the best quality of 81–100 points make up 0.48% of the total irrigated lands.

The average credit quality of meadow-alluvial soils distributed in the territory of the district was 55.9 points.

Conclusion.

1. The mechanical composition of soils, depending on the nature of the parent rocks that form them, mainly medium (46.9%), heavy (27.9%) and light loams (14.8%), in some cases loamy and corresponds to sands (10.4%).
2. The humus content of the irrigated soils fluctuated between 0.410 and 1.180% and was evaluated as very low and moderately supplied. Amounts of gross nitrogen, phosphorus, and potassium are 0.033–0.083, 0.088–0.316, and 0.91–2.10 percent, respectively, while amounts of mobile phosphorus and potassium are 8.6–16.8 and 136-298 mg/kg, respectively. It is very low and low with mobile phosphorus, and low and moderate with potassium.
3. The humus reserve in the 0–30 cm layer in irrigated meadow-alluvial soils was 39.24 t/ha, decreasing by 3.06 t/ha compared to 2004.
4. Irrigated meadow-alluvial soils are the fertile lands for growing agricultural crops in the district. They spread over an area of 16,783.7 hectares and have an average score of 56.0.

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