Determination of the mechanical composition and salinity of the Bukhara Gijduvan district of the Bukhara region

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Abstract. In the article, the mechanical composition and type and level of salinity of meadow-alluvial soils of Gijduvan district of Bukhara region were determined. According to the obtained data, this type of soil is mostly non-saline, salinity is found in the layer below 1 meter. The mechanical composition is moderate in the driving layer, but heavy in the lower layers. In different soil-climatic conditions of our republic, including determining the general properties of irrigated soils of Gijduvon district of Bukhara region, determining the state of land reclamation, reducing the effects of degradation processes occurring in oasis soils, maintaining, increasing and protecting soil fertility, and carrying out research on effective use of land going is important. The reclamation condition of Bukhara oasis soils, their mechanical composition, their origin and causes of formation, the reclamation condition of meadow alluvial soils with different levels of salinity, the melioration condition of the soils of the meadow alluvial soils are noted to be better than that of other meadow alluvial soils. The change in the composition of the absorption complex of saline soils and the increase in the share of sodium and magnesium cations in it is due to the movement of salts in the Aral Sea with the help of the wind. It is necessary to take into account not only the mechanical composition of the soil, the level of salinity, but also the type and chemistry of salinity in salt washing. It is highlighted that special agrotechnical activities are carried out on these soils.

1 Introduction

At present, the total area of our republic is 44,410.3 thousand hectares, and the land used for agriculture is 25,681.3 thousand hectares, or 57.8% of the total land fund. Of these, intensively used in agriculture, i.e. agricultural products. This determines the production activity of the national and agricultural sectors of our republic.

49% of irrigated lands in our republic belong to varying degrees of salinity, of which 18% are highly and moderately saline lands, and more than 23% belong to the category of low quality lands. Most of the lands with unsatisfactory ameliorative condition belong to the Republic of Karakalpakstan, Khorezm, Bukhara, Jizzax and Fergana regions.

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Irrigated solonchaks in Uzbekistan are distributed in various latitudinal horizontal zones: southern (Surkhandarya, Kashkadarya, Bukhara regions), central (some regions of the Fergana Valley, Mirzachul , Jizzax, some regions of the Samarkand region) and northern (Khorezm region, Republic of Karakalpakstan). These lands consist of saline and salt marshes. In addition, sodium is absorbed in the absorption complex of soils common in Bukhara, Kashkadarya regions, the Republic of Karakalpakstan, there are also wet soils with very poor agrophysical properties and high magnesium content. The productivity of irrigated saline soils depends on the nature of the soil-forming rocks, soil types, irrigation periods, salinity level and the complex of agrotechnical and reclamation measures carried out on them [1].

Soil solids are composed of particles of various sizes, with the largest particles being larger than 1 mm and the smallest colloidal particles being smaller than 0.0001 mm. The physical, physico-mechanical, especially physico-chemical and chemical properties of the soil are directly related to this solid part of the soil. Therefore, an important task in learning soil properties is to determine the size and quantity of various small and large particles, which are called its mechanical elements.

Currently, the classification of mechanical elements recommended by N. A. Kachinsky is widely used. Particles larger than 1 mm in fractions are called the stony part of rocks or the soil skeleton, and less than 1 mm are called small particles or a small part. Also, particles larger than 0.01 mm are conditionally called “physical sand”, since their properties are close to sand, and particles smaller than 0.01 are called “physical clay” or “physical silt”, since they are similar to clay.

Many soil properties and productivity depend on the granulometric composition. The granulometric composition significantly affects the water-physical, physical-mechanical, air, thermal properties of the soil, redox conditions, absorption capacity, accumulation of humus, ash elements and nitrogen in the soil. The properties of granulometric fractions directly depend on the relative surface of the particles and their chemical and mineralogical composition, so the study of the mechanical composition of the soil is one of the topical issues [2,3].

The total area of irrigated land in the Bukhara region is 229.2 thousand hectares, of which 205.2 thousand hectares are of varying degrees (non-saline - 24.0; slightly saline - 125.8; medium saline - 48.2 and highly saline - 31.2 thousand .ha). are saline areas. In the Gijduvan region, 2 types of soils prevail: irrigated meadow-barren and irrigated meadow-alluvial soils. 79% of irrigated lands in the region are non-saline, 11.5% slightly saline, 2.5% moderately saline and 7% highly saline. According to the mechanical composition of the soil, sands and loams make up 17.5%, light sands - 20.3%, medium sands - 52.6%, heavy sands and clays - 9.6%. To know the mechanical composition, types and salinity levels of the soils of the Gijduvan district of the Bukhara region, to preserve and increase the productivity of the soils of this area, to use them effectively.

This is the preservation and increase in the productivity of various types of soils common in the Gijduvon district of the Bukhara region, the improvement of the reclamation state of lands, the efficient use of lands and the scientific substantiation of the importance of the composition, properties and characteristics of the soil in growing high and high-quality crop yields.

2 Methods

Field and laboratory studies are being carried out in the conditions of irrigated soils in the Gijduvan district of the Bukhara region. Genesis, evolution, mechanical composition, properties and characteristics of the soils of the region, preservation and increase in productivity, type and level of salinity, improvement of soil and reclamation conditions,

etc. in soil science are usually considered as profile-genetic, morphological, soil. absorption, physical, physico-chemical, in chemical-analytical methods, laboratory and analyzes are carried out on the basis of such methods as "Methods of agrochemical, agrophysical and microbiological studies in irrigated cotton areas", "Methods of agrophysical studies of soils in Central Asia", "Methods for studying the physical properties of soils and soils", "Properties of soil composition and analysis". The results obtained are analyzed mathematically, statistically and depressively according to B.A. Dospekhov (1985) [4].

3 Results and discussion

A soil section (pit) was dug in the conditions of meadow-alluvial soils, irrigated since ancient times (Omad farm). Soil samples were taken from site №1 and analyzed in the laboratory to determine the type and degree of salinity. One of the main methods of testing saline soils in laboratory conditions is water absorption analysis. Water absorption analysis is usually used to provide a comparative description of the amount and composition of water-soluble substances in different soils and to determine the degree of salinity of the soil. Among the water-soluble salts, the most common in soils are calcium, magnesium, sodium and potassium sulfates, chlorides and bicarbonates. According to the results of the analysis, the amount of dry residue in the 0-29 cm layer was 0.295%. As the soil deepened, the amount of dry residue became almost the same, but it was found that the amount of dry residue in the lowest (103–115 cm) layer was 0.413% (Table 1).

It has been established that the soil in the 0-103 cm layer is not saline, and the lowest layer belongs to the slightly saline soil type [5].

Table 1. Meadow-alluvial soils of the Gijduvan region water extract analysis ("Omad" farm).

Incision No.	Depth, cm	Dry residue, %	100 g in soil, %/mg/eq.					
			HCO_3^-	Cl^-	SO_4^{2-}	Ca^{2+}	Mg^{2+}	Na^++K^+
1	0-29	0.295	0.026	0.049	0.140	0.068	0.012	0.008
			0.426	1.382	2.913	3.393	0.987	0.341
	29-52	0.264	0.027	0.014	0.154	0.059	0.01	0.006
			0.443	0.395	3.205	2.944	0.823	0.275
	52-79	0.256	0.027	0.011	0.151	0.058	0.009	0.006
			0.443	0.310	3.142	2.894	0.741	0.260
	79-103	0.293	0.031	0.039	0.14	0.076	0.007	0.004
			0.508	1.100	2.913	3.792	0.576	0.153
	103-115	0.413	0.031	0.060	0.200	0.116	0.006	0.002
			0.508	1.693	4.162	5.788	0.494	0.081

It is noted that the amount of calcium cation increases with the deepening of the soil layer, and the amount of magnesium cation is inversely proportional. It has been established that the type of soil salinity is chloride-sulfate [6,7].

The mechanical composition of the soil was determined. The amount of physical clay in the passage layer is 43.7%; according to the type of mechanical composition, it is medium loamy [8]. As the soil layer deepened, the amount of physical clay increased, and it was determined by type as heavy loamy (Table 2).

Table 2. The mechanical composition of the meadow-alluvial soils of the Gijduvan region ("Omad" farm).

Fractions, %										
Incision	**Depth cm**	**>0.25**	**0.25-0.1**	**0.1-0.05**	**0.05-0.01**	**0.01-0.005**	**0.005-0.001**	**<0.001**	**Amount of physical sludge, %**	**Type**
1	0-29	2.5	2.5	7.6	43.7	7.2	6.4	30.2	43.7	Medium loamy
	29-52	5.0	3.5	4.8	39.8	8.0	7.2	31.8	46.9	heavy loamy
	52-79	4.3	4.5	5.4	39.8	9.5	8.0	28.6	46.1	heavy loamy
	79-103	1.0	1.7	12.3	31.0	7.9	11.9	34.2	54.1	heavy loamy
	103-115	1.3	1.0	11.1	39.8	9.5	8.7	28.6	46.9	heavy loamy

A soil section (pit) was also dug from the field of "Hasan Rajabi" farm of Gijduvan district. Soil samples were taken from section 3 and analyzed in the laboratory to determine the type and degree of salinity. According to the results of the analysis, the soil in the upper layers of the soil is not saline. Salinity started only in the 108-148 cm layer of the soil, and weak salinity was detected when moving to the next (148-178 cm) layer (Table 3).

Table 3. Meadow-alluvial soils of the Gijduvan region water extract analysis ("Hasan Rajabi" farm).

Incision No.	**Depth, cm**	**Dry residue, %**	**100 g in soil, %/mg/eq.**					
			HCO_3^-	**Cl^-**	**SO_4^{2-}**	**Ca^{2+}**	**Mg^{2+}**	**Na^++K^+**
1	0-38	0.244	0.027	0.018	0.140	0.048	0.011	0.013
			0.443	0.508	2.913	2.395	0.905	0.563
	38-72	0.188	0.024	0.016	0.098	0.049	0.001	0.008
			0.393	0.451	2.039	2.445	0.082	0.357
	72-108	0.218	0.029	0.035	0.1	0.052	0.002	0.018
			0.475	0.987	2.081	2.595	0.165	0.784
	108-148	0.287	0.032	0.042	0.14	0.066	0.007	0.017
			0.524	1.185	2.913	3.293	0.576	0.753
	148-178	0.501	0.035	0.052	0.3	0.108	0.006	0.055
			0.574	1.467	6.243	5.389	0.494	2.401

It was found that the soil in the 0-108 cm layer of this soil is not saline, and the lowest layer belongs to the type of weakly saline soil [2].

The mechanical composition of the soil in the plow layer (0-38 cm) contained 37.4% physical clay, and according to the type of mechanical composition, it was medium loam. With the deepening of the soil layer, the amount of physical clay decreased and it was found to be light sandy by type (Table 4).

Table 4. The mechanical composition of the meadow-alluvial soils of the Gijduvan region ("Hasan Rajabi" farm).

Fractions, %										
Incision	**Depth cm**	**>0.25**	**0.25-0.1**	**0.1-0.05**	**0.05-0.01**	**0.01-0.005**	**0.005-0.001**	**<0.001**	**Amount of physical sludge, %**	**Type**
1	0-38	3.0	6.0	24.2	29.4	9.5	8.0	19.9	37.4	Medium loamy
	38-72	3.5	6.5	20.8	47.7	4.8	4.0	12.7	21.5	light loamy
	72-108	2.5	7.5	19.2	46.9	4.0	3.2	16.7	23.9	light loamy
	108-148	3.0	6.0	28.2	41.3	4.8	4.0	12.7	21.5	light loamy
	148-178	2.2	1.5	31.1	42.1	4.8	4.0	14.3	23.1	light loamy

Light and medium loamy soils are considered the best soils from the point of view of agro-production. They have the property of forming a structure (granulation), it is relatively easy to work on the ground, in which the soil structure is well separated into pieces. They are characterized by a high moisture capacity and more water retention after irrigation, but even when the soil moisture corresponds to the minimum moisture capacity, 10-20% of their pores are occupied by air, which means that the aeration porosity of these soils is satisfactory and they are rich in nutrients necessary for plants.

The mechanical composition of the soil depends on the degree of salinity. In soils with a light mechanical composition, it is easier for salts to fall into the lower layers of the soil. Salt leaching is also somewhat easier in such soils [8].

Due to the fact that the mechanical composition of the investigated soils is heavy, medium and light clay, it is necessary to pay special attention to the rate, number and methods of irrigation in the cultivation of agricultural crops. If irrigation is neglected, soil salinity can rise to the upper layers and cause soil salinization.

4 Conclusion

Thus, the meadow-alluvial soils of Gijduvan district of Bukhara region are not saline in terms of salinity level, salinity is below 1 meter layer, and according to the type of salinity it is chloride-sulphate. The mechanical composition of soils in the plow layer is mainly medium sand, and the sub-plot and lower layers are light and heavy sand. In order to prevent soil salinization, it is necessary to properly organize irrigation.

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