Section 1. Technical sciences

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STUDY OF SALINITY OF SOILS IN SOME AREAS OF KARAKALPAKSTAN

Abstract. Studies were carried out to assess the state of soils in the Muinak, Chimbay and Amu Darya districts for salinization and content of water-soluble salts in the Muinak, Chimbay and Amu Darya districts. All soil samples taken are saline, saline-sulfate-chloride, chloride-sulfate, sulfate. The degree of salinity varies from medium to very strong in all soil profiles. Summary data on the studied components, the most characteristic soil conditions of the surveyed areas are also provided.

Keywords: Salination of soils, soils, salinity, emptying, salts, agriculture, water-soluble salts, loam.

Introduction. The anthropogenic factor led to a violation and change in the natural conditions of the Southern Aral Sea. The changes affected all components of the natural environment, primarily surface and groundwater. Then the restructuring of the natural environment affected the soils, causing the process of their salinization and desertification. Changing the environmental situation causes damage, manifested in the reduction of soils suitable for agriculture, and a decrease in land productivity. The process of draining and drying the bottom of the Aral Sea led to pollution, the environment, salinity of soils, salinity, which depends on the areas of phased salt formations [1].

The adaptability of plants to salts arose in the process of evolution during the development of saline habitats by plants. It has also been found that long-term cultivation of plants on saline soil in combination with selection leads to a significant increase in salt resistance.

Under the salt resistance of crops, those limit values of salt content are taken, at which normal growth, development and ability to yield crops are possible. Plants adapted to soil settlement are distinguished not only by high salt resistance, but also by an increase in productivity.

Research objects and methods. The object of the study in this work is the soils of the Muynak district: the Ali aul site located 80 km from the center of Muynak, the Dustlik site 70 km from the center of Muynak. The soils of the Chimbay and Amu Darya districts were also studied.

Research material and methodology. Water extract of soils was prepared according to the generally accepted method-soil: water in ratio 1:5 [2]. The content of chlorine ions was determined by argentometric methods by sea; calcium and magnesium trilonometric; sulfate by titration; aqueous drawing with a sulfuric acid solution in the presence of a methyl orange indicator; sodium and potassium ions by the difference in the sum of anions and cations. The results of the analysis of aqueous extracts were expressed in milligram equivalents per 100 g of dry air soil, the sum of water-soluble salts in percent.

The results of the aqueous extract analysis were monitored for a dense (dry) residue.

The degree of soil salinization was assessed on a scale of [2–4].

Table 1. – Content of water-soluble salts of the Ali aul site in the Muynak region

	section No.	depth. cm	dry residue.%	CO_3 in%	the general HCO_3 in%	Ce^-%	SO_4^-%	Ca%	Mg%	Na+K by difference		Sum of components. in%
										mg/eq	in%	
-S- strongly	Light loam	0–10	2.231	–	0.049	0.142	1.248	0.170	0.024	20.3	0.467	2.100
-S-strongly	loam	10–20	2.217	–	0.061	0.142	1.224	0.180	0.018	20.0	0.460	2.085
-S-so-so	sandy loam	20–40	1.676	–	0.049	0.053	0.996	0.020	0.055	17.55	0.404	1.577
-Ch-S-so-so	sandy loam	40–60	0.560	0.001	0.029	0.071	0.269	0.106	0.016	1.52	0.035	0.527
-Ch-S-so-so	sandy loam	60–80	0.396	–	0.024	0.057	0.187	0.028	0.029	2.1	0.048	0.373

Table 2. – Content of water-soluble salts of the Dustlik section of the Muynak region

	section No.	depth, cm	dry residue,%	CO_3 in%	the general HCO_3 in%	Ce^-%	SO_4^-%	Ca%	Mg%	Na+K by difference		Sum of components, in%
										mg/eq	in%	
-S-so-so	loam	0–10	1.632	–	0.073	0.071	0.912	0.140	0.012	14.2	0.327	1.535
-S-so-so	loam	10–20	2.063	–	0.110	0.106	1.104	0.180	0.024	16.8	0.420	1.944
-S-so-so	loam	20–40	1.614	–	0.073	0.071	0.900	0.135	0.012	14.2	0.327	1.614
-S-so-so	Clay	40–60	1.602	–	0.079	0.071	0.888	0.140	0.012	13.8	0.317	1.507
-S-so-so	Clay	60–80	1.596	–	0.085	0.071	0.876	0.145	0.006	13.9	0.320	1.503

Table 3. – Content of water-soluble salts of the Kenes section of the Chimbay region

	section No.	depth, cm	dry residue,%	CO_3 in%	the general HCO_3 in%	Ce^-%	SO_4^-%	Ca%	Mg%	Na+K by difference		Sum of components, in%
										mg/eq	in%	
-S-poorly	loam	0–10	1.247	–	0.031	0.089	0.708	0.060	0.061	9.75	0.224	1.173
-S-poorly	loam	10–20	1.240	–	0.037	0.089	0.696	0.065	0.058	9.6	0.221	1.166
-S-poorly	loam	20–40	1.229	–	0.043	0.089	0.684	0.070	0.058	9.2	0.212	1.156
-S-poorly	Light loam	40–60	1.403	0.002	0.029	0.021	0.207	0.032	0.001	3.76	0.087	0.379
-S-so-so	Light loam	60–80	1.958	–	0.055	0.071	0.516		0.049	5.65	0.130	0.958

Table 4. – Content of water-soluble salts of the Aiteke site in the Chimbay region

	section No.	depth, cm	dry residue,%	CO_3 in%	the general HCO_3 in%	Ce^-%	SO_4^-%	Ca%	Mg%	Na+K by difference		Sum of components, in%
										mg/eq	in%	
-Ch-S-so-so	Light loam	0–10	0.552	–	0.022	0.064	0.288	0.088	0.033	1.06	0.224	0.519
-Ch-S-so-so	Light loam	10–20	0.548	–	0.024	0.064	0.283	0.090	0.030	1.1	0.225	0.516
-S- poorly	loam	20–40	0.714	–	0.029	0.028	0.413	0.020	0.026	6.78	0.156	0.672
-S-poorly	loam	40–60	0.711	–	0.032	0.028	0.408	0.022	0.024	6.72	0.155	0.669
-S-poorly	loam	60–80	0.707	–	0.034	0.028	0.403	0.024	0.023	6.66	0.153	0.665

Table 5. – Content of water-soluble salts of the Kilichboy site in the Amu Darya region

	section No.	depth, cm	dry residue,%	CO_3 in%	the general HCO_3 in%	Ce^-%	SO_4^-%	Ca%	Mg%	Na+K by difference		Sum of components, in%
										mg/eq	in%	
-S- ery much	loam	0–10	3.075	–	0.061	0.213	1.848	0.411	0.243	5.0	0.115	2.891
-S-strongly	loam	10–20	3.039	–	0.073	0.213	1.680	0.301	0.085	20.2	0.505	2.857
-S-strongly	loam	20–40	2.217	–	0.061	0.142	1.224	0.180	0.018	20.0	0.460	2.085
-S-poorly	Clay	40–60	0.714	–	0.027	0.028	0.446	0.014	0.078	3.44	0.079	0.672
-S-poorly	Clay	60–80	0.712	–	0.029	0.028	0.442	0.018	0.075	3.38	0.078	0.670

Research results: Soil salinization occurring in arid regions is associated with the predominance of water evaporation over soil washing processes. Water found in the lower horizons ascends the soil

capillaries to the surface, water evaporates, and salts remain in the upper soil layers.

During winter, the salts are backwashed deep into the soil. In addition to this factor, arid salinity occurring in the zone of the Southern Aral Sea also imposes an imprint on the state of soils.

The amount of soils salted to varying degrees in the Southern Aral region is almost 95%, and in the Muinak territory, the most close to the Aral ecological crisis zone is 99% [5]. Therefore, crop production under harsh conditions in the Southern Aral Region (saline soils, a sharply continental climate with sharp temperature fluctuations, water scarcity) determines the choice of a scientific approach to assessing the types and salinity of soils, their reclamation state, the development of methods for their processing, the selection of the most salt-resistant and drought-resistant crops, methods for increasing their salt resistance for successful harvest.

Among the cultivated plants there are some plants that are relatively well tolerant of the high salt content in the soil. These are sugar beets and cotton [3].

Scientists of the Karakalpak Research Institute of Natural Sciences KKOANRUz conducted research in the Muinak, Chimbai and Amu Darya districts to assess the state of soils.

40 soil samples were analyzed. According to the results of the studies, it was established that the soils differentiate in terms of grain size distribution. The horizons are composed of both sands and fine soil-clay fractions, loams. Throughout the soil, there are salts that allow only the most salt-tolerant crops to grow.

The table summarizes the studied components, the most characteristic soil conditions of the surveyed areas.

The site is classified as highly saline and mechanically classified as loam.

The upper horizons are characterized by a sulfate type of salinization, and the lower chloride-sulfate type of salinization and the mechanical composition belong to sandy loams. Sunflower, sugar beets, feed beets, technical sorghum, ordinary sorghum can grow in such areas as having the highest degree of salt resistance.

The site belongs to the category of very highly saline, mechanically to loams and clays. Therefore, it is necessary to carry out reclamation and agrotechnical measures.

The upper horizons are characterized by the chloride-sulfate type of salinization, and the lower – sulfate type of salinization. Sunflower with the highest degree of salt resistance can grow in such areas.

The site belongs to the category of strongly and very strongly salted, and mechanically to loams.

On the first table: upper horizons (0–10 cm), (10–20 cm), medium horizons (20–40 cm) are characterized by sulfate type of salinization, horizon 40–60 cm, 60–80 cm are characterized by chloride-sulfate type of salinization.

On the second, third and fifth table: all horizons are of sulfate type of salinization, and on the fourth table: the upper (0–10 cm, 10–20 cm) are characterized by chloride-sulfate type of salinization, the horizon is 20–40 cm, 40–60 cm, 60–80 cm are characterized by sulfate type of salinization.

With regard to sandy soils, maximum precautions must be taken. The slightest mechanical effect on the soil can cause negative phenomena: intense deflation, aeolian removal of salts.

Conclusions: Thus, studies have shown that all soil samples are saline, characterized by mixed salinization-chloride-sulfate, the sulfate degree of salinization varies from medium to very strong in all soil profiles.

It was revealed that the soils differ in their mechanical composition and degree of salinity, which indicates the need to develop special rules for the selection and preparation of planting zones and crops to increase their engraftment. Various agrotechnical activities significantly wander on the growth and development of agricultural plants.

In addition to combating soil salinization by selecting crops and creating salt-resistant varieties, it is necessary to apply techniques to certain types of soil salinization that ensure increased salt resistance and yield of cultivated plants on salinized soils.

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