PROPERTIES AND CHARACTERISTICS OF MEADOW-ALLUVIAL SOIL

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ABSTRACT

Over the past 50 years, throughout the world — including in the territories of our Republic — climate change has caused significant transformations in agrolandscapes. These changes are clearly observed in the soil cover, its morphology and genesis, as well as in the movement of salts and substances throughout the soil profile. Such processes have led to major alterations in the region's soil composition: as a result, part of the formerly hydromorphic soils has shifted to semi-automorphic or automorphic conditions, while some automorphic soils have undergone desertification. In addition, within irrigated soil profiles, the accumulation of salt crystals has intensified, and in certain areas, the concentration of toxic salts harmful to crops has been observed to exceed permissible limits.

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The soils of the lower Amu Darya region, including those of the Khorezm oasis, cover a total area of 608.1 thousand hectares. Their varying degrees of salinity have had a negative impact on their ecological, agrophysical, and other properties. Due to the drying of the Aral Sea, improper agricultural land use, and excessive water application during irrigation and leaching, the degree of soil salinization continues to increase. Consequently, the agrophysical properties of the soils deteriorate, soil density increases, and ecological balance is being disrupted.

Only by improving the fertility level and properties of soils used in agriculture is it possible to obtain abundant and high-quality yields from crops. To achieve this goal, it is necessary to develop the most effective measures based on a thorough study of all soil properties and characteristics.

Taking the above into account, the main properties and characteristics of irrigated meadow-alluvial soils, which are widely distributed in the Khorezm region, were studied. The mechanical composition of the soil in the examined pilot area is shown in Table 1 below.

According to the data presented in the table, the genetic layers of the studied pilot area's soil consist mainly of light loamy and sandy loam soils.

Table-1

Mechanical composition of irrigated meadow alluvial soils of the pilot area, in %

Segment№	Layer, sm.	Particle size, mm, content in %.							Physical clay	Soil mechanical composition
		sand			dust			clay		
		>0,25	0,25-0,1	0,1-,05	0,05-0,01	0,01-0,005	0,005-0,001	<0,001		
1 X-G-Ch-GGT-K	0-30	12,3	5,3	23,6	33,8	11,5	9,3	4,2	25,0	Light sandy
	30-53	11,5	4,9	21,7	34,5	13,6	8,4	5,4	27,4	Light sandy
	53-82	12,8	5,7	23,6	30,4	12,9	8,9	5,7	27,5	Light sandy
	82-104	11,3	6,2	25,9	38,1	5,9	7,2	5,4	18,5	Sandy
	104-152	12,9	6,4	27,8	35,7	6,8	6,4	4,0	17,2	Sandy
2 X-G-Ch-GGT-K	0-27	10,9	4,8	21,6	36,9	12,3	8,6	4,9	25,8	Light sandy
	27-44	11,5	4,9	22,7	31,8	15,6	9,3	4,2	29,1	Light sandy
	44-85	12,3	4,2	23,6	33,4	13,4	7,9	5,2	26,5	Light sandy
	85-97	14,2	6,0	21,7	40,6	5,7	7,1	4,7	17,5	Sandy
	97-126	12,6	6,2	25,9	42,7	4,1	4,6	3,9	12,6	Sandy
	126-162	10,7	5,9	24,3	41,9	5,4	7,6	4,2	17,2	Sandy
3 X-G-Ch-GGT-K	0-26	9,8	2,9	20,4	42,6	11,3	9,6	3,4	24,3	Light sandy
	26-43	9,6	3,6	23,6	39,8	13,3	7,2	2,9	23,4	Light sandy
	43-75	10,7	3,9	21,7	45,9	7,1	8,3	2,4	17,8	Sandy
	75-95	12,3	4,6	20,9	49,5	4,2	4,9	3,6	12,7	Sandy
	95-130	10,1	4,1	24,6	49,1	2,6	5,4	4,1	12,1	Sandy
	130-178	11,7	4,5	20,7	50,9	2,1	6,3	3,8	12,2	Sandy
4 X-G-Ch-GGT-K	0-32	11,2	4,5	26,3	32,5	14,2	7,2	4,1	25,5	Light sandy
	32-50	10,9	3,9	27,3	29,8	15,6	7,9	4,6	28,1	Light sandy
	50-67	12,3	4,2	31,9	36,5	4,9	6,6	3,6	15,1	Sandy
	67-91	10,7	2,9	29,4	38,3	5,2	9,6	3,9	18,7	Sandy
	91-112	13,5	3,6	25,3	39,4	5,6	9,4	3,2	18,2	Sandy
	112-175	12,4	4,3	26,4	42,9	4,9	5,4	3,7	14,0	Sandy
5 X-G-Ch-GGT-K	0-33	13,2	3,3	25,4	30,6	15,8	7,8	3,9	27,5	Light sandy
	33-52	12,6	3,7	23,6	32,4	16,4	6,9	4,4	27,7	Light sandy
	52-87	11,9	2,9	24,9	32,6	14,8	8,6	4,3	27,7	Light sandy

	87-107	13,6	4,1	19,6	34,6	13,6	9,3	5,2	28,1	Light sandy
	107-146	12,8	3,6	30,2	38,3	4,9	6,4	3,8	15,1	Sandy
	46-182	11,7	3,7	31,8	37,1	4,2	7,2	4,3	15,7	Sandy

According to the mechanical composition of the described soil type, fine sand particles (0.1–0.05 mm) dominate among the sand fractions, while among the dust particles, coarse dust particles (0.05–0.01 mm) prevail. Since light loamy and sandy loam soils are close in their mechanical composition, in both cases, the dominance of coarse dust particles has been observed. However, fine sand particles were found to be somewhat predominant in sandy loam soils (see Table 1).

At present, around the world, research aimed at preventing and combating soil salinization is being conducted in the following priority directions: developing technologies to reduce the amount of water lost to filtration in irrigation networks of saline and irrigated lands; improving technologies to increase the efficiency of irrigation systems and prevent the rise of groundwater levels; designing various types of collector–drainage structures for the radical reclamation of saline lands; improving leaching methods for saline soils; and conducting scientific studies to develop and cultivate salt-tolerant crop species and varieties, along with the appropriate agrotechnologies for their growth.

It was determined that the irrigated meadow-alluvial soil under classification is uniformly saline throughout the soil profile, belonging to the group of slightly saline soils.

In the irrigated soils of the region, due to the continuous leaching of easily soluble salts by irrigation water, their amount in the soil does not reach strong or very strong salinity levels. Furthermore, according to the type of salinization, the studied area was found to have a chloride-sulfate type of salinity.

Chemical analyses revealed that in this soil profile, for chloride-sulfate type saline soils, the average amount of dry residue fluctuates between 0.125–0.250%.

According to the chemism of salinization, the soil mainly consists of chloride-sulfate types of salts. In the qualitative composition of salts, $CaSO_4$ and $ClSO_4$ salts occupy a dominant position, followed by Na_2SO_4 and $Ca(HCO_3)_2$ salts. In addition, the pH value in this soil profile was recorded to be within the range of 7.31–8.25.

Information regarding the soil's cation exchange capacity (CEC), the composition of absorbed bases, as well as the content of carbonates and gypsum, can be seen in Table 2.

The cation exchange capacity and the total absorbed bases of the studied irrigated meadow-alluvial soils were determined to vary from 7.33 to 8.04 meq throughout the soil profile.

Table-2

Absorption capacity and composition of absorbed bases of irrigated meadow alluvial soils, mg-eq, %

Intercept number	Layer d sm	100 g of soil in mg-eq.				Total (mg-eq)	% of the total.				CO2 carbonate, %	Gypsum
		Ca^{++}	Mg^{++}	K^{+}	Na^{+}		Ca^{++}	Mg^{++}	K^{+}	Na^{+}		
1	0-30	4,98	2,54	0,125	0,347	7,99	62,31	31,78	1,56	4,34	7,965	0,276
X-	30-53	4,85	2,72	0,127	0,341	8,04	60,34	33,84	1,58	4,24	8,245	0,391
G-Ch-	53-82	4,57	2,29	0,114	0,352	7,33	62,38	31,26	1,56	4,80	8,367	0,484

GGT-K	82-104	4,67	2,44	0,113	0,357	7,58	61,61	32,19	1,49	4,71	8,429	0,422
	104-152	4,96	2,28	0,117	0,356	7,71	64,31	29,56	1,52	4,62	8,438	0,539

In this soil profile, the carbonate content was observed to range from 7.965% to 8.429%, while the gypsum content varied between 0.276% and 0.539%.

Due to continuous irrigation, the carbonates in the composition of the irrigated meadow-alluvial soils have been subject to constant leaching. According to research and chemical analysis results, the carbonate content gradually increases toward the lower layers of the soil profile. This indicates that the upward movement of groundwater contributes to the leaching and redistribution of these carbonates.

In addition, as a result of regular irrigation and leaching practices, carbonates have been washed down to the lower horizons of the soil.

In conclusion, the genetic horizons of the meadow-alluvial soil—specifically, the upper layers where crops grow and develop—consist mainly of light loamy textures, while the lower layers are sandy loam. This composition ensures relatively rapid water transpiration, and therefore, this factor must be considered when applying mineral fertilizers.

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