



CONTENT OF WATER-SOLUBLE SALTS IN TYPICAL GRAY SOILS, DEGREE AND TYPES OF SALINATION

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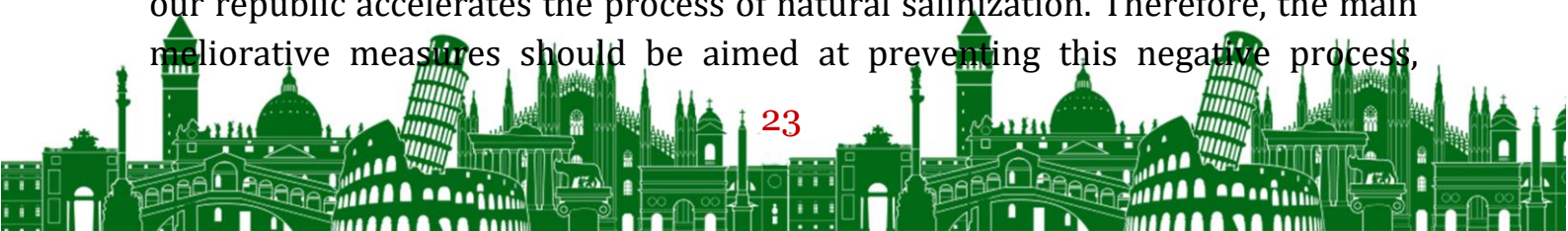
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Annotation. The type of salinity in the studied sections of typical irrigated gray soils consists of sulfate and chloride-sulfate salinity types, and according to the degree of salinity, they are classified as non-saline, weakly and moderately saline. They are considered to be relatively fertile soils with good amelioration status. Increasing salinity levels lead to a decrease in soil fertility and a decrease in the quantity and quality of agricultural crops.

Key words: soil, salinity, toxic salts, land reclamation, fertility.

Introduction. Salinity is considered one of the negative soil processes that determine the fertility and productivity of irrigated lands, as well as the ecological and reclamation state and the productivity of agricultural crops. This process depends on the relief, geomorphological and lithological structure of the site (selected objects), soil climate and human economic conditions, especially the state of hydraulic and hydro-reclamation systems, as well as the depth of groundwater, the level of mineralization and a number of other factors. The damage caused by soil salinity to the national economy is extremely great. In weakly saline lands, cotton productivity decreases by 25-30% compared to non-saline fertile lands, by 40-50% in moderately saline soils, by 60-80% in soils with strong sulfate-chloride and chloride salinity, and in very strongly saline and saline lands, cotton seedlings die after the first irrigation. The complete destruction of the soil has been proven in scientific research and field experiments. The main reason for this is the “toxic” (poisonous) effect of toxic salts accumulated in the soil on plants.

Among the many factors causing soil salinization, groundwater occupies the main place. It is necessary to pay special attention to the concepts (states) of its “critical depth” and “critical mineralization”. The evaporation of a large amount of moisture from the soil surface of irrigated lands with a dry and hot climate of our republic accelerates the process of natural salinization. Therefore, the main meliorative measures should be aimed at preventing this negative process,



reducing its impact on the productivity of irrigated soils and the life of cultivated plants.

Literature review. The salts involved in the formation of saline soils, the main elements in the formation of saline compounds are Ca, Ma, Na, K, Cl, S, N, B, Si, and the participation of Sr, Li, and J, Br elements in the process of soil salinization has also been determined in studies. The migration of these elements and their accumulation in the soil mainly occurs in the form of the following hypothetical salts: chlorides - NaCl, KCl, MgCl₂, CaCl₂; sulfates - Na₂SO₄, MgSO₄, K₂SO₄, CaSO₄; carbonates - Na₂CO₃, NaHCO₃, MgCO₃, CaCO₃, Ca(HCO₃)₂; nitrates - NaNO₃, KNO₃; borates - Na₂B₂O₂ and others. These salts can also include dissolved silica - SiO₂ x H₂O; silicates - Na₂SiO₄ K₂SiO₃, Ca SiO₃ and alkali metal humates [3; 103-p.].

The solubility of MgCl₂ salt decreases sharply in the presence of CaCl₂. A similar situation is rarely observed for CaSO₄ in the presence of Na₂SO₄ and MgCl₂. The solubility of CaCO₃ salt increases approximately 22 times in the presence of NaCl, and 50 or more times in the presence of Na₂SO₄. The solubility of MgCO₄ increases 4 times in the presence of NaCl, and 5 times in the presence of NaSO₄ [2; p. 122].

There are several methods for determining the amount of toxic salts in the soil (%), one of which is the method of determination using the empirical formula proposed by N.I. Bazilevich and E.I. Pankova. It is determined by dividing the sum of the national equivalent amounts of sodium (Na) and magnesium (Mg) ions in the aqueous solution by 15 [1;80-82.].

The closer the mineralized groundwater is located to the surface, the more rapidly the salinization process occurs, and its prevention requires the organization of hydromelioration systems, maintaining collector and aquifer networks in full working order, ensuring the full flow of groundwater, and strict adherence to irrigation and salt leaching regimes, norms and technologies. The salinization process also depends on the relief of the location, geomorphological and lithological conditions, and a number of other factors [1; 80-82.].

The processes of salinization and desalination of irrigated areas, their direction and level of activity, conditions of salt accumulation and secondary salinity in the soil, the amount and reserves of salts, distribution patterns of saline soils depend on the above-mentioned natural and anthropogenic-economic conditions kli, high brackish, brackish, deep brackish, deep brackish and non-brackish) can be found [1; 80-82.].



Research results. Due to the fact that the soils of the selected research object are located in low mountains and sub-mountain and sub-mountain plains (5-10, >10), active salinity conditions are not observed in these areas, the soils are mainly weakly saline and non-saline. Only in some weakly saline lowland areas can moderately saline soils be found.

The results of the analytical data of water absorption analysis conducted on polluted and saline soils under the influence of various anthropogenic and natural factors in irrigated lands developed under various geomorphological-lithological and soil-climatic conditions are presented in the table in the amount of main sections (0-200 cm).

Due to the deep location of weakly mineralized groundwater in the typical gray soils irrigated by the studied farms, the well-drained foothills, and the ruggedness and disturbance of the relief, the soils are mainly non-saline, the total amount of easily soluble salts in water in the soil profile is 0.115-0.290%, only in some sections is the amount of salts observed in the amount of 0.300-0.535%, which indicates weak salinity.

According to the data presented in the table, section 15 is practically not saline, the amount of salts in the soil profile is 0.135-0.290%. Only one salt horizon (0.488 and 0.443) is found in sections 16-17, and two salt horizons are found in sections 13-14 and they are observed in amounts of 0.415-0.520 and 0.345-0.535%. The chlorine content in the upper aquifer layers of the soil is

Amount (%) of easily soluble salts in water, degree of salinity and types

Sectio, No.	Depth, cm	Dry residue	HCO ₃ ⁻	Cl ⁻	SO ₄ ²⁻	Ca ²⁺	Mg ²⁺	Na ⁺	Anionic cations	SO4/ Cl	Salting		pH
											Type	Level	
"Khiromiddin Nurullaevich" farm, Kitab district													
13	0-30	0,270	0,052	0,016	0,126	0,053	0,007	0,016	3,92	8,69	S	Unsalte d	7,31
			0,85	0,45	2,62	2,64	0,58	0,7	3,22				
	30-50	0,300	0,060	0,016	0,139	0,045	0,006	0,036	4,32	6,42	S	Lightly salted	7,25
			0,98	0,45	2,89	2,25	0,49	1,58	2,74				
	50-80	0,205	0,040	0,021	0,082	0,040	0,003	0,016	2,95	2,90	CH-S	Lightly salted	7,35
			0,65	0,59	1,71	2,00	0,25	0,7	2,25				
	80-100	0,225	0,049	0,017	0,093	0,040	0,003	0,023	3,23	3,96	CH-S	Lightly salted	7,41
			0,080	0,49	1,94	2,00	0,25	0,98	2,25				
	100-150	0,415	0,049	0,010	0,218	0,040	0,003	0,078	5,62	16,21	S	Lightly salted	7,50
			0,080	0,28	4,54	2,00	0,25	3,37	2,25				
	150-200	0,520	0,043	0,014	0,28	0,030	0,003	0,119	6,91	14,92	S	Lightly	7,47



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			0,70	0,39	5,82	1,50	0,25	5,16	1,75			salted	
13A	0-30	0,305	0,043	0,010	0,154	0,030	0,003	0,056	4,18	11,43	S	Lightly salted	7,35
			0,70	0,28	3,20	1,50	0,25	2,43	1,75				
	30-50	0,238	0,040	0,007	0,12	0,038	0,006	0,022	3,35	12,50	S	Unsalted	7,27
			0,65	0,20	2,50	1,90	0,49	0,96	2,39				
	50-80	0,485	0,052	0,010	0,257	0,035	0,003	0,103	6,48	19,10	S	Lightly salted	7,39
			0,85	0,28	5,35	1,75	0,25	4,48	2,00				
	80-100	0,410	0,055	0,007	0,216	0,040	0,003	0,076	5,54	22,45	S	Lightly salted	7,25
			0,90	0,20	4,49	2,00	0,25	3,290	2,25				
135	0-30	0,340	0,048	0,024	0,159	0,043	0,005	0,051	4,78	4,87	CH-S	Medium salty	7,22
			0,79	0,68	3,31	2,15	0,41	2,22	2,56				
	30-50	0,310	0,052	0,010	0,151	0,028	0,005	0,057	4,27	11,21	S	Lightly salted	7,21
			0,85	0,28	3,14	1,40	0,41	2,46	1,81				
	50-80	0,370	0,061	0,010	0,185	0,035	0,003	0,072	5,13	13,75	S	Lightly salted	7,41
			1,00	0,28	3,85	1,75	0,25	3,13	2,00				
	80-100	0,385	0,043	0,014	0,199	0,040	0,003	0,069	5,24	10,64	S	Lightly salted	7,45
			0,70	0,39	4,15	2,00	0,25	2,99	2,25				
14	0-30	0,300	0,054	0,037	0,118	0,028	0,009	0,052	4,39	2,36	CH-S	Medium salty	7,32
			0,89	1,04	2,46	1,40	0,74	2,25	2,14				
	30-50	0,305	0,055	0,043	0,109	0,020	0,009	0,062	4,44	1,79	CH-S	Medium salty	7,24
			0,90	1,27	2,27	1,00	0,74	2,70	1,74				
	50-80	0,345	0,046	0,021	0,165	0,065	0,003	0,029	4,77	5,81	S	Lightly salted	7,36
			0,75	0,59	3,43	3,24	0,25	1,28	3,49				
	80-100	0,535	0,043	0,010	0,296	0,055	0,003	0,096	7,15	8,81	S	Lightly salted	7,45
			0,70	0,70	6,17	2,74	0,25	4,16	2,99				
14A	0-30	0,183	0,051	0,010	0,075	0,035	0,005	0,012	2,68	5,57	S	Unsalted	7,23
			0,84	0,28	1,56	1,75	0,41	0,52	2,16				
	30-50	0,278	0,046	0,016	0,134	0,045	0,007	0,027	3,99	6,2	S	Unsalted	7,33
			0,75	0,45	2,79	2,25	0,58	1,16	2,83				
	50-80	0,280	0,049	0,010	0,134	0,035	0,003	0,043	3,86	9,93	S	Unsalted	7,35
			0,80	0,28	2,78	1,75	0,25	1,86	2,00				
	80-100	0,265	0,052	0,010	0,123	0,035	0,003	0,039	3,70	9,18	S	Unsalted	7,41
			0,83	0,28	2,57	1,75	0,25	1,70	2,00				
145	0-30	0,145	0,045	0,016	0,049	0,028	0,005	0,009	2,21	2,26	CH-S	Lightly salted	7,21
			0,74	0,45	1,02	1,40	0,41	0,40	1,81				
	30-50	0,168	0,049	0,010	0,067	0,035	0,005	0,009	2,47	4,96	CH-S	Lightly	7,17



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			0,80	0,28	1,39	1,75	0,41	0,31	2,16			salted	
	50-80	0,155	0,049	0,010	0,056	0,015	0,003	0,029	2,24	4,140	CH-S	Lightly salted	7,09
			0,80	0,28	1,16	0,75	0,25	1,24	1,00				
	80-100	0,155	0,052	0,010	0,058	0,020	0,009	0,014	2,33	4,290	CH-S	Lightly salted	7,08
			0,85	0,28	1,20	1,00	0,74	0,59	1,74				
Farm "Varganza Bogishamol Home Service LLC", Kitab district													
15	0-30	0,210	0,024	0,010	0,107	0,020	0,005	0,034	2,90	7,96	S	Unsalted	7,23
			0,39	0,28	2,23	1,00	0,41	1,49	1,41				
	30-50	0,290	0,062	0,010	0,134	0,020	0,007	0,058	4,09	9,96	S	Unsalted	7,26
			1,02	0,28	2,79	1,00	0,58	2,51	1,58				
	50-80	0,155	0,046	0,010	0,058	0,020	0,003	0,023	2,23	4,29	CH-S	Lightly salted	7,09
			0,75	0,28	1,20	1,00	0,25	0,98	1,25				
	80-100	0,200	0,046	0,010	0,088	0,020	0,006	0,032	2,87	6,57	S	Lightly salted	7,18
			0,75	0,28	1,84	1,00	0,49	1,38	1,49				
	100-150	0,135	0,040	0,010	0,051	0,025	0,006	0,006	1,99	3,79	CH-S	Lightly salted	7,21
			0,65	0,28	1,06	1,25	0,49	0,25	1,74				
	150-200	0,180	0,040	0,007	0,086	0,015	0,015	0,015	2,65	9,00	S	Unsalted	7,08
			0,65	0,20	1,80	0,75	1,23	0,67	1,98				
	0-30	0,325	0,043	0,014	0,160	0,022	0,005	0,067	4,42	8,59	S	Lightly salted	7,27
			0,70	0,39	3,35	1,10	0,41	2,91	1,51				
	30-50	0,325	0,041	0,016	0,159	0,022	0,003	0,071	4,43	7,36	S	Lightly salted	7,32
			0,67	0,45	3,31	1,10	0,25	3,08	1,35				
15A	50-80	0,235	0,043	0,007	0,113	0,015	0,003	0,052	3,26	11,80	S	Unsalted	7,29
			0,70	0,20	2,36	0,75	0,25	2,26	1,00				
	80-100	0,220	0,046	0,007	0,103	0,030	0,006	0,025	3,09	10,70	S	Unsalted	7,25
			0,75	0,20	2,14	1,50	0,49	1,100	1,99				
	0-30	0,352	0,045	0,012	0,181	0,020	0,007	0,075	4,84	11,06	S	Lightly salted	7,19
			0,74	0,34	3,76	1,00	0,58	3,26	1,58				
	30-50	0,168	0,040	0,014	0,068	0,018	0,005	0,027	2,47	3,64	CH-S	Lightly salted	7,16
			0,66	0,39	1,42	0,90	0,41	1,16	1,31				
	50-80	0,170	0,052	0,007	0,072	0,025	0,009	0,013	2,55	7,50	S	Unsalted	7,25
			0,85	0,20	1,50	1,25	0,74	0,56	1,99				
	80-100	0,315	0,040	0,010	0,165	0,020	0,009	0,060	4,36	12,25	S	Lightly salted	7,33
			0,65	0,28	3,43	1,00	0,74	2,62	1,74				
16	0-30	0,192	0,052	0,010	0,081	0,023	0,006	0,027	2,82	6,04	S	Unsalted	7,19
			0,85	0,28	1,69	1,15	0,49	1,18	1,64				
	30-50	0,488	0,052	0,014	0,258	0,028	0,006	0,109	6,61	13,77	S	Lightly salted	7,28
			0,85	0,39	5,37	1,40	0,49	4,72	1,89				
	50-80	0,245	0,040	0,007	0,121	0,030	0,003	0,038	3,38	12,65	S	Lightly salted	7,19
			0,65	0,20	2,53	1,50	0,25	1,63	1,75				



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16A	80-100	0,160	0,037	0,007	0,072	0,025	0,009	0,007	2,30	7,50	S	Unsalte d	7,20
			0,60	0,20	1,50	1,25	0,74	0,31	1,99				
	100-150	0,145	0,043	0,007	0,061	0,015	0,009	0,004	2,17	6,35	S	Unsalte d	7,17
			0,70	0,20	1,27	1,25	0,74	0,18	1,99				
	150-200	0,150	0,040	0,014	0,062	0,015	0,015	0,008	2,32	3,28	CH-S	Lightly salted	7,15
			0,65	0,39	1,28	0,75	1,23	0,34	1,98				
16B	0-30	0,228	0,043	0,008	0,107	0,018	0,005	0,043	3,16	9,70	S	Unsalte d	7,22
			0,70	0,23	2,23	0,90	0,41	1,85	1,31				
	30-50	0,130	0,046	0,011	0,046	0,018	0,009	0,009	2,02	3,10	CH-S	Lightly salted	7,11
			0,75	0,31	0,96	0,90	0,74	0,38	1,64				
	50-80	0,120	0,043	0,007	0,041	0,025	0,003	0,006	1,76	4,30	CH-S	Lightly salted	7,07
			0,70	0,20	0,86	1,25	0,25	0,26	1,50				
	80-100	0,220	0,040	0,014	0,099	0,025	0,003	0,037	3,10	5,28	S	Unsalte d	7,11
			0,65	0,39	2,06	1,25	0,25	1,60	1,50				
	0-30	0,285	0,048	0,012	0,139	0,018	0,009	0,055	4,02	8,50	S	Unsalte d	7,09
			0,79	0,34	2,89	0,90	0,74	2,38	1,64				
16C	30-50	0,168	0,043	0,009	0,069	0,025	0,005	0,017	2,39	5,76	S	Unsalte d	7,05
			0,70	0,25	1,44	1,25	0,41	0,73	1,66				
	50-80	0,195	0,046	0,007	0,086	0,030	0,003	0,023	2,75	9,000	S	Unsalte d	7,11
			0,75	0,20	1,80	1,50	0,25	1,00	1,75				
	80-100	0,170	0,043	0,007	0,072	0,020	0,003	0,027	2,40	7,500	S	Unsalte d	7,21
			0,70	0,20	1,50	1,00	0,25	1,15	1,25				
	0-30	0,442	0,043	0,009	0,232	0,028	0,003	0,095	5,78	19,32	S	Lightly salted	7,32
			0,70	0,25	4,83	1,40	0,25	4,15	1,63				
	30-50	0,185	0,048	0,012	0,077	0,025	0,005	0,025	2,43	4,71	CH-S	Lightly salted	7,07
			0,79	0,34	1,60	1,25	0,41	1,07	1,66				
17	50-80	0,215	0,037	0,007	0,105	0,020	0,003	0,040	2,98	10,90	S	Unsalte d	7,13
			0,60	0,20	2,18	1,00	0,25	1,73	1,25				
	80-100	0,115	0,40	0,007	0,041	0,025	0,003	0,005	1,71	4,30	CH-S	Lightly salted	7,12
			0,65	0,20	0,86	1,25	0,25	0,21	1,50				
	100-150	0,125	0,046	0,007	0,043	0,025	0,003	0,008	1,85	4,5	CH-S	Lightly salted	7,1
			0,75	0,20	0,90	1,25	0,25	0,35	1,50				
	150-200	0,190	0,037	0,010	0,088	0,010	0,012	0,028	2,71	6,54	S	Unsalte d	7,08
			0,60	0,28	1,83	0,50	0,99	1,22	1,49				
	0-30	0,255	0,037	0,010	0,126	0,025	0,003	0,046	3,51	9,36	S	Unsalte d	7,11
			0,61	0,28	2,62	1,25	0,25	2,01	1,50				
17A	30-50	0,103	0,051	0,010	0,025	0,022	0,005	0,003	1,64	1,85	CH-S	Lightly salted	7,01
			0,84	0,28	0,52	1,10	0,41	0,13	1,51				
	50-80	0,090	0,037	0,007	0,038	0,020	0,003	0,008	1,59	3,95	CH-S	Lightly salted	7,03
			0,60	0,20	0,79	1,00	0,25	0,34	1,25				
	80-100	0,090	0,037	0,007	0,038	0,020	0,003	0,008	1,59	3,95	CH-S	Lightly salted	7,03



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	80-100	0,215	0,370	0,007	0,111	0,010	0,015	0,032	3,11	11,55	S	Unsalte d	7,23
			0,60	0,20	2,32	0,50	1,23	1,38	1,73				
175	0-30	0,168	0,048	0,120	0,067	0,028	0,006	0,014	2,52	4,08	CH-S	Lightly salted	7,09
			0,79	0,34	1,39	1,40	0,49	0,63	1,89				
	30-50	0,215	0,046	0,009	0,098	0,020	0,005	0,037	3,04	8,16	S	Lightly salted	7,28
			0,75	0,25	2,04	1,00	0,40	1,63	1,41				
	50-80	0,190	0,046	0,010	0,081	0,020	0,006	0,028	2,70	5,96	S	Unsalte d	7,11
			0,75	0,28	1,67	1,00	0,49	1,21	1,49				
	80-100	0,165	0,040	0,007	0,072	0,020	0,003	0,025	2,33	7,50	S	Unsalte d	7,19
			0,65	0,20	1,5	1,00	0,25	1,10	1,25				
			0,054	0,009	0,255	0,031	0,058	0,100	5,09	15,8	S	Lightly salted	7,14
			0,095	0,25	3,95	1,15	0,32	3,85	1,25				
18	30-50	0,178	0,052	0,012	0,082	0,019	0,009	0,037	2,29	5,28	S	Lightly salted	7,13
			0,60	0,28	1,48	1,28	0,49	1,22	1,78				
	50-80	0,195	0,034	0,017	0,112	0,022	0,008	0,075	2,47	6,78	S	Unsalte d	7,19
			0,60	0,28	1,90	1,17	0,28	1,77	0,98				
	80-100	0,147	0,40	0,019	0,054	0,027	0,009	0,008	1,66	3,96	CH-S	Lightly salted	7,22
			0,65	0,24	0,95	1,20	0,29	0,33	1,48				
	100-150	0,109	0,046	0,015	0,097	0,018	0,008	0,004	1,31	4,27	CH-S	Lightly salted	7,20
			0,75	0,22	0,94	1,00	0,25	0,49	1,43				
	150-200	0,101	0,037	0,012	0,091	0,009	0,021	0,025	2,46	5,69	S	Unsalte d	7,11
			0,60	0,26	1,48	0,38	0,103	1,12	1,57				
18A	0-30	0,218	0,033	0,028	0,155	0,036	0,006	0,054	3,39	7,30	S	Unsalte d	7,05
			0,55	0,39	2,85	1,25	0,24	2,11	1,44				
	30-50	0,122	0,047	0,011	0,028	0,034	0,007	0,008	1,58	3,53	CH-S	Lightly salted	7,10
			0,97	0,28	0,99	1,35	0,48	0,14	1,53				
	50-80	0,100	0,041	0,009	0,038	0,033	0,007	0,004	1,65	3,30	CH-S	Lightly salted	7,18
			0,68	0,26	0,86	1,12	0,23	0,33	1,31				
	80-100	0,201	0,340	0,014	0,132	0,018	0,019	0,037	3,19	7,68	S	Lightly salted	7,14
			0,69	0,29	2,23	0,64	1,28	1,41	1,68				
185	0-30	0,157	0,054	0,133	0,075	0,037	0,009	0,019	2,54	6,12	S	Unsalte d	7,12
			0,72	0,24	1,47	1,54	0,57	0,68	1,63				
	30-50	0,223	0,038	0,014	0,032	0,019	0,008	0,043	3,14	8,48	S	Unsalte d	7,09
			0,77	0,25	2,12	1,16	0,46	1,66	1,52				
	50-80	0,201	0,052	0,021	0,087	0,031	0,007	0,034	2,77	7,0	S	Unsalte d	7,15
			0,79	0,22	1,54	1,08	0,98	1,28	1,53				
	80-100	0,168	0,048	0,009	0,077	0,014	0,008	0,032	2,28	7,82	S	Unsalte d	7,07
			0,75	0,23	1,8	1,13	0,29	1,11	1,31				



0.010-0.037%, sulfates are 0.081-0.232%. The ratio of sulfates to chlorine ions in the aquifer layers is 5.57-19.32, and in the sub-aquifer layers it is 4.71-13.77, indicating sulfate salinity ($SO_4:Cl > 5$). This indicator is 2.36 and 1.79 in section 14, respectively. The type of salinity in this section is chloride-sulfate.

The amount of salts in typical gray soils irrigated by farms in the Kitab district fluctuates in the soil profile in sections 13, 13B, 14 at 0.270-0.520%, in sections 15, 15A, 16, 17 at 0.210-0.488%, and in the upper layer of the soil the amount of salts is 0.270-0.340% and 0.125-0.220%, respectively. According to the salinity chemistry, the soils are of sulfate and chloride-sulfate salinity types, and the soils are weakly and moderately saline.

The environmental reaction of the studied soils is weakly alkaline, which is characteristic of all types and types of soils distributed in Uzbekistan, and the pH values are recorded at 7.07-7.50.

In conclusion, typical gray soils are mostly non-saline and weakly saline, and the profile of sections 13-18 consists of mixed-sulfate and chloride-sulfate salinity types, and are relatively fertile soils with good reclamation status.

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