

DIFFERENTIAL INDICATORS OF SALINITY DIAGNOSTIC EXPRESSION IN DESCRIBING CHANGES IN THE AMOUNT OF SOLUBLE SALTS IN WATER IN THE TERMIZ DISTRICT

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Abstract

To date, soil salinization has attracted great interest among scientists as a factor resulting from drastic changes in the environment due to human activity and deterioration of the ecological situation. In this zone, natural and anthropogenic factors have had a strong impact on the geochemical situation and soil formation processes, resulting in a negative water-salt balance and a deterioration in the ecological condition of irrigated soils.

Keywords: Differential index, salinity, diagnostic, chloride salts, qualitative composition of salts.

Introduction

As we know, despite the fact that in recent years much attention has been paid to desalinization of saline soils and improvement of the reclamation of irrigated saline lands, an increase in the area of saline soils is observed in a number of regions of our republic, and the excessive accumulation of toxic salts is leading to a decrease in soil fertility and crop yields.

Based on the above problems, in order to conduct an in-depth study of the state of soils distributed in the Surkhan-Sherabad valley, we examined the specific characteristics of soil salinization, as well as the laws of formation of saline soils, depending on zonal factors and regional conditions related to the geomorphological and hydrogeological characteristics of the region.

Studies on the reclamation status of the soils of the Surkhan-Sherabad valley have been covered in many scientific studies. Surkhandarya As a result of research conducted in the region in 2017, salinization processes leading to the deterioration of soil reclamation and a decrease in soil fertility have been identified. and The province has an area of 107,643.7 hectares, which is 59.4% of the irrigated land of the province [5; 6; 7; 14].

According to the results of the chemical analysis, the movement of salts along the soil profile, their



accumulation in layers, and the type and level of salinity in sandy-desert, desert-meadow, and meadow-alluvial soils distributed in the desert region of the Surkhan-Sherabad valley are subject to specific laws in accordance with the soil-climatic conditions of the region.

In the desert area of the Surkhan-Sherabad valley, ecosystems with automorphic, hydromorphic, and semi-hydromorphic soil types are clearly distinguished, depending on the characteristics of salinity and salt accumulation.

The degree and type of salinity of these soils are related to the accumulation of salts, salt solubility parameters, depth of groundwater, and degree of mineralization. The degree of salinity of soils varies widely along the soil profile [1; 2; 8; 14].

As mentioned above, during the dry and hot summers typical for the Surkhandarya region, as a result of the movement of groundwater from the bottom up and as a result of evaporation, dissolved salts in it accumulate in the upper layers of the soil, and during seasons with high precipitation and humidity, the salts accumulated above are again added to the groundwater in the form of a solution. The repetition of such seasonal evaporation processes over many years leads to an increase in the mineralization level of groundwater. [1; 2; 8;].

Therefore, in a comprehensive study of the current state of soils in the region, it is extremely important to take into account, in addition to their general properties, the causes of salinization, the conditions of formation, the limits of salt change along the soil profile, the degree and type of salinity, and the level of toxicity to plants.

Among the soil samples taken in the "Namuna" massif of Termez district, soils with a weak, moderate, and strong degree of salinity were recorded, ranging from non-saline soils. Depending on the ratio of sulfate and chlorine ions in the salts found in the soils, the salinity type was mainly sulfate and chloride-sulfate [1; 2; 8;10;11; ;12].

Main part

The difference in salinity levels of soil types and soil layers depends on the total amount of salts they contain, with variations observed under the influence of different accumulations of salts in layers with different mechanical composition and variations in the location of salt layers.

According to the results of water absorption analysis conducted on soils distributed at the research site, it was determined that the amount of dry residue along the soil profile fluctuates around 0.655% in desert-sandy soils (0-30) cm, 0.186% in desert-meadow soils (0-30) cm, and 0.270% in meadow-alluvial soils (56-85) cm. These soils are characterized by belonging to the groups of non-saline (temporarily washed out of salts), weak, moderately saline soils.

The sulfate ion content of the studied soils is 4.45-26.10 mg/eq in desert-sandy soils, and the chlorine ion content is 0.20-1.59 mg/eq, which is characterized by sulfate salinity.

In the studied steppe soils, sulfate ions are 0.96-13.53 mg/eq, belonging to the chloride-sulfate salinity type. In the composition of irrigated meadow-alluvial soils, sulfate ions also prevail, and they fluctuate in the range of 2.06-15.94 mg/eq along the soil profile, while chlorine ions vary in the range of 0.28-0.48 mg/eq. (Table 3.5.1). It should be noted that the salt reserve depends on the salinity level of the studied soil type, with an increase in the amount of dry matter, the salt reserve also increases, which in turn leads to a decrease in soil fertility.

In the studied soil types, the salt content in most cases increased from bottom to top and reached a maximum in the uppermost layer. The distribution of salts along the soil profile was correlated

with the content of salts in nearby mineralized groundwater (Table 3.5). As can be seen from the table, the studied soils are mainly chloride-sulfate, rarely sulfate salinity types, and in the qualitative composition of salts, Na₂SO₄ and CaSO₄ salts occupy the leading positions, followed by Ca(HCO₃)₂ stands.

Chloride salts consist mainly of the easily water-soluble MgCl₂ salt, with NaCl salt occurring in very small quantities [2.9; 2.10; 2.13; 2.58; 3.26], TWhile Mg(HCO₃)₂ and CaCl₂ salts were not found in the soil, Na₂CO₃ salt was found in very small quantities in some soil layers. Tin the composition of the According to the results of chemical analyses conducted on soil samples, it was determined that the soil does not contain magnesium bicarbonate (Mg(HCO₃)₂) and calcium chloride (CaCl₂) salts.[1; 2; 14].

Table 1 Description of salinity of irrigated soils of the “Namuna” massif in Termez district

Cut No.	Depth (cm)	Dry residue	NSO -3	Cl-	SO ₄ ⁻	Ca ⁺	Mg ⁺	No ⁺	Salinity	
		%							Type	Level
1	0-30	0.655	0.031	0.007	0.400	0.130	0.021	0.019	S	Weak
	30-59	0.695	0.031	0.032	0.395	0.14	0.015	0.032	S	Weak
	59-99	0.720	0.034	0.042	0.403	0.135	0.018	0.044	S	Weak
	99-150	1,125	0.031	0.056	0.647	0.225	0.027	0.048	S	Average
33	0-28	1,115	0.024	0.032	0.682	0.190	0.024	0.093	S	Average
	28-55	0.405	0.03	0.017	0.214	0.05	0.009	0.05	S	Weak
	55-88	1,445	0.027	0.017	0.919	0.28	0.033	0.077	S	Average
	88-130	1,250	0.024	0.017	0.788	0.210	0.037	0.086	S	Average
8	0-29	2,210	0.021	0.024	1,380	0.230	0.021	0.392	S	Strong
	29-58	2,442	0.35	0.038	1,254	0.140	0.009	0.579	S	Strong
	58-97	2,325	0.024	0.038	1,410	0.220	0.024	0.410	S	Strong
	97-148	2,245	0.4	0.042	1,002	0.110	0.003	0.526	S	Strong
19	0-30	0.186	0.046	0.011	0.052	0.020	0.006	0.015	XS	Weak
	30-49	0.194	0.052	0.01	0.064	0.30	0.003	0.293	XS	Weak
	49-70	0.170	0.043	0.014	0.055	0.020	0.006	0.017	XS	Weak
	70-100	0.150	0.043	0.105	0.046	0.020	0.006	0.011	XS	Weak
11	0-30	1,211	0.061	0.280	0.402	0.062	0.035	0.26	XS	Strong
	30-52	1,602	0.076	0.281	0.651	0.013	0.012	0.484	XS	Strong
	52-80	1,441	0.055	0.230	0.615	0.011	0.011	0.431	XS	Strong
	80-110	0.170	0.027	0.034	0.049	0.029	0.003	0.017	XS	Weak

Continuation of Table 2 Description of salinity of irrigated soils of the “Namuna” massif in Termez district

Cut No.	Depth (cm)	Dry residue	NSO -3	Cl-	SO ₄ ⁻	Ca ⁺	Mg ⁺	No ⁺	Salinity	
		%%							Type	Level
43	0-30	0.235	0.046	0.011	0.099	0.030	0.006	0.026	S	Unsalted
	30-56	0.265	0.049	0.014	0.108	0.035	0.006	0.028	S	Unsalted
	56-85	0.270	0.052	0.011	0.122	0.040	0.006	0.028	S	Unsalted
	85-146	0.265	0.052	0.014	0.114	0.035	0.009	0.026	S	Unsalted
29	0-33	0.485	0.037	0.011	0.29	0.090	0.018	0.023	S	Weak
	33-61	0.750	0.034	0.014	0.46	0.150	0.024	0.024	S	Weak
	61-85	0.795	0.037	0.011	0.482	0.160	0.024	0.023	S	Weak
	85-125	0.585	0.031	0.014	0.345	0.105	0.021	0.026	S	Weak
20	0-35	2,360	0.040	0.140	1,340	0.235	0.028	0.425	S	Strong
	35-64	2,410	0.042	0.146	1,360	0.230	0.031	0.439	S	Strong
	64-85	2,485	0.034	0.138	1,420	0.020	0.038	0.458	S	Strong
	85-126	2,386	0.044	0.128	1,440	0.220	0.042	0.450	S	Strong

Table 3 Qualitative composition of salts in irrigated soils of the “Namuna” massif of Termez district

Cut No.	Depth (cm)	Ca(HCO ₃) ₂	CaSO ₄	CaCl ₂	Na ₂ SO ₄	NaCl	MgSO ₄	MgCl ₂	Na ₂ CO ₃	Amount of salts			The amount of toxic salts in relation to the amount of total salts, %
										General	Poisonous	Non-toxic	
1	0-30	0.041	0.407		0.058		0.092	0.009		0.608	0.159	0.448	26.2
	30-59	0.041	0.441		0.1		0.02	0.043		0.645	0.163	0.482	25.3
	59-99	0.045	0.421		0.136		0.018	0.056		0.676	0.210	0.466	31.1
	99-150	0.041	0.73		0.149		0.039	0.075		1,034	0.263	0.771	25.4
33	0-28	0.009	0.638		0.092		0.075	0.023		0.837	0.190	0.647	22.7
	28-55	0.04	0.136		0.156		0.016	0.023		0.370	0.195	0.176	52.6
	55-88	0.036	0.921		0.239		0.135	0.023		1,353	0.397	0.957	29.3
	88-130	0.032	0.687		0.266		0.154	0.023		1,162	0.443	0.719	38.1
8	0-29	0.028	0.758		0.717	0.014		0.012		1,529	0.743	0.786	48.6
	29-58	0.465	0.085		1,765	0.019		0.035		2,370	1,819	0.550	76.8
	58-97	0.032	0.381		1,062	0.025		0.012		1,512	1,099	0.413	72.7
	97-148	0.531			1,482	0.055		0.012	0.09	2,169	1,639	0.531	75.6
19	0-30	0.061	0.017		0.047		0.011	0.015		0.150	0.073	0.078	48.7
	30-49	0.069	0.091	0.016						0.175	0.016	0.160	9.1
	49-70	0.057	0.02		0.054		0.006	0.019		0.155	0.079	0.077	50.8
	70-100	0.057	0.02		0.033		0.012	0.014		0.136	0.059	0.077	43.3
11	0-30	0.081	0.143		0.446	0.293		0.137		1,100	0.876	0.224	79.7
	30-57	0.101			0.961	0.406		0.047	0.05	1,565	1,464	0.101	93.6
	52-80	0.073			0.909	0.326		0.043	0.03	1,381	1,308	0.073	94.7
	80-110	0.036	0.068		0.001	0.042		0.012		0.159	0.055	0.104	34.6



Continuation of Table 4 Qualitative composition of salts in irrigated soils of the “Namuna” massif of Termez district

Cut No.	Depth (cm)	Ca(HCO ₃) ₂	CaSO ₄	CaCl ₂	Na ₂ SO ₄	NaCl	MgSO ₄	MgCl ₂	Na ₂ CO ₃	Amount of salts			The amount of toxic salts in relation to the amount of total salts, %
										General	Poisonous	Non-toxic	
43	0-30	0.061	0.051		0.081		0.011	0.015		0.218	0.107	0.112	49.1
	30-56	0.065	0.064		0.086		0.006	0.019		0.240	0.111	0.129	46.3
	56-85	0.069	0.078		0.086		0.011	0.015		0.259	0.112	0.147	43.3
	85-146	0.069	0.061		0.08		0.021	0.019		0.250	0.120	0.130	48.0
29	0-33	0.049	0.265		0.07		0.07	0.015		0.469	0.155	0.314	33.1
	33-61	0.045	0.472		0.076		0.095	0.019		0.707	0.190	0.517	26.9
	61-85	0.049	0.502		0.07		0.1	0.015		0.737	0.185	0.551	25.1
	85-125	0.041	0.322		0.079		0.08	0.019		0.542	0.178	0.363	32.9
20	0-35	0.053	0.074		0.425		0.065	0.019		0.637	0.509	0.127	80.0
	35-64	0.036	0.836		0.017		0.206	0.013		1.109	0.236	0.872	21.3
	64-85	0.036	0.14		0.093		0.016	0.023		0.307	0.132	0.176	43.0
	85-126	0.032	0.296		0.086	0.009		0.012		0.434	0.107	0.328	24.6

This may be due to the fact that these minerals do not accumulate in the area or in the samples, and they do not actively participate in migration processes. At the same time, sodium carbonate (Na₂CO₃) salt was noted to be found in some deeper or local soil layers, although in very small quantities.

The studied irrigated soils are saline to varying degrees, depending on the degree of salinity, from non-saline (washed out of salts) and weakly saline soils to strongly saline soils. The processes of salt accumulation and re-salination in the soils, their direction and intensity are formed depending on the complex geomorphological-lithological structure of the area, hydrogeological, soil-climatic, anthropogenic, agricultural conditions, especially the degree of natural and artificial drainage of irrigated lands, the state of hydromelioration systems and groundwater, as well as the quality of irrigation water.

In soils with varying degrees of salinity, the salt-forming ions are correlated with each other. For example, when the chlorine content is on average 0.017%, the standard deviation is ±1.16, and the coefficient of variation is 66.9%, and when the sodium content is 0.030%, the standard deviation is ±1.86, and the coefficient of variation is 61.6%, the correlation coefficient (r) is +0.33, and the square is (r²) is 0.11, which is a positive indicator. Another characteristic feature of the Surkhan-Sherabad valley desert region is the complex climatic conditions (dry and hot, lack of moisture, excessive moisture with desertification in some areas, extremely low relative humidity, high evaporation, various degrees of especially strong Garmsel "Afghan wind", etc.) and the weak drainage of the territory, which is associated with the rapid accumulation of salts due to poor groundwater flow. [14].



REFERENCES

1. Kadirova D. A., Allayarov X. N., Turdaliev J. M., Rasulov X. N., The composition and changes of water-soluble salts in the termiz district \\\ wcd of scientist: international scientificresearch jornnal issn : 27 76 - 0929, wolume 6, Issue 1, jonuary – 2025
2. Turdaliyev J.M., Allayarov X. N., va boshqalar Tuproq sho‘rlanishi, sho‘rlangan tuproqlar va tuzlarning o‘simliklarga ko‘rsatadigan ta‘siri // “O‘zbekiston zamini” jurnali. – Toshkent, 2020. – № 2/2020. – B. 40-45
3. Qodirova D.A Allayarov X. N., Termiz tumani tuproqlarning geografik o‘rni va gidrometeorologik holati // “O‘zbekiston agrar fani xabarnomasi” jurnali. – Toshkent, 2023. – № 4 (10). – B. 18-20 03.00.00; № 8
4. Qodirova D.A Allayarov X. N., Termiz tumani tuproqlarning mexanik tarkibi // “Qishloq xo‘jaligida yer resurslaridan foydalanishning dolzarb masalalari” O‘zbekiston agrar fani xabarnomasi Respubilka ilmiy-amali anjuman (maxsus son) – Toshkent, 2023. – № 3 (9/2). – B. 55-57
5. Abdullayev A.X. O‘zbekistonda sug‘oriladigan yerlarning melorativ holati va ularning yaxshilash // Monografiya, Toshkent, 2018. - B.130-135
6. Axmedov A.U., Abdullayev S.A., Parpiyev G‘.T. Sirdaryo va Jizzax viloyatlarining sug‘oriladigan tuproqlari // Monografiya. – Toshkent: O‘zRFA «Fan» nashr., 2005. B. 122-157.
7. Axmedov A.U., Abdullayev S.A., Sabitova N.I., Parpiyev G.T. Проблемы засоления, мелиорации и плодородия почв. // Актуальные проблемы почвоведения (к 50 летию освоения целинных и залежных земель). Алматы, 2004-йil
8. Qurvantayev R., Hakimova N.X., Vafoyev B.B., Boltayev M.I Zarafshon vohasi sug‘oriladigan tuproqlarining kimyoviy xossalari // Turli tuproq-iqlim sharoitida qishloq xo‘jalik mahsulotlarini yetishtirish va o‘simliklarni himoya qilishda innovatsion yondashuvlar Buxoro 2023. B. 5-11.
9. Horneck D.A., Ellsworth J.W., Hopkins B.G., Sullivan D.M. and Stevens R.G. Managing Salt-affected soils for crop production. USA. Oregon State University. 2007. – B. 4-20.
10. Yadav, Sangeeta, Mohd Irfan, Aqil Ahmad, and Shamsul Hayat. “Causes of Salinity and Plant Manifestations to Salt Stress: A Review.” *Journal of Environmental Biology*, vol. 32, no. 5, 2011, pp. 667.
11. Podmore, C. Irrigation Salinity – Causes and Impacts. Natural Resource Advisory Services, 2009.
- 11 Abrol, I. P. “Salt-Affected Soils: Problems and Prospects in Developing Countries.” *Global Aspects of Food Production*, edited by M. S. Swaminathan and S. K. Sinha, Tycooly International, 1986, pp. 283–305.
- 13 Ehlig, C. F. “Growth and Evapotranspiration of Cotton as Affected by Salinity and Moisture Stress.” *Agronomy Journal*, vol. 61, no. 5, 1969, pp. 716–719.
14. Allayarov X. N., Biologiya fanlari bo‘yicha falsafa doktori (PhD) // Dissertatsiyasi 48-54 b

