Caspian Journal of Applied Mathematics, Ecology and Economics
V. 14, No 1, 2026, March, ISSN: 1560-4055

CHANGES IN SOME INDICATORS OF IRRIGATED SOILS IN THE SALYAN PLAIN

https://doi.org/10.69624/cjamee2026.14.1.1

F.M. Mustafayev
Institute of Geography, Ministry of Science and Education
of the Republic of Azerbaijan
faridmustafayev124@gmail.com

Abstract: *The article comparatively analyzes the results of comprehensive soil studies carried out in experimental plots selected in irrigated areas of the Salyan Plain, which has an ancient irrigation history and is located in the Kura–Araz lowland. The research was conducted in areas where grain (wheat) and cotton crops were cultivated. According to the research results, it was determined that in both areas, compared with 2020, in 2024 the amount of salts, water mineralization, pH level, and several other indicators decreased by approximately 10–15%. As a result of the proposed agromeliorative measures (deep plowing, application of organic and mineral fertilizers under plowing, increasing the number of irrigations while reducing irrigation norms, ensuring the discharge of drainage water into collectors, etc.), gradual improvement of soil conditions was achieved in these areas, and crop productivity increased by 20–25%.*

Keywords: *salinization, groundwater, salt content, mineralization, salt type*

INTRODUCTION

In recent years, as a result of successful agrarian reforms carried out in the republic, lands have been divided into different forms of ownership and new relations in land use have emerged. The decree issued on August 25, 2008 by the President of the Republic of Azerbaijan, Ilham Aliyev, titled *"State Program on Reliable Provision of the Population with Food Products in the Republic of Azerbaijan for 2008–2015"*, requires efficient use of existing land resources and the implementation of new comprehensive studies aimed at their improvement. Currently, out of approximately 1.45 million hectares of irrigated land in the republic, about 550 thousand hectares are affected by salinization to varying degrees. Considering the population growth and the need to solve food security problems, the improvement of these lands is considered one of the most urgent issues of the present time. In this regard, studying the current condition of irrigated soils in the Salyan Plain, as well as the gradual improvement of soils affected by different degrees of salinization and alkalization, increasing their fertility, and obtaining higher yields from agricultural crops, has significant scientific and practical importance.

RESEARCH OBJECT AND METHODS

As a research object, two experimental sites located on municipal lands in Seyidsadıxlı village of the Salyan district were selected, where grain and cotton crops were cultivated. Each site covered an area of 3.0 hectares, and a total of six soil profiles were established. The coordinates of each soil profile were recorded. At the same time, samples were taken from the irrigation canal operating in the research area, from the drainage system, and from groundwater observed in soil profiles. The required chemical analyses were carried out under laboratory conditions. The analyses were performed using widely applied methods in the republic [7]. The classification proposed by V.R. Volobuyev was used to determine the amount and type of salts in soil and water samples [9].

ANALYSIS AND DISCUSSION

The Salyan Plain, located in the Kura–Araz lowland, is bounded by the Akkuşa River in the west, the Caspian Sea in the east, the Kura River in the north, and the Gizilaghaj Bay in the south. The total area of the plain is 149 thousand hectares, of which 46 thousand hectares are used for agricultural crops. The geology of the Salyan Plain is associated with the general geotectonic history of the Caspian Sea basin. Although the area is generally flat, small depressions occur in some places. River valleys and irrigation canals have contributed to the dissection of the relief. The relief mainly consists of plains. Most of the territory lies below the level of the world ocean in hypsometric terms. Toward the north, the relief rises slightly, which is especially noticeable in the areas of river alluvial cones. The average annual air temperature varies between 1.8–2.5°C, while the average annual relative humidity ranges between 62–81% [17–20]. About 46 thousand hectares of the soils in the Salyan Plain are used for agricultural crops. The soils mainly belong to the gray soil type, and various subtypes dominate, including meadow-gray, gray-meadow, and meadow-swamp soils [1–3]. Long-term studies have shown that the soils of the Salyan Plain are mainly characterized by sulfate–chloride salinization, while in some areas chloride-type salinized soils are also found. The humus content in the upper soil layer varies between 1.2–2.8% [4–8]. According to granulometric composition, the soils are clayey and clayey-sandy. The soils of the plain have different water permeability capacities. Irrigation water is mainly taken from the Akkuşa River.During agricultural cultivation, changes in soil salt composition depend on the composition of irrigation water, the drainage conditions of the area, and the groundwater regime. During the growing season, irrigation water introduces 2.0–3.6 t/ha of readily soluble salts in dry steppe zones and 3.4–4.6 t/ha in semi-desert zones. The salt migration within the soil profile of irrigated lands follows specific regularities for each zone [10–12]. The vegetation cover of the area mainly consists of halophyte, xerophyte, and ephemeral plants [4,10]:

- alophytes: Salt-loving or salt-tolerant plants forming the main natural vegetation cover of the region. They occur in fallow and uncultivated lands throughout the vegetation period.
- Xerophytes: Drought-resistant plants that occupy relatively smaller areas and have limited influence on soil formation processes. Examples include wormwood and other similar plants.
- Ephemeral plants: These plants germinate in early spring and complete their vegetation cycle quickly. After the first autumn precipitation, ephemerals begin to germinate again.
- Hydrophilic plants: These plants remain green throughout the year and develop under excessive moisture conditions. They are mainly found around rivers, channels, and lakes. Examples include reeds and meadow grasses.

The depth of groundwater in the plain varies depending on relief conditions. The groundwater level often approaches the surface during May–June. In the northwestern part of the plain, groundwater is generally absent. In areas near the Kura River, groundwater occurs at depths of 3–5 m, forming a narrow belt extending from the northeast of Karimbeyli village to Bankaya. Where groundwater is located close to the surface (1.0–1.5 m), the salt content in the soil and water mineralization increase several times. In the villages of Seyidsadıxlı, Quşçu, Alçalı, Arbatan, Dayıkənd, and Şorsulu, groundwater depth ranges between 2–3 m. Seasonal fluctuations in groundwater levels vary between 5–10.5 m. Studies show that groundwater in the research area has different levels of mineralization [13–16]. It should be noted that the soils in the research area are used for cotton and grain cultivation. The analysis results are presented in Table 1. As seen, the CO_3 ion was not detected in the anion composition. The HCO_3 ion ranged between 0.13–0.25 g/l, the Cl ion between 0.95–3.08 g/l, and the SO_4 ion between 0.408–1.65 g/l. In the cation composition, the Ca content ranged between 0.11–0.45 g/l, Mg between 0.018–0.216 g/l, and Na+K between 0.437–1.884 g/l. The total salt content varied between 1.43–2.82 g/l, while the mineralization of water samples taken from soil profiles reached 6.70 g/l. According to the results obtained in 2024, the salt content in soils under grain crops ranged between 0.12–1.23%, while in soils under cotton crops it ranged between 0.12–0.68%. Thus, the soils of the experimental area are classified as non-saline or slightly saline. The pH values ranged between 7.31–7.71 in grain fields and 7.12–7.53 in cotton fields, indicating alkaline soil conditions. Therefore, meliorative measures are recommended. The results also show that the salt content calculated by dry residue ranged between 0.11–0.20% in soil samples, while the drainage water had a dry residue of 3.56 g/l.According to the Cl:SO_4 ratio, the salt type in the soils of the experimental area is sulfate–chloride and sulfate. At the same time, the amount of absorbed bases in the soils of the experimental area was re-determined for comparison, and the results were presented in Table 7. The results obtained in 2020 were compared with those obtained in 2024. The comparison showed that if in 2020 the total absorbed bases in the 0–50 cm soil layer were 24.17–27.87 meq per 100 g of soil, while in the 0–100 cm layer they were 27...

Table 1. *Changes in water mineralization in the irrigation canal, drainage system, and groundwater passing through the experi mental area (2024).*

Profile No.	Mq-ekv							g/l							Total salts, g/l	Dry residue, g/l
	CO_3	HCO_3	CI	SO_4	Ca	Mg	Na+K	CO_3	HCO_3	CI	SO_4	Ca	Mg	Na+K		
1	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Canal A – head section	No	3,00	28,0	11,99	22,5	1,50	18,99	No	0,19	0,98	0,576	0,45	0,018	0,437	2,64	2,82
Akkusha River	No	2,00	29,0	12,99	5,50	8,00	30,49	No	0,13	1,02	0,624	0,11	0,096	0,702	2,68	2,75
Canal A – middle section	No	3,00	27,0	8,494	7,50	8,50	24,49	No	0,19	0,95	0,408	0,11	0,102	0,563	2,32	2,57
Drain, normal	No	2,00	47,0	15,98	9,50	6,00	51,48	No	0,13	1,65	0,768	0,15	0,072	1,185	3,95	1,43
Profile 2, water sample	No	4,00	88,0	19,98	12,0	18,0	81,90	No	0,25	3,08	0,960	0,24	0,216	1,884	6,63	6,70

The salt type was determined in the collected water samples. According to the Cl/SO_4 ratio, the salt type was identified as chloride at the head of Canal A and in the Akkuşa River. In the middle section of Canal A and in the drainage water, the salt type was sulfate–chloride, whereas in the water sample taken from the soil profile, it was sulfate (Table 2).

Table 2. *Determination of salt type in drainage water, irrigation canal, and the Akkuşa River according to the Cl:SO_4 ratio.*

Profiles	Based on the Cl:SO_4 ratio	Salt type
Canal A – head section	1,71	Chloride
Akkusha river	1,64	Chloride
Canal A – middle section	2,33	Sulfate–chloride
Drain	2,15	Sulfate–chloride
Profile F-2	3,21	Sulfate

It was also determined that the collected water samples are suitable for irrigation purposes.

$$SAR = \frac{Na^0}{\sqrt{0,5(Ca^{00} + Mg^{00})}}$$

If SAR < 10, the water is considered fully suitable for use; if SAR ranges between 10–18, it is considered conditionally suitable; and if SAR > 26, the water is considered unsuitable for use. According to the obtained data, the SAR value was 1.58 at the beginning of Canal A, 4.52 at the Akkuşa bridge, 3.06 in the middle section of Canal A, 6.64 in the drainage water, and 5.46 in soil profile F-2. As can be seen, all water samples are fully suitable for irrigation use. As is well known, in areas where intensive irrigated agriculture is practiced, soil salinization occurs more rapidly. In saline soils, plant development depends on the chemical composition of the soil solution and the concentration of salts. As the salt concentration in the soil solution increases, the plant's ability to absorb water becomes more difficult. Under such conditions, even though sufficient water may be present in the soil, its uptake by plants does not occur. In colder climatic conditions, the reduced demand for water enables plants to tolerate higher salt concentrations [1,3,8,9,13]. The soils of the Salyan Plain are characterized by different degrees of salinization. Soil investigations have shown that the intensive development of irrigated agriculture, along with the construction of collector–drainage and irrigation networks, has led to changes in the morphogenetic characteristics of soils widespread in this region. The soils of the experimental area are used for the cultivation of cotton and grain crops. Soil samples were taken from these areas, and initially the exchangeable bases, pH, and salt composition were determined. The obtained results are presented in Tables 5, 6, and 7. As can be seen, the pH values of the soils in the experimental area vary between 7.31–7.71 in soils under grain crops and 7.12–7.53 in soils under cotton crops. In the anion composition of salts, the SO_4 ion predominates, with its content ranging between 0.012–0.384% in soils under grain crops and 0.012–0.420% in soils under cotton crops. In the cation composition of salts, the content of Na+K (by difference) ranged between 0.003–0.495% in soils under grain crops and 0.005–0.082% in soils under cotton crops.

Table 4. *Results of brief water extract analyses in the soils of the experimental area (2024).*

Profile No.	Depth, cm	Mq-ekv/%							Total salts, %	Dry residue,%
		CO_3	HCO_3	HCl	SO_4	Ca	Mg	Na		
F-1	0-20	No	0,65	2,00	2,60	2,50	1,38	1,37	0,334	0,348
			0,040	0,071	0,125	0,050	0,017	0,031		
	20-40		0,60	1,50	4,12	2,63	1,37	2,22	0,407	0,415
			0,037	0,053	0,198	0,052	0,016	0,051		
	40-60		0,65	2,50	4,28	2,38	1,25	3,80	0,485	0,503
			0,040	0,089	0,206	0,048	0,015	0,087		
	60-80		0,60	3,00	3,39	2,25	1,50	3,24	0,444	0,468
			0,037	0,107	0,163	0,045	0,018	0,074		
	80-100		0,55	2,50	2,14	2,00	0,88	2,31	0,330	0,343
			0,034	0,089	0,103	0,040	0,011	0,053		
	100-125		0,60	2,00	3,49	3,00	1,75	1,34	0,387	0,408
			0,037	0,071	0,168	0,060	0,021	0,030		
	150-200		0,55	2,00	4,58	2,87	1,51	2,75	0,464	0,478
			0,034	0,071	0,220	0,058	0,018	0,063		
F- 2	0-20	No	0,70	2,00	4,37	2,25	0,88	3,94	0,470	0,495
			0,043	0,071	0,120	0,045	0,011	0,090		
	20-40		0,90	1,50	4,68	2,50	1,13	3,45	0,476	0,508
			0,055	0,053	0,225	0,050	0,014	0,075		
	40-60		0,95	1,00	2,87	2,13	1,37	1,32	0,322	0,335
			0,058	0,036	0,138	0,043	0,017	0,030		
	60-80		0,85	2,00	3,37	2,38	1,25	2,59	0,407	0,423
			0,052	0,071	0,162	0,048	0,015	0,059		
	80-100		0,80	1,50	2,56	2,00	1,00	1,86	0,319	0,335
			0,049	0,053	0,123	0,040	0,012	0,042		
	100-125		0,75	2,00	5,08	2,88	1,37	3,58	0,517	0,538
			0,046	0,071	0,244	0,057	0,017	0,082		
	150-200		0,65	2,50	4,06	2,50	1,50	3,24	0,596	0,620
			0,040	0,089	0,195	0,050	0,018	0,073		
F-3	0-20	No	0,85	1,00	1,08	1,13	0,75	1,05	0,196	0,203
			0,052	0,036	0,052	0,023	0,009	0,024		
	20-40		0,80	2,50	1,33	1,38	0,62	2,63	0,297	0,315
			0,049	0,089	0,064	0,028	0,007	0,060		
	40-60		0,70	1,50	1,58	1,50	0,75	1,53	0,246	0,258
			0,043	0,053	0,076	0,030	0,009	0,035		
	60-80		0,65	1,00	1,73	1,88	0,87	0,63	0,221	0,233
			0,040	0,036	0,083	0,038	0,010	0,014		
	80-100		0,75	2,00	1,39	1,75	0,88	1,51	0,264	0,275
			0,046	0,071	0,067	0,035	0,011	0,034		
	100-125		0,80	1,00	1,68	1,13	0,87	1,98	0,261	0,270
			0,049	0,053	0,081	0,022	0,010	0,045		
	125-150		0,85	1,00	1,92	1,25	0,50	2,02	0,257	0,265
			0,052	0,036	0,092	0,025	0,006	0,046		
	150-200		0,90	2,00	1,27	1,50	1,00	1,67	0,267	0,273
			0,055	0,071	0,061	0,030	0,012	0,038		

Profile No.	Depth, cm	Mq-ekv/%			Dry residue, %	pH
		CO_3	HCO_3	HCl		
F- 4	0-25	No	0,40 0,024	2,80 0,098	0,16	7,6
N 39^{0}32'38,80" E 48^{0}55' 30,60"	25-50		0,40 0,024	2,80 0,098	0,15	7,6
	50-75		0,40 0,024	1,40 0,049	0,11	7,7
	75-100		0,40 0,024	1,20 0,042	0,14	7,7
F-5	0-25	No	0,20 0,012	2,40 0,084	0,20	7,6
N 39^{0}32' 39,60" E 48^{0}55' 30,40"	25-50		0,20 0,012	3,20 0,112	0,15	7,7
	50-75		0,20 0,012	0,20 0,007	0,14	7,7
	75-100		0,20 0,012	1,80 0,063	0,12	7,6
Drain water N 39^{0}32'40,01" E 48^{0}55' 29,80 "		No	3,20 0,195	104,8 3,668	3,56	

It can be seen from the table that in 2020 the salt content in the soils of the experimental area, calculated by dry residue, ranged between 0.11–0.20%. In the drainage channel passing along the edge of the field, the dry residue amounted to 3.56 g/l. As can be observed, the soils of the experimental area were non-saline. According to the results obtained in 2024, based on the $Cl:SO_4$ ratio, the salt type in the soils of the experimental plots was identified as sulfate–chloride and sulfate. At the same time, the amount of exchangeable bases in the soils of the experimental area was re-determined for comparative analysis, and the results are presented in Table 7. The results obtained from the determination of exchangeable bases in 2020 were compared with the results obtained in 2024. As shown in the table, in 2020 the total amount of exchangeable bases in 100 g of soil was 24.17–27.87 meq in the 0–50 cm layer, and 27.02–33.87 meq in the 0–100 cm layer. In 2024, this indicator in soils under cotton ranged between 26.7–34.2% in the 0–50 cm layer and 28.4–30.9% in the 0–100 cm layer. Accordingly, in the composition of exchangeable bases in 2020, Ca predominated, accounting for 62.85% in the 0–50 cm layer and 62.92% in the 0–100 cm layer. In 2024, these values were 14.0% and 46.8%, respectively. The content of Mg was 35.42% and 34.64% in 2020, while in 2024 it increased to 36.4% and 73.9% in the 0–50 cm and 0–100 cm layers, respectively (Table 7). The Na content ranged between 5.38–6.65% in 2020, whereas in 2024 it increased to 10.2–16.8%. In the experimental field, the yield obtained from the cotton variety “Beyaz Altun” was 30–35 centners per hectare (c/ha). The field was irrigated three times during the growing season. In soil profile F-2, groundwater was encountered at a depth of 1 m. In soils under grain crops, sparse emergence of wheat was observed in profile F-2, while good emergence was recorded in profile F-1. Groundwater was encountered at a depth of 1.20 m in the profile. In profile F-3, wheat emergence was very weak.

Table 5. *Changes in salt content and pH in the soils of the experimental area.*

№	Profile No.	Depth, cm	CO_3	HCO_3 Mq-ekv /%	Cl Mq-ekv /%	SO_4 Mq-ekv /%	Ca Mq-ekv /%	Mg Mq-ekv /%	Na+k Mq-ekv /%	Total salts, %	Dry residue, %	pH
1	**F-7** Cotton N 39⁰33ʹ28,1ʺ E48⁰54ʹ11,3ʺ	0-30	No	0,60 0,036	1,40 0,049	0,249 0,012	1,75 0,035	0,25 0,003	0,249 0,005	0,14	0,23	7,33
		30-60		1,40 0,085	1,20 0,042	0,749 0,036	1,25 0,025	0,25 0,003	1,849 0,043	0,24	0,23	7,53
		60-100		1,20 0,073	2,60 0,091	3,747 0,180	2,00 0,040	2,00 0,024	3,547 0,082	0,49	0,53	7,39
2	**F-8** Cotton N 39⁰33ʹ29,5ʺ E 48⁰54'11,6ʺ	0-30	No	1,00 0,061	1,00 0,035	0,249 0,012	1,75 0,035	0,25 0,003	0,249 0,005	0,27	0,15	7,34
		30-60		0,60 0,036	0,60 0,021	0,249 0,012	1,50 0,030	0,25 0,003	0,499 0,012	0,21	0,16	7,33
		60-90		0,80 0,048	1,60 0,056	3,247 0,156	2,00 0,040	0,25 0,003	3,397 0,078	0,39	0,38	7,42
		90-120		1,00 0,061	1,00 0,035	0,249 0,012	1,75 0,035	0,25 0,003	0,049 0,002	0,14	0,14	7,53
3	**F-9** Cotton N 39⁰33ʹ31,4ʺ E 48⁰54ʹ11,4ʺ	0-30	No	1,00 0,061	1,80 0,063	2,748 0,132	2,00 0,040	0,25 0,030	3,298 0,075	0,37	0,37	7,12
		30-60		0,60 0,036	0,80 0,028	0,499 0,024	1,50 0,030	0,25 0,030	0,149 0,030	0,12	0,36	7,40
		60-90		0,80 0,048	1,00 0,035	8,744 0,420	3,25 0,062	4,75 0,057	2,50 0,058	0,68	1,07	7,25
		90-120		1,00 0,061	1,60 0,056	6,745 0,324	2,50 0,050	3,50 0,042	3,345 0,076	0,61	0,63	7,35
4	**F-10** **(Grain)** N 39⁰33ʹ28,7ʺ E 48⁰54ʹ07,5ʺ	0-30	No	1,80 0,109	0,60 0,021	0,749 0,036	2,75 0,055	0,25 0,003	0,149 0,004	1,23	1,30	7,71
		30-60		1,20 0,073	0,20 0,007	0,249 0,012	1,00 0,020	0,50 0,006	0,149 0,004	0,12	0,13	7,57
		60-90		1,00 0,061	0,60 0,021	0,249 0,012	1,50 0,030	0,25 0,003	0,099 0,003	0,13	0,17	7,51
		90-120		0,60 0,036	0,60 0,021	1,748 0,084	2,50 0,050	0,25 0,003	0,198 0,495	0,69	0,20	7,71
5	**F-11** **(Grain)** N 39⁰33ʹ29,1ʺ E 48⁰54ʹ 06,8ʺ	0-30	No	0,80 0,048	0,80 0,028	0,249 0,012	1,25 0,025	0,50 0,006	0,099 0,003	0,13	0,26	7,52
		30-60		0,60 0,036	0,80 0,028	0,749 0,036	1,25 0,025	0,50 0,006	0,399 0,009	0,14	0,18	7,57
		60-90		0,80 0,048	1,00 0,035	4,247 0,204	1,75 0,035	1,00 0,012	3,297 0,075	0,41	0,43	7,31
		90-120		0,80 0,048	1,40 0,049	0,999 0,048	1,50 0,030	0,25 0,003	1,443 0,033	0,21	0,28	7,37
6	**F-12** **(Grain)** N 39⁰33'31,5ʺ E 48⁰54 '03,4ʺ	0-30	No	1,00 0,061	0,80 0,021	0,249 0,012	1,50 0,030	0,25 0,003	0,099 0,003	0,13	0,15	7,51
		30-60		0,80 0,048	0,40 0,014	0,249 0,012	1,00 0,020	0,25 0,003	0,199 0,004	0,10	0,16	7,41
		60-90		0,80 0,048	1,00 0,035	2,998 0,144	2,25 0,045	0,25 0,003	2,298 0,052	0,33	0,38	7,41
		90-120		0,40 0,024	0,40 0,014	7,994 0,384	4,25 0,085	0,50 0,006	4,044 0,093	0,61	0,63	7,56

Table 6. *Total exchangeable bases (Ca, Mg, and Na) and pH variation in the soils of the experimental area*

Profile No.	Depth, cm	Meg			Total cations, mq-ekv/100 g soil	%			Humus content, %
		Ca	Mg	Na		Ca	Mg	Na	
F-1	0-20	16,00	10,12	1,50	27,62	57,93	36,64	5,43	2,18
	20-40	17,37	9,13	1,70	28,20	61,60	32,38	6,02	1,74
	40-60	14,62	8,25	1,30	24,17	60,49	34,13	5,38	1,41
	60-80	18,25	11,0	1,80	31,05	58,78	35,43	5,79	0,82
	80-100	17,00	8,62	1,40	27,02	62,92	31,90	5,18	0,54
F-2	0-20	19,50	7,62	1,80	28,92	67,43	26,35	6,22	1,58
	20-40	15,75	8,12	1,40	25,27	62,33	32,13	5,54	1,25
	40-60	16,50	9,87	1,50	27,87	59,20	35,42	5,38	1,04
	60-80	13,87	7,13	1,30	22,30	62,20	31,97	5,83	0,71
	80-100	21,12	10,75	2,00	33,87	62,36	31,74	5,90	0,49
3	0-20	16,37	8,75	1,50	26,62	61,49	32,87	5,64	2,56
	20-40	17,62	9,88	1,60	29,10	60,55	33,95	5,50	2,01
	40-60	17,00	8,25	1,80	27,05	62,85	30,50	6,65	1,52
	60-80	16,12	9,13	1,50	26,75	60,26	34,13	5,61	0,98
	80-100	16,75	9,62	1,40	27,77	60,32	34,64	5,04	0,65

Table 7. *Changes in the exchangeable bases of light gray meadow soils*

Profile No.	Soil layers, cm	Exchangeable bases, mq-ekv/100 g soil			Total exchangeable bases, mq-ekv/100 g soil	Percentage of total exchangeable bases (%)		
		Ca	Mg	Na		Ca	Mg	Na
Light clay, light gray-brown soils								
F-10 Grain	0-30	18,0	2,50	2,50	29,8	31,2	60,4	8,40
	30-60	0,75	0,30	0,30	10,1	89,6	7,43	2,97
	60-90	15,8	2,20	2,20	29,0	37,9	54,5	7,60
	90-120	14,2	2,40	2,40	30,4	45,4	46,7	7,90
F-11 Grain	0-30	28,7	0,50	2,00	31,2	92,0	1,60	6,41
	30-60	19,7	8,00	2,20	29,9	65,9	26,7	7,40
	60-90	21,2	3,00	1,20	25,4	83,5	11,8	4,72
	90-120	21,7	2,80	1,00	25,5	85,1	10,9	4,00
F-12 Grain	0-30	16,4	1,70	0,90	19,0	86,3	8,95	4,75
	30-60	11,4	0,70	0,30	12,4	91,9	5,65	2,45
	60-90	9,15	19,5	2,70	31,4	29,2	62,11	8,60
	90-120	17,1	20,3	3,50	40,9	41,8	49,7	8,50

F-7	0-30	3,95	22,7	3,50	30,2	13,1	75,2	11,6
Cotton	30-60	4,30	21,3	3,20	28,8	14,0	73,9	11,2
	60-100	5,80	19,7	4,00	29,5	19,6	66,8	13,6
F-8	0-30	8,25	15,7	2,70	26,6	31,0	59,0	10,1
Cotton	30-60	12,5	9,70	4,50	26,7	46,8	36,4	16,8
	60-90	10,6	17,7	2,40	30,7	34,6	57,6	7,82
	90-120	18,9	10,0	2,0	30,9	61,1	32,3	6,60
F-9	0-30	9,30	22,5	3,70	35,5	26,2	63,4	10,4
Cotton	30-60	8,40	22,3	3,50	34,2	24,5	65,2	10,2
	60-90	10,1	16,6	2,60	29,3	34,5	56,5	8,87
	90-120	8,10	17,8	2,50	28,4	28,5	62,6	8,80

CONCLUSIONS AND RECOMMENDATIONS

1. Based on the conducted studies, it was determined that the salt content in the soils of the experimental area in the 0–100 cm soil layer was 0.256–0.419% in 2020, 0.11–0.20% in 2022, and 0.14–0.63% in 2024. The obtained results indicate that the soils of the experimental plots are non-saline, slightly saline, and moderately saline.
2. It was determined that the pH values ranged between 7.31–7.71 in soils under grain crops and 7.12–7.53 in soils under cotton crops, which indicates that these soils are slightly alkaline.
3. In the experimental area, for soils that are slightly saline, it is recommended to carry out deep plowing of the fields, application of organic and mineral fertilizers together under plowing, winter leaching irrigation, and irrigation according to crop water requirements.
   In moderately saline and solonetzic areas, in addition to the above-mentioned measures, minor meliorative measures should also be implemented, such as the construction of temporary drainage systems and collectors, and ensuring the discharge of excess water into permanent drainage channels.
   The implementation of comprehensive agromeliorative measures will make it possible to reduce the salt content in soils, lower the groundwater level and mineralization, and increase crop productivity by 20–25%.

REFERENCES

1. Azizov G.Z. – *Water–salt balance of reclaimed soil–ground complexes of the Kura–Araz lowland and scientific analysis of its results.* Baku, “Elm” Publishing House, 2006, 258 p.
2. Mammadov G.Sh. – *Fundamentals of Soil Science and Soil Geography.* Baku, “Elm”, 2007, pp. 19–43.
3. Mammadov G.Sh., Hashimov A.C. – *Assessment of Saline and Solonetzic Soils.* Baku, 2005, 180 p.
4. Mammadov G.Sh., Khalilov M.Y. – *Ecology and Environmental Protection.* Baku, “Elm”, 2005, p. 879.

5. Mustafayev M.G. – *Meliorative condition of soils in the Mugan–Salyan massif and ways of their improvement.* Azerbaijan State University, Azerbaijan Geographical Society, Proceedings “Modern Problems of Geography”, Baku, 2008, pp. 120–124.
6. Mustafayev M.G. – *Increasing the efficiency of collector–drainage systems and improving the eco-meliorative condition in the Mugan Plain.* International Scientific Conference “Soils of Azerbaijan: Genesis, Geography, Melioration, Efficient Use and Ecology”. Baku, “Elm”, 2012, pp. 373–377.
7. Arinushkina E.V. – *Guidelines for Chemical Analysis of Soils.* Moscow, Moscow State University Press, 1970, 488 p.
8. Babaev M.P. – *Irrigated Soils of the Kura–Araz Lowland and Their Productivity.* Baku, “Elm”, 1984, 172 p.
9. Volobuev V.R., Azizov K.Z. – *Saline soils of the Kura–Araz lowland.* Proceedings of the Symposium of the V Congress of the All-Union Society of Soil Scientists, Vol. 6, Tbilisi, 1981, pp. 104–124.
10. Grossheim A.A. – *Analysis of the Flora of the Caucasus*. Works of the Botanical Institute of AzFAN USSR, Vol. 1, Baku, 1936, 257 p.
11. Israfilov G.Yu. – *Groundwater of the Kura–Araz Lowland.* Baku, “Maarif”, 1975, 204 p.
12. Mammadov G.Sh. – *Land Reform in Azerbaijan (Legal and Scientific–Ecological Issues).* Baku, “Elm”, 2000, 371 p.
13. Mustafayev M.G. – *Study of changes in soil and groundwater salinity in the Salyan steppe.* Scientific Research in Melioration and Water Management, Vol. 42, Issue 2, Taraz, IC “Akva”, 2006, pp. 51–53.
14. Mustafayev M.G. – *Efficiency assessment of meliorative measures.* International Scientific–Practical Conference “Ecological Condition of the Natural Environment and Scientific–Practical Aspects of Modern Meliorative Technologies”. Ryazan, “RAGU”, 2012, pp. 187–190.
15. Mustafayev M., Tukenova Z., Alimzhanova M., Ashimuly K., Mustafayev F. – *The influence of fertilization on the water–salt regime in the conditions of the Mugan–Salyan massif, Azerbaijan.* Journal of Water and Land Development, 2022, No. 55 (X–XII), Poland, pp. 276–285.
16. Mustafayev M.G., Kocharli S.A., Gulaliyev Ch.G., Mustafayev F.M., Aliyeva F.N. – *Agrophysical characteristics of soils of the Karabakh plain of Azerbaijan.* Journal “Melioration”, Minsk, 2024, No. 1 (107), pp. 43–49.
17. Museibov M.A. – *Physical Geography of Azerbaijan.* Baku, “Maarif”, 1998, 40 p.
18. Salaev M.E. – *Diagnosis and Classification of Soils of Azerbaijan.* Baku, “Elm”, 1991, 240 p.
19. Figurovsky I.V. – *Climatic Zoning of Azerbaijan.* Materials on the Zoning of the Azerbaijan SSR, Issue 4, Baku, 1936, pp. 45–63.
20. Shykhlinsky E.M. – *Climate of Azerbaijan.* Academy of Sciences of the Azerbaijan SSR, Baku, 1968, 343 p.