



DEPTH AND MINERALIZATION OF GROUNDWATER IN IRRIGATED MEADOW SOILS OF THE BUKHARA REGION

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ABSTRACT

This thesis presents data on the groundwater depth and mineralization of irrigated soils in the Karakul and Kogon districts of the Bukhara region, and provides a comparative description in relation to previous years' data..

Introduction. Groundwater, soil water, and surface (irrigation) water are integral components of a single chain in soil processes related to the formation, movement, and accumulation of salts. Therefore, their comprehensive study plays an important role in solving reclamation problems. In soil formation, particularly in the development of secondary salinization, mineralized groundwater plays a significant role. The degree and intensity of soil salinity depend on the depth and mineralization level of groundwater as well as the composition of salts. The closer the groundwater table is to the soil surface, the stronger its impact on soil properties, influencing salinization processes and the water-salt regime in various ways. Under certain conditions, it serves as a mechanism for retaining (accumulating) salts and redistributing them by transporting dissolved salts to surrounding areas through groundwater flow [1, pp. 956–971; 2, pp. 128–135; 3, pp. 52–61].

Research results. Currently, the state (main parameters) of groundwater in the irrigated soils of the Y. Oxunboboyev area of the Karakul district and the “Bo’ston” area of the Kogon district of the Bukhara region has a seasonal character depending on natural and anthropogenic conditions. During the irrigation period of the vegetation season, the groundwater level rises significantly and averages 1,5–2,2 meters across the study areas, while after the irrigation period it drops to 2,5–3,0 meters. The amplitude of fluctuation ranges between 1–1,5 meters (Figure 1- graph).

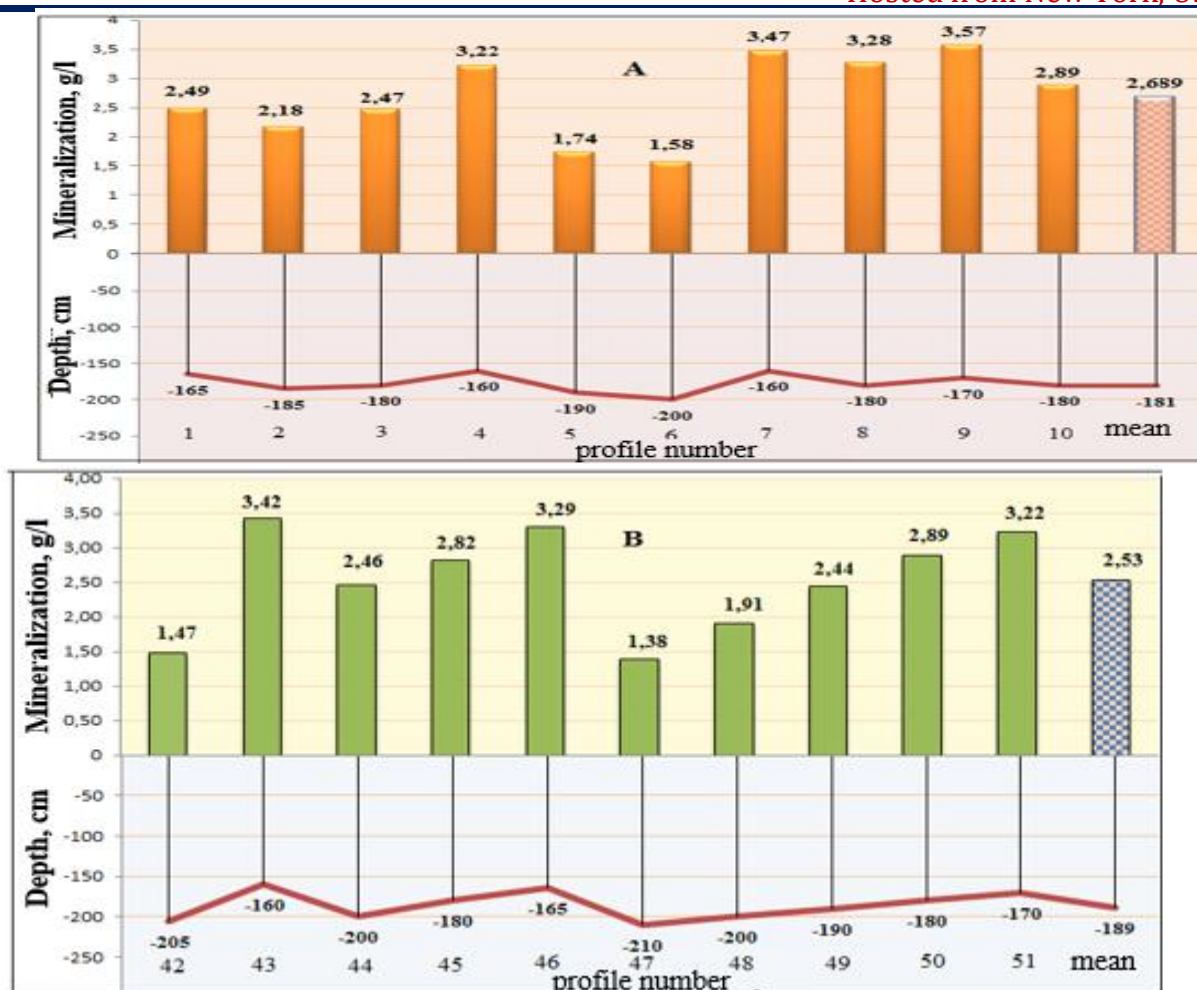


Figure 1 – Graph. Depth and mineralization of groundwater by soil profiles in the irrigated soils of Karakul (A) and Kogon (B) districts.

In the irrigated lands of the studied areas, the groundwater level varies in depth and salinity depending on the relief conditions of the territory, the state of hydromeliorative systems, the degree of natural and artificial drainage, and the type of cultivated crops. According to these conditions, groundwater belongs to the groups of weakly (1-3 g/l) and moderately (3-10 g/l) mineralized waters (Figure 1 - graph).

Prolonged fluctuations in the groundwater level-its periodic rise and fall-lead to a gradual deterioration of the soil-meliorative condition of irrigated lands. This process becomes particularly intense due to the formation of the “second water table,” which appears between irrigation intervals. Overall, the level and mineralization of groundwater determine the water-salt regime of irrigated soils.

If the current data are compared with previous years, in 2003-2005 the groundwater depth in the irrigated lands of the Y. Oxunboboyev area of Karakul district fluctuated within a relatively wide range (190-240 cm), with an average depth of 221 cm, while the mineralization level ranged between 3,644-5,420 g/l, averaging 4,580 g/l. The groundwater indicators of the “Bo’ston” area in Kogon district did not differ significantly from those of the previously described area: groundwater depth ranged between 205-250 cm, averaging 232

cm, and the mineralization level fluctuated between 3,210-5,590 g/l, averaging 4,410 g/l (Table 1).

Based on field observations and analytical results from the 2022–2023 studies, the key parameters of groundwater and the qualitative and component composition of salts in the studied areas varied depending on different factors. During this period, the groundwater depth in the irrigated lands of the Y. Oxunboboyev area of Karakul district ranged between 160–210 cm, with an average depth of 181 cm, while the mineralization level varied between 1,580–3,570 g/l, averaging 2,689 g/l (Table 1).

Table 1. Range of fluctuation and average arithmetic indicators of groundwater depth and mineralization in selected areas of Bukhara region.

№	District, name of the area (massif)	Groundwater			
		Depth, cm		Mineralization, g/l	
		Range of fluctuation	Mean value	Range of fluctuation	Mean value
in 2022–2023					
1	Karakul District, Y. Oxunboboyev massif	160-200	181	1,580- 3,570	2,689
2	Kagan District, “Bo’ston” massif	160-200	189	1,380- 3,420	2,530
in 2003-2005					
1	Karakul District, Y. Oxunboboyev massif	190-240	221	3,644- 5,420	4,580
2	Kagan District, “Bo’ston” massif	205-250	232	3,210- 5,590	4,410

In the irrigated soils of the “Bo’ston” area of Kogon district, the groundwater depth did not differ much from that of the Y. Oxunboboyev area, ranging from 160–200 cm, with an average value of 189 cm. The mineralization level in this area was slightly lower, fluctuating between 1,380–3,420 g/l, with an average of 2,530 g/l (Table 1).

Conclusion. The results of comparative analysis show that over the past 18–20 years, the salinity chemistry of groundwater has remained almost unchanged, with the chloride-sulfate type of salinization largely preserved. During this period, groundwater depth in the studied areas has decreased from 221–232 cm to 181–189 cm, while the mineralization level has declined from 4,580–4,410 g/l to 2,530–2,689 g/l.

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