Registered in Germany **Europa Revue Journal**
ISSN: 1862-6564 **Vol. 6 No. 6 (2026) Published June 14, 2026**

The use of a drainage system to prevent salinization in irrigated lands

Sh. Bobobekova

3rd-year student of Agrochemistry and Soil Science **Gulistan State University**

bobobekovasharofat3@gmail.com

Abstract

This article discusses the problem of salinization in irrigated lands and highlights the importance of drainage systems in its prevention. The main causes of salinization, its negative impact on soil fertility, and reclamation measures are examined. In addition, information is provided about the types of open and closed drainage systems, their working principles, and their efficiency. According to the research results, a properly designed drainage system plays an important role in reducing soil salinity, regulating groundwater levels, and increasing crop productivity. This work contributes to the improvement of land reclamation practices in agriculture.

Keywords

Salinization, groundwater, open drains, closed drains, temporary drains, optimal depth, collector-drain system.

Introduction: Irrigated agriculture is one of the main branches of agriculture in Uzbekistan and the Central Asian region. However, during long-term irrigation processes, soil salinization remains one of the most serious ecological and agronomic problems. Salinization significantly reduces crop yields, worsens the physical and chemical properties of the soil, and limits plant growth. Therefore, drainage systems play an important role in preventing and managing salinization.

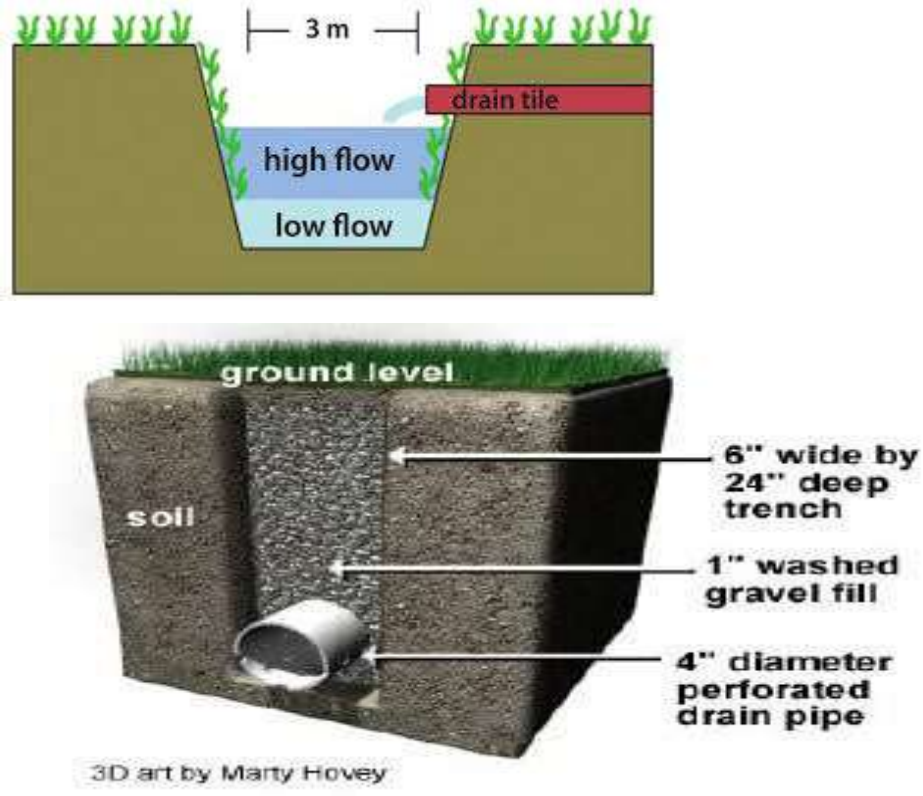
In order to ensure the implementation of the Resolution of the President of the Republic of Uzbekistan No. PQ-4795 dated July 30, 2020, “On measures to further improve the system of agricultural education,” as well as to define priority directions for the modernization of higher agricultural education, and to raise the process of training highly qualified specialists with modern knowledge and high moral and ethical qualities to a new qualitative level based on advanced educational technologies [1].

Research object, Methods, and Materials: In the irrigated areas of the Syrdarya region, the accumulation of water-soluble salts in the upper soil layers, which are

important for plant nutrition, occurs during the irrigation process. The intensity of salt accumulation is related to the groundwater level being higher than the “optimal” depth and its high salinity. In the areas of the region that have long been cultivated, during the irrigation of agricultural crops, irrigation norms are increased while reducing the number of irrigations, and the intervals between irrigations are also extended. Although this method of irrigation temporarily reduces salts in the upper soil layers, it leads to a sharp rise in groundwater levels and disrupts the soil’s water-salt balance. In the Syrdarya region, there are a total of 287,470 hectares of irrigated land (as of January 1, 2021). To remove groundwater from these lands, a drainage network with a total length of 16,083.41 km is in operation. Of this, 7,830.6 km are open drains and 8,252.81 km are closed (subsurface) drains. Of the open drains, 1,974.63 km are inter-farm and 5,855.98 km are on-farm drains. Of the closed drains, 2,814.99 km are funded by the state budget and 5,437.82 km belong to farms. The irrigated lands are fully supplied with collector-drainage networks, and the length of collectors per hectare is 56.0 linear meters. As of January 1, 2021, there are 515 vertical drainage wells in the region, serving to remove pressurized groundwater from 61,224 hectares of irrigated land [2].

Research results: According to the data of V.G. Nasonov and I.B. Ro‘ziyev (1998), there are about 1,000 vertical drainage wells in the Syrdarya region, and the specific length of horizontal drains averages 42.2–46.7 meters per hectare, which is significantly higher than the national average (28.1 m/ha). Despite this, the meliorative condition of irrigated soils in the region remains quite poor, making them unfavorable for agriculture. In this region, the operation of vertical drainage systems is limited and has low efficiency. When determining their operating regimes, natural groundwater flow and weather conditions of a given year are not considered uniformly across all areas of the region. Therefore, it is necessary to divide these lands into zones (subregions) based on the intensity of vertical drainage influence (strong and moderate impact zones). For each identified subregion, it is required to establish irrigation and leaching parameters. At the same time, improving and optimizing the operating regimes of vertical drainage systems and increasing their efficiency are among the

primary tasks. Use and drawbacks of open drains: In addition to continuously operating deep drains, it is often advisable to use temporary auxiliary shallow drains in the reclamation of saline lands. If the distance between permanent drains is too large, the use of temporary additional drains yields good results and eliminates the need for constructing extra deep drains. Horizontal closed drainage systems usually consist of pipe networks buried horizontally at a certain depth. Pipe drains are widely used. The working principle of horizontal closed drains is similar to that of open horizontal drains: groundwater is distributed within the area of influence, and the direction of water flow is the same. The depth and spacing of closed drains are determined similarly to those of open horizontal drains. When vertical drainage systems are used, groundwater is extracted through deep bore wells equipped with pumps. This is considered one of the most effective methods for land reclamation [3].



General Analysis: In areas where saline groundwater cannot drain sufficiently, drainage systems play a key and decisive role—along with field leveling—in leaching salts, desalinating deeper soil layers, and lowering the groundwater table. Where drainage systems function effectively, proper use of water management and agro-meliorative practices makes it easier to increase the productivity of both newly

developed and long-irrigated lands. Drainage is an active and effective method in combating soil salinization and waterlogging, and it is widely used in many countries such as the United States, Australia, Egypt, India, Algeria, and Italy. The deeper the groundwater level is lowered and the stronger its flow through natural or artificial drainage systems, the more effectively soil salinity is reduced. According to observations from reclamation stations in the Oqoltin district of Mirzachol, soils are desalinized more effectively and to greater depths in areas with drainage systems compared to those without them. For example, before leaching in Oqoltin (on medium and heavy loamy soils), the groundwater depth is about 2.5–2.6 meters, and the chlorine content in the upper 1-meter soil layer is 0.183–0.273%. When a leaching norm of 5,700–9,100 m³ per hectare is applied, in areas without drainage, the chlorine content decreases to 0.074–0.029%, and desalination reaches only up to 0.7 meters depth. However, in areas with drainage systems, soils are desalinated down to a depth of 2 meters, and the chlorine content in the 1-meter layer decreases significantly to 0.004–0.001%. The dynamics of soil desalination in drained and non-drained areas can be clearly seen from the data obtained at the Oqoltin experimental station.

Denamics of soil desalination during leaching

Chlorine content % in saline soil by weight				
Soil layer, cm	**Before leaching**	**After leaching at a rate of cubic meters per hectare,**		
		3540 **8,1**	**5960** **28,1**	**8830** **12,11**
Under drained conditions, 1939-1940				
0-20	**0,241**	**0,006**	**0,005**	**0,004**
20-40	**0,215**	**0,008**	**0,004**	**0,004**
40-60	**0,219**	**0,040**	**0,005**	**0,004**
60-80	**0,213**	**0,061**	**0,007**	**0,004**
80-100	**0,198**	**0,093**	**0,010**	**0,004**
0-60	**0,225**	**0,018**	**0,005**	**0,004**
0-100	**0,217**	**0,042**	**0,006**	**0,004**
	23.XI	**2800**	**5000**	**8800**
		24 XP	**30.XII**	**6,1**
In undrained conditions, 1942-1943				

0-10	**0,416**	**0,082**	**0,043**	**0,038**
10-20	**0,300**	**0,159**	**0,192**	**0,078**
20-30	**0,183**	**0,203**	**0,164**	**0,135**
30-50	**0,189**	**0,198**	**0,169**	**0,052**
50-70	**0,140**	**0,176**	**0,067**	**0,059**
70-100	**0,092**	**0,109**	**0,067**	**0,067**
0-50	**0,256**	**0,168**	**0,147**	**0,147**
0-100	**0.183**	**0,151**	**0,107**	**0,107**

Conclusion: Based on the above-mentioned considerations, as well as the proposed suggestions and recommendations, it is advisable to continue comprehensive and in-depth scientific research on the current meliorative condition of irrigated soils in the region, to provide an objective assessment, and to restore, improve, and maintain soil fertility. At the same time, it is necessary to introduce more effective reclamation measures that ensure high crop yields from saline lands and implement them in practice. The effective functioning of drainage networks, that is, the smooth flow of groundwater into them, depends on many factors such as the proper planning and depth of drains, the distance between them, and the water-physical and filtration properties of the soil. When constructing drainage systems, it is very important to correctly design the layout of collector-drain networks. It is recommended to place drains along the main slope of the land, between irrigation canals. In this case, under the pressure of water infiltrating from both adjacent irrigation canals, groundwater flows into the drains and accumulates, which helps to remove salts from the soil more quickly and efficiently.

References

1.Resolution of the President of the Republic of Uzbekistan No. PQ-4795 dated July 30, 2020, “On measures to further improve the system of agricultural education.”

2 Altmishev, Adil Sherkulovich. Soil Water-Salt Regime. Tashkent: “Metodist Publishing House,” 2023.

3. Abdullayev, S.A., and Namozov, X.Q. Soil Reclamation and Hydrology. Tashkent: “Excellent Polygraphy,” 2020.

4 Ahmedov, H.A. Irrigation Reclamation. Tashkent: “O‘qituvchi,” 1977.