European Science Methodical Journal
ISSN (E): 2938-3641
Volume 4, Issue 6, June- 2026

THE EFFECT OF IRRIGATION REGIMES ON THE SOIL SALINITY AND WATER REGIME

Sh. Bobobekova
3rd-Year Student of Agrochemistry and Soil Science
Gulistan State University
bobobekovasharofat3@gmail.com

Abstract:

This article examines the effect of irrigation regimes on the soil water–salt regime. The influence of irrigation rates, timing, and methods on soil moisture and salt movement is analyzed. In addition, the processes of soil salinization caused by improper irrigation practices and their negative impact on soil fertility are discussed. The research findings demonstrate that the scientifically based management of irrigation regimes plays a crucial role in improving the soil's reclamation status, preventing salinization, and achieving higher agricultural crop yields.

Keywords: Irrigation regime, soil water–salt regime, soil salinization, soil fertility, soil moisture, land reclamation, agriculture.

Introduction

Irrigation regimes have a significant influence on the soil water–salt balance. When the irrigation rate, timing, and method are properly selected, the optimum soil moisture level is maintained, thereby promoting the growth and development of crops. However, excessive irrigation may cause the groundwater table to rise. As a result, salts move upward through capillary action and accumulate in the upper soil layers, intensifying the process of soil salinization. Conversely, insufficient irrigation leads to soil moisture deficiency, which negatively affects crop growth and reduces agricultural productivity. To ensure the consistent implementation of the tasks and achievement of the key performance indicators established by the Decree of the President of the Republic of Uzbekistan No. PF-6024, dated July 10, 2020, "On Approval of the Concept for the Development of the Water Management Sector of the Republic of Uzbekistan for 2020–2030," and Decree No. PF-158, dated September 11, 2023, "On the Uzbekistan–2030 Strategy," comprehensive measures have been undertaken to improve water resource management, enhance irrigation efficiency, and ensure the sustainable use of land and water resources.

Main Body

In irrigated agricultural lands, it is essential to study and predict not only the climatic and agronomic conditions required for crop growth but also the soil water regime, which directly affects the nutrient, thermal, and salt regimes of the soil. Effective water management is

ISSN (E): 2938-3641
Volume 4, Issue 6, June- 2026

achieved through scientifically designed irrigation regimes and techniques, ensuring that the required amount of water is delivered to fields via properly managed irrigation networks. During irrigation, water distribution should be organized in a way that does not interfere with the operation of agricultural machinery or reduce land-use efficiency. This can be achieved by constructing temporary irrigation ditches, which may later be filled in if necessary, or by using mobile pipelines and modern irrigation technologies such as drip irrigation systems or subsurface pipe irrigation. Managed irrigation networks consist of temporary canals, field ditches, and furrows that ensure the uniform distribution of irrigation water across agricultural fields. Proper organization of the soil water regime through these systems supplies crops with adequate moisture, supports other agronomic practices, improves soil fertility, and ultimately increases crop productivity. These objectives can be achieved through efficient water use, the construction of well-managed irrigation systems, and the application of advanced irrigation technologies. Irrigation methods used in agricultural production can generally be divided into three categories. The first is surface irrigation, in which water is distributed over the soil surface and infiltrates into the soil profile. The second is drip irrigation, where water is supplied through specialized equipment and emitters, providing moisture directly to the root zone while also maintaining adequate humidity in the upper soil layer. The third is subsurface irrigation, in which water is delivered through buried pipelines installed within the active root zone. This method relies primarily on the capillary movement and water-retention properties of the soil. Among these methods, surface irrigation remains the most widely practiced because it requires relatively low labor input and lower capital investment than many other irrigation systems. Regardless of whether irrigation is applied from the surface or below the ground, the primary purpose is to moisten the soil, allowing plants to absorb water and dissolved nutrients through their root systems. Surface irrigation possesses several distinctive characteristics. First, it wets different soil layers depending on the amount of applied water. Second, gravitational water plays a major role in water movement, leading to greater water storage within the soil profile. Third, fluctuations in soil moisture during the irrigation cycle require relatively frequent irrigation with smaller irrigation depths. Therefore, frequent irrigation using moderate water application rates is generally recommended. The choice of irrigation method depends on the crop species. Flood irrigation is commonly used for rice cultivation and for leaching salts from saline soils. Alfalfa and cereal crops are generally irrigated using border-strip irrigation. Melons and other cucurbit crops are irrigated through furrows, while cotton, sugar beet, grapevines, maize, and many other field crops are predominantly irrigated using furrow irrigation. Efficient water use and the proper operation of irrigation systems largely depend on appropriate irrigation techniques. The main objectives of irrigation technology are as follows: 1.To ensure high crop yields by maintaining an optimal balance between soil water, air, nutrients, salts, and temperature while improving soil fertility through appropriate agronomic practices. 2.To provide uniform and adequate soil moisture throughout the cultivated field. 3.To preserve the soil structure and maintain favorable soil aggregation. 4.To create suitable conditions for the mechanization of agricultural operations. 5.Strict compliance with the prescribed irrigation regime is essential to ensure efficient water use, minimize water losses, and prevent unnecessary waste. Furthermore, irrigation practices should be mechanized and automated wherever possible to improve labor productivity and enhance irrigation efficiency. For soils susceptible to salinization, the lower threshold of soil moisture is generally maintained at 70–80% of the Field Capacity (FC). At the same time, the irrigation application rate is increased by approximately 20–30% compared with that used on non-saline soils. Under soil conditions with relatively thin underlying gravel layers (Hydromodule Regions I and II), both the number of irrigation events and the seasonal irrigation requirement are increased by approximately 15%. This adjustment is associated with the relatively low water-holding capacity of these soils, while the higher seasonal irrigation requirement compensates for increased water losses through crop transpiration and soil evaporation. The selection of an irrigation method depends on several factors, including crop type, the level of mechanization, agronomic practices, field topography and slope, and the physical properties of the irrigated soil, such as its water-holding capacity, hydraulic conductivity, and texture. Based on these factors, A. N. Kostyakov developed a classification of irrigation methods according to both seasonal irrigation requirements and single irrigation application rates, which remains one of the fundamental approaches in irrigation science.

Table 1

General Irrigation Methods	Method of ater application to the field	Single Irrigation Application methods	
		Using low pressure and Low water discharge	Higher pressure and greater water consumption
Surface Flow Irrigation (Flood Irrigation)	Across the Field Surface a) Border Irrigation; b)Furrow Irrigation	1.Border irrigation (irrigation by dividing the field into strips). 2. Furrow irrigation using closed-end deep furrows.	3. Flood irrigation. 4.Furrow irrigation using closed-end (non-draining) deep furrows.
Sprinkler Irrigation	Sprinkler irrigation (using specialized equipment).	Water is sprayed over a short distance using low pressure.	Water is sprayed over a long distance using high pressure.
Subsurface irrigation (using special pipes).	Water is supplied below the soil surface (the ploughed soil layer absorbs water from below)	Water is sprayed over a short distance using low pressure.	Irrigation is carried out using intermittently operating pressurized systems.

Now that we understand the differences between each irrigation method and the climatic conditions in which they are most suitable, these irrigation methods can be further classified according to their role and application in nature. Based on the summarized results of many years of research and field experience, an optimized irrigation schedule for cotton has been developed and recommended for practical implementation (Table 2).

Irrigation schedule and seasonal irrigation norm.

Table 2

Soil–climatic regions (oases).	Hydromodule region	Seasonal irrigation requirement (m^3/ha)	Irrigation schedule
Lower Amu Darya Oasis, desert zone soils.	V	5000	1-4-0
	VI	5600	2-4-0
	VII	3000	1-2-0
Mirzachol Oasis, gray soils of the long-established irrigated zone.	IX	4000	1-3-0
	V	4500	1-4-0
	VI	5500	2-4-0
	VIII	2500	0-2-0
	IX	3500	1-2-0
Surkhandarya Oasis, takyr and takyr–meadow soils of the Sherabad Desert. Fergana Oasis, light gray and gray–meadow soils.	II	8000	3-5-1
	III	7500	2-5-1
	VI	7000	2-4-1
	IX	5000	1-4-1
	II	7000	3-4-1
	III	6600	2-4-1
	VI	5000	1-4-1
	VII	6000	2-4-1
	VIII	3000	1-2-0
	IX	4000	1-3-0

Based on the table above, if each crop is irrigated according to the recommended irrigation norm considering the soil and climatic conditions of the area where it is grown, it will not significantly affect the soil water–salt regime. In contrast, excessive irrigation can dissolve salts in the lower soil layers and raise the groundwater level. As a result, salts accumulate in the upper soil layer, leading to the onset of soil salinization.

Conclusion

The analyses conducted indicate that the irrigation regime is one of the main factors influencing the soil water–salt regime. Scientifically based determination of irrigation rates and schedules prevents excessive salt accumulation in the soil, maintains an optimal moisture level, and creates favorable conditions for plant growth and development. Conversely, excessive or insufficient irrigation may alter the groundwater level, promote salt accumulation in the upper soil layers, and reduce soil fertility. Furthermore, improving irrigation systems, adopting water-saving technologies, ensuring the efficient operation of drainage systems, and regularly monitoring the meliorative condition of soils play an important role in reducing soil salinization. Particularly under conditions of limited water resources, the implementation of scientifically based irrigation practices not only helps maintain a balanced soil water–salt regime but also promotes the rational use of water resources and contributes to the sustainable improvement of agricultural crop productivity.

References

1. Abdullayev, S. A., & Namazov, X. (2011). Soil Melioration. Tashkent: Uzbek National Encyclopedia Publishing House.
2. Acreman, M. (Ed.). (2000). The Hydrology of the UK: A Study of Change. London: Routledge
3. Course Program Brochures of the Centre for International Postgraduate Studies of Environmental Management (CIPSEM). (2004). Dresden, Germany.
4. Gafurova, L., Abdullayev, S., & Namazov, X. (2000). Meliorative Soil Science. Tashkent