

“SALINIZATION OF IRRIGATED SOILS AND THEIR AGROCHEMICAL PROPERTIES IN THE OLOT DISTRICT OF THE BUKHARA REGION (UZBEKISTAN)”

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Abstract

Salinization of irrigated soils is one of the most pressing environmental and agricultural problems limiting land productivity in arid and semi-arid regions. This article presents comprehensive information on saline soils, their salinization types and degrees, as well as the spatial distribution of salinized lands in the Republic of Uzbekistan, with a particular focus on the Olot district of Bukhara region.

Keywords

Soil, irrigated soil, salinization, salinity type, degree of salinity, soil fertility, groundwater, Bukhara region.

Introduction: The study reveals that semi-hydromorphic and hydromorphic soils dominate the soil cover of the district and constitute the main part of the land fund. Among the genetic soil groups, meadow soils account for 51.0%, meadow alluvial soils for 43.9%, takyr-meadow soils for 4.0%, and meadow-desert soils for 2.0%. These soil types are widely distributed across all geomorphological zones of the district.

Current assessments indicate that 23.29% of the total land area is non-saline, while 58.81% is slightly saline, 14.56% moderately saline, and 3.33% strongly and very strongly saline. Soil fertility analysis shows that humus content in most soils is very low (less than 1%) or low (1.1–2.0%). Areas with humus content below 1% occupy 97.4% of the district, whereas only 2.6% of soils contain 1.1–2.0% humus. This condition necessitates the rational use of local and non-traditional organic and mineral fertilizers to improve soil fertility.

Based on water extract analyses, meadow soils in the district are characterized by non-saline, weakly, moderately, and strongly saline variations. According to salinity chemistry, chloride–sulfate and sulfate salinization types prevail. In all irrigated soil types—meadow, takyr-meadow, meadow-desert, and meadow alluvial soils—the contents of humus, available

phosphorus, and exchangeable potassium decrease from the plough layer to deeper horizons. This pattern is mainly caused by long-term anthropogenic impacts such as irrigation practices and agrotechnical measures, which have resulted in the leaching of nutrients to lower soil layers.

Soil salinization significantly affects soil fertility, crop productivity, and the ecological and reclamation status of irrigated lands. The intensity of salinization depends on terrain relief, geomorphological and lithological structure, soil-climatic conditions, and human economic activities. Particularly, saline groundwater causes severe damage to agriculture: cotton yields decrease by 20–30% on slightly saline soils, 40–60% on moderately saline soils, and up to 80% on strongly saline lands. In extremely saline and solonchak soils, cotton seedlings may completely perish after the first irrigation. These findings are supported by numerous field experiments and long-term research results.

Main Part

The soil cover of the Olot district is mainly represented by semi-hydromorphic and hydromorphic soils, which form the dominant part of the regional land fund. These soils developed under conditions of shallow groundwater occurrence and long-term irrigation impact. According to their genetic classification, meadow soils occupy 51.0% of the total area, meadow alluvial soils account for 43.9%, takyrmeadow soils cover 4.0%, and meadow-desert soils make up 2.0%. Such soils are distributed across all geomorphological zones of the district and play a key role in agricultural production.

At present, the degree of soil salinity in the district varies considerably. Detailed soil surveys indicate that 23.29% of the total land area is non-saline, while 58.81% is slightly saline. Moderately saline soils occupy 14.56%, and strongly to very strongly saline soils constitute 3.33% of the area. This distribution reflects the influence of natural factors such as relief and groundwater depth, as well as anthropogenic factors, including irrigation practices and insufficient drainage systems.

The humus content of soils in the Olot district is generally low. The majority of soils are characterized by very low humus content (less than 1.0%) and low humus content (1.1–2.0%). Areas with humus content below 1.0% cover 97.4% of the total area, whereas soils containing 1.1–2.0% humus account for only 2.6%. Such low organic matter levels negatively affect soil structure, water-holding capacity, and nutrient availability, thereby

limiting crop productivity. This situation necessitates the rational use of organic, mineral, and non-traditional fertilizers to maintain and improve soil fertility.

Water extract analyses show that meadow soils include non-saline, weakly, moderately, and strongly saline variants. According to the chemical composition of soluble salts, chloride–sulfate and sulfate types of salinization predominate. The formation of these salinity types is closely related to groundwater mineralization and evaporative conditions typical of arid regions.

In all irrigated soil types of the district—meadow, meadow alluvial, takyrmeadow, and meadow-desert soils—the contents of humus, available phosphorus, and exchangeable potassium decrease gradually from the plough layer to the deeper horizons. This vertical distribution pattern is mainly the result of long-term anthropogenic impacts. Continuous irrigation and agrotechnical practices over many years have led to the leaching of nutrients from the upper soil layers into the lower horizons, resulting in reduced fertility of the topsoil.

Soil salinization is a key factor determining the fertility, productivity, and ecological–meliorative condition of irrigated lands. The intensity of salinization depends on relief features, geomorphological and lithological structure, soil and climatic conditions, and human economic activities. In particular, saline groundwater poses a serious threat to agricultural production. Numerous field experiments and long-term studies have shown that cotton yields decrease by 20–30% on slightly saline soils, by 40–60% on moderately saline soils, and by up to 80% on strongly saline soils. In extremely saline and solonchak soils, cotton seedlings may completely perish after the first irrigation.

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