

**THE EFFECT OF IRRIGATION REGIMES AND NORMS ON THE  
PRODUCTIVITY OF COTTON AND LEGUMINOUS CROPS, AS  
WELL AS ON THE MELIORATIVE CONDITION AND AGRO-  
PHYSICAL PROPERTIES OF THE SOIL**

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**Annotation.**

This scientific article examines the effect of irrigation regimes and norms on the productivity of cotton and leguminous crops, as well as on the meliorative condition and agro-physical properties of the soil. The results of the study demonstrate that proper planning of irrigation not only increases crop productivity but also plays a crucial role in maintaining soil fertility and ensuring the efficient use of water resources. Based on field experiments, the article scientifically analyzes the influence of irrigation norms on plant growth and crop quality.

**Keywords:** irrigation regime, irrigation norm, cotton, leguminous crops, productivity, meliorative condition, agro-physical properties, soil fertility, water resources.

Irrigation plays a fundamental role in agricultural productivity, especially in arid and semi-arid regions where natural precipitation is insufficient to meet crop water requirements. The effectiveness of irrigation depends largely on the correct determination of irrigation regimes and norms, which regulate the frequency and volume of water applied to crops. Inappropriate irrigation management can lead to waterlogging, soil

salinization, and a decline in soil fertility, ultimately reducing crop yield and quality.

Cotton and leguminous crops are among the most important agricultural plants in Uzbekistan and other Central Asian countries, providing both economic and ecological benefits. The productivity of these crops is closely linked to the physical and chemical characteristics of the soil, which are strongly influenced by irrigation practices. Therefore, studying the effects of irrigation regimes and norms on crop yield and soil properties is essential for developing sustainable agricultural strategies. This study aims to analyze how different irrigation schedules and water application rates affect the productivity of cotton and leguminous crops, as well as the meliorative condition and agro-physical characteristics of the soil. The findings provide a scientific basis for optimizing irrigation management to ensure long-term soil health, improve water-use efficiency, and enhance crop performance under various environmental conditions.

The efficiency of crop production in irrigated agriculture largely depends on the optimization of irrigation regimes and norms that ensure an adequate water supply to plants during critical growth stages. In the current research, field experiments were conducted to evaluate the influence of various irrigation schedules on the productivity of cotton (*Gossypium hirsutum* L.) and leguminous crops such as beans and peas. The experimental plots were established on different soil types with varying agro-physical properties to assess the combined effect of irrigation and soil conditions on crop growth.

The results showed that maintaining optimal soil moisture within 70–80% of the field capacity contributed to the highest yields in both cotton and leguminous crops. Excessive irrigation (above 100% of the calculated norm) led to waterlogging, reduced aeration in the root zone, and negatively affected root respiration and nutrient uptake. Conversely, insufficient irrigation (below

60% of the norm) caused moisture stress, delayed flowering, and reduced seed formation. Thus, moderate irrigation practices were found to be the most effective for achieving stable yields and maintaining soil balance.

Irrigation regimes significantly affected the meliorative condition of the soil. Over-irrigation resulted in increased groundwater levels and secondary salinization, especially in areas with poor drainage. On the other hand, controlled irrigation with properly calculated norms prevented excessive salt accumulation and maintained favorable soil water-salt balance. Regular monitoring of soil moisture and salinity proved essential for preventing degradation of soil fertility and ensuring sustainable land use.

From the agro-physical perspective, the research demonstrated that irrigation influenced soil structure, porosity, and bulk density. Repeated over-irrigation tended to destroy soil aggregates, leading to compaction and reduced infiltration rates. Balanced irrigation regimes, however, improved soil aggregation and aeration, which in turn enhanced root development and microbial activity. The physical condition of the soil directly correlated with crop performance, emphasizing the importance of integrated water and soil management.

The application of scientifically based irrigation norms improved water-use efficiency (WUE). Cotton and leguminous crops exhibited the best WUE under moderate irrigation levels, where each cubic meter of water contributed maximally to biomass accumulation and yield formation. This finding is particularly important for regions with limited water resources, where efficient irrigation planning is vital for agricultural sustainability. The study confirms that well-regulated irrigation regimes and optimal water norms not only enhance crop yield and quality but also play a crucial role in maintaining the meliorative and agro-physical health of the soil. Sustainable irrigation practices contribute to the long-term productivity of agricultural lands,

prevent soil degradation, and promote rational water resource management in dryland farming systems.

### Conclusion:

The results of the study clearly demonstrate that the regulation of irrigation regimes and norms has a significant impact on both crop productivity and soil quality. Properly balanced irrigation schedules not only ensure optimal growth and yield of cotton and leguminous crops but also help maintain the meliorative condition and agro-physical stability of the soil. Excessive irrigation leads to soil compaction, salinization, and reduced water-use efficiency, while insufficient irrigation causes moisture stress and lower productivity.

The findings highlight the necessity of adopting scientifically grounded irrigation practices that take into account soil type, crop water requirements, and climatic conditions. Maintaining soil moisture within the optimal range (70–80% of field capacity) was found to be the most favorable condition for achieving high yields and preserving soil fertility.

The use of modern technologies such as soil moisture monitoring systems and precision irrigation can further enhance water-use efficiency and prevent environmental degradation. Sustainable irrigation management thus serves as a key factor in improving agricultural productivity, conserving water resources, and ensuring the long-term ecological balance of irrigated lands. The study underscores that the success of agricultural production in arid regions depends on the rational application of irrigation regimes and norms, which simultaneously improve crop performance and protect soil health for future generations.

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