THE INFLUENCE OF SOIL AGRO-PHYSICAL PROPERTIES AND IRRIGATION REGIMES ON THE PRODUCTIVITY OF SUNFLOWER VARIETIES AND HYBRIDS GROWN AS A REPEATED CROP

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Annotation: *This scientific article examines the effect of soil agro-physical properties and irrigation regimes on the productivity of sunflower varieties and hybrids grown as a repeated crop. The research identified how different irrigation rates and timings influence plant growth stages, the efficiency of light and moisture utilization, and seed yield. It was also proven that the soil's mechanical composition, density, and moisture capacity directly affect the biological characteristics of sunflower plants. The results of the study contribute to determining the optimal irrigation schedule and maintaining soil fertility when cultivating sunflower as a repeated crop.*

Keywords: *sunflower, repeated cropping, yield, soil agro-physical properties, irrigation regime, hybrid, water regime, fertility.*

In recent years, the effective use of repeated crops in agriculture has become an important issue due to the growing demand for sustainable production and rational use of land and water resources. Repeated cultivation allows farmers to increase land productivity, maintain soil fertility, and obtain additional yields within a single growing season. Among various crops,

sunflower (Helianthus annuus L.) is considered one of the most promising for repeated cultivation because of its short vegetation period, adaptability to diverse climatic conditions, and high oil content.The agro-physical properties of soil—such as its mechanical composition, density, water permeability, and moisture capacity—play a crucial role in the growth and development of sunflower plants. These factors influence the absorption of nutrients and moisture, root system activity, and overall plant productivity. Likewise, the irrigation regime significantly affects photosynthetic activity, nutrient uptake, and the final seed yield. Therefore, identifying optimal irrigation conditions based on the soil's physical characteristics is essential for improving the yield potential of repeated sunflower crops.

This research aims to study the effect of different irrigation regimes and soil agro-physical conditions on the productivity of sunflower varieties and hybrids grown as a repeated crop. The study results will contribute to developing practical recommendations for efficient water management, preservation of soil fertility, and sustainable sunflower cultivation in repeated cropping systems.

Sunflower (Helianthus annuus L.) is a valuable oilseed crop widely cultivated in many regions of the world. In recent years, its cultivation as a repeated crop has gained significant attention due to the plant's ability to adapt to different environmental and soil conditions. The productivity of sunflower varieties and hybrids largely depends on the soil's agro-physical characteristics and the irrigation regime applied during the growing season.

The soil's physical properties—such as bulk density, porosity, structure, and water-holding capacity—directly affect the root system's activity and the plant's ability to absorb nutrients and moisture. Loamy and sandy-loam soils with moderate density and good water permeability create favorable conditions for the growth and development of sunflower roots. Excessive soil compaction,

on the other hand, reduces air circulation and root respiration, leading to a decline in plant vigor and yield.Irrigation plays a vital role in ensuring optimal growth conditions for sunflowers, especially when cultivated as a repeated crop under warm and dry climates. The timing and amount of irrigation directly influence the plant's physiological processes such as photosynthesis, transpiration, and nutrient uptake. Research results have shown that applying irrigation during critical growth phases—particularly at the budding and flowering stages—significantly increases seed yield and oil content. Insufficient or excessive watering, however, negatively affects both the growth dynamics and the final productivity of the crop.

Comparative experiments with different sunflower varieties and hybrids demonstrated that hybrids generally outperform traditional varieties in terms of adaptability, moisture use efficiency, and yield stability. Hybrid varieties tend to have a stronger root system and better tolerance to temporary drought or water stress conditions. Furthermore, the interaction between soil texture and irrigation regime was found to be crucial: lighter soils require more frequent irrigation with smaller doses, while heavier soils with higher water retention can be irrigated less often but with larger amounts.

Maintaining soil fertility during repeated cropping is also essential for sustainable production. Continuous cultivation without proper management may lead to soil structure degradation and a decrease in organic matter. Therefore, the application of organic fertilizers, crop rotation, and mulching are recommended to preserve soil structure and moisture balance. These practices not only improve water retention but also enhance the efficiency of mineral fertilizers, ultimately leading to higher yields.The productivity of repeated sunflower cultivation is strongly influenced by the soil's agro-physical properties and the irrigation regime. Proper management of these factors

ensures efficient water use, stable yields, and long-term soil fertility, contributing to the sustainability of agricultural production systems.

Conclusion: The conducted research has shown that the productivity of sunflower varieties and hybrids grown as a repeated crop is significantly influenced by the agro-physical properties of the soil and the applied irrigation regimes. Favorable soil conditions — including optimal density, good aeration, and sufficient moisture-holding capacity — ensure better root development and nutrient uptake, which directly affect plant growth and yield.

It was determined that maintaining an appropriate irrigation schedule, particularly during the budding and flowering stages, plays a decisive role in achieving high yields and oil content. Both water deficit and excessive irrigation negatively impact the physiological processes of the sunflower, leading to reduced productivity.Hybrid sunflower varieties have demonstrated higher adaptability, efficient use of soil moisture, and better tolerance to temporary drought compared to traditional varieties. These characteristics make them more suitable for repeated cropping systems under varying soil and climatic conditions.

To ensure sustainable sunflower production, it is necessary to consider the interaction between soil type and irrigation regime. The use of organic fertilizers, mulching, and proper crop rotation practices helps maintain soil fertility and structure, thus supporting stable yields over time.Optimizing irrigation management based on the soil's agro-physical characteristics can significantly increase the efficiency of water and nutrient use, improve yield potential, and contribute to the ecological stability of agricultural lands when cultivating sunflower as a repeated crop.

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