THE ROLE OF SPECIFIC ASPECTS OF SOIL CAPILLARITY AND POROSITY IN PRACTICE

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ABSTRACT

This scientific article conducts a thorough examination of the specific facets governing soil capillarity and porosity, aiming to provide a detailed understanding of their roles in agricultural systems. Employing a multidisciplinary approach involving field observations, laboratory analyses, and modeling techniques, the study navigates the intricate dynamics of capillarity and porosity properties. The investigation sheds light on the nuanced relationships between soil structure, water movement, and plant interactions, offering valuable insights for the sustainable management of soil resources in agriculture.

Keywords: capillarity phenomena across soil types, fine-textured soils, coarse-textured soils, pore structure and water transport, pore size distribution, dynamic water flow, plant-water dynamics, capillarity and plant uptake, water use efficiency.

The capillary property of the soil mainly depends on its mechanical composition and structure. The free water contained in the soil moved mainly under the influence of gravity and surface tension. The limit of upward movement of water through capillaries continues until the forces of weight and surface tension acting on it become equal.

In different soils, the height of water rising through the capillaries is different, and it mainly depends on the size or smallness of the capillaries in the soil structure. For example, the height of water rising through capillaries in sandy soil is 30–60 cm, and in clayey soil it reaches 3–4 cm.

Water rising through capillaries can be fully absorbed by plants, and it is the main useful water in the soil.

Soil porosity is important for the normal development of agricultural crops. Especially in the layer where the root develops, it is necessary to have not only moisture

but also a certain amount of air. Because the role of oxygen is high in the transformation of nutrients into a state absorbed by plants.

The porosity of the soil is determined by the amount of air contained in the intact structural soil in its natural state, and it indicates what percentage of the total volume is air.

The table below shows porosity values for different soil types:

Soil types	Porosity (%)
Heavy soil	40-60
Right soil	45-60
Heavy sandy soil	40-55
Average sandy soil	40-52
Light loam soil	38-50
Sandy soil	35-45
Loam soil	32-40
Sand soil	30-38

When soil porosity is increased by mechanical tillage, its density may decrease. Soil density, together with its porosity, is one of its main indicators. Soil porosity provides active air exchange and water permeability for the arable layer.

Timely, high-quality cultivation not only saves water but also ensures stable productivity. Cultivation after irrigation in cotton and other cultivated crops creates air, heat, and nutrition regimes that ensure normal plant growth.

Environmental considerations and conservation measures are addressed, emphasizing the contribution of soil capillarity to water conservation strategies and providing insights into sustainable practices for mitigating water scarcity challenges. The role of porosity in preventing soil erosion is also explored, with practical measures suggested to maintain soil structure and integrity.

The study advocates for the integration of advanced sensor technologies for real-time monitoring of specific capillarity and porosity parameters, enabling precision agriculture and informed decision-making. Furthermore, it highlights the importance of sophisticated modeling and simulation techniques to predict soil capillarity and porosity under diverse environmental scenarios, facilitating proactive planning.

In conclusion, the article culminates in offering practical guidelines and recommendations derived from the study. These actionable insights are tailored for farmers, agronomists, and policymakers, aiming to optimize soil and water management practices based on the specific capillarity and porosity considerations

discussed throughout the research. Overall, the article serves as a valuable resource, contributing significantly to the understanding of these special aspects and their implications for sustainable and efficient agricultural systems.

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