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Opinion Article

Contribution of Shallow Groundwater to Soil Water and Crop Growth in Layered Soils

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DESCRIPTION

Due to heavy, prolonged irrigation of croplands with poor drainage, shallow groundwater tables are easily generated in arid and semiarid regions. While the capillary rise from shallow groundwater might provide water for crop growth, it can also introduce salt into the root zone. Capillary rise is encouraged by a low groundwater table, which increases the salt of the root zone and reduces crop output. In salinized croplands, understanding the interplay between groundwater, soil water, and salt is crucial for crop growth. Numerous studies have examined the ideal Groundwater Table Depth (GWD) for crop production by measuring water use, soil salinity, and crop yield under various GWDs However, layered soils can have a major impact on salt transport and soil water flow, which alters the best GWD for a particular area and impacts groundwater level dynamics. Therefore, it is critical to understand how layered soils affect groundwater flux, salt and water accumulation in the root zone, and crop output.

The effects of layered soils on water and solute transport have been the subject of several laboratory and simulation investigations. When water reaches the interface between fine-textured soil and coarse-textured soil, the fine-textured soil's greater sorptivity causes the penetration rate to slightly rise. Meanwhile, came to the conclusion that the fine-textured soil layer's reduced absorption water flux is caused by its lower water content when compared to the overlying coarse-textured soil layer. According to Stormont and Anderson, who reversed the order of the soil layers, the capillary break brought on by the lower water entry suction from the underlying coarse-textured soil could lead to an increase in water storage in the upper fine-textured soil during infiltration. However, multiple investigations discovered that the capillary barrier effect might disappear and that the interlayer of coarse-textured soil with increased water content might even accelerate the movement of water and salt

The physical status of the soil (such as its unsaturated hydraulic conductivity and water content), which is regulated by GWD, has a direct bearing on the behaviors of the soil water and solute in layered soils. Layered soils also have an impact on groundwater table depth because they significantly alter water flux; however very few studies have examined the interactions between GWD dynamics, water flow, and solute transport in layered soils. One of the popular techniques for examining soil water movement, salt transport, and crop growth in the intricate soil-crop system is model simulation reliable model that mimics soil water and salt transport, HYDRUS (1D/2D/3D), has been used in various research to investigate multilayered soil systems. Agro-hydrological models that physically represent soil water flow, salt transport, and crop development conditions include SWAP, RZWQM, WAVES, and HYDRUS-WOFOST. The impacts of GWD on water use, soil salinity, and crop yield in fields have been examined in several researches using the agro-hydrological models. Few of them, however, have examined the variations in soil water and salt fluxes and crop production in layered soils with shallow GWDs and compared the dynamics of shallow groundwater tables in clearly layered soils with a coarse- or fine-textured soil interlayer. The responses of shallow GWDs to various layered soil types as well as the effects of shallow GWDs on root zone water and salt dynamics and crop output. The field measurements are used to calibrate the physically-based agro-hydrological model LAWSTAC in order to meet these goals: soil water content, salt concentration, GWD, leaf area index, biomass, and crop yield. The model is also applied to soil profiles with different GWDs and an interlayer of coarse- or fine-textured soil below the root zone.

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