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Subsurface drip irrigation and soil amendment: experiments and modeling of water storage, movement and uptake

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Soil water is a crucial factor for plant and root growth. Plants defeat soil water shortage by either preserving their tissues longer vital via physiological adaptations or extending the root growth in moist soil region. Turfgrasses normally have shallow root systems. Therefore, they are highly susceptible to droughts. Due to growing interest in water saving in recreation industry including parks and golf courses, the question of how to maintain good quality turfgrasses with applying less irrigation water rises.
Subsurface drip irrigation minimises water looses, since it carries water directly to the roots. Soil amendments are proposed to increase soil water storage capacity. Combining the advantages of subsurface drip irrigation and soil amendments irrigation water can be saved along with keeping the cover green. The objective of the ongoing study is to evaluate the performance of subsurface drip irrigation combined with a specific inorganic soil amendment added in different proportions (2 and 5%) to the sand profile.

A typical mixture of grass species and cultivars for golf putting greens is grown on sand-based profiles under defined climate conditions in a climate chamber. Two profile modifications adding the clay mineral based amendment to the layer surrounding the irrigation emitter are compared with the common golf course profile. For this, special boxes have been constructed for immediate observation of water movement, root and plant growth. The boxes are equipped with TDR and pressure probes to assess the spatial distribution and status of the soil water. The in- und outflows are recorded in minute steps. Further, turfgrass growth observations are simultaneously conducted.

Addressing these data, water storage, movement and uptake are estimated, analysed and compared with numerical simulations. HYDRUS 1/2 D is applied to simulate soil water movement for the treatments without and with amendment incorporated and different irrigation rates.
First experimental results show that, the adding of the inorganic soil amendment decreases the soil hydraulic conductivity, while the soil water storage increases. The modelling outputs support these results. Additionally, it was observed that the growth rate of the newly planted turfgrasses was higher on the amended compared to the control profiles. Finally, the results will be discussed in respect to water conservation strategies for humid and arid climate conditions.

Keywords: subsurface drip irrigation, soil amendment, turfgrass, climate chamber experiments, HYDRUS simulations