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Evolution of the spherical cavity radius generated around a subsurface emitter

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Subsurface drip irrigation (SDI) has been spreading all over the world in the last decades due to its advantages such as, the reduction in water application (evaporation is decreased) and the potential of using wastewater. Nevertheless, it also has the disadvantage that emitters' flow rate can be affected by soil hydraulic properties since a positive pressure hs develops at the buried emitter outlet, where a spherical cavity is supposed to be formed.

In steady conditions, hs can be related to the soil hydraulic properties (saturated hydraulic conductivity and the parameter of the unsaturated hydraulic conductivity of Gardner's equation), the emitter flow rate q and the spherical cavity radius r0.

hs is very sensitive to r0. In most of the studies, r0 is considered constant with independence from emitter flow rate although no experimental observations have been yet reported regarding the formation of such spherical cavity around emitter outlet. Values of r0 use to be estimated.

Our previous studies have shown a linear relation between q and estimated r0. However, it is expected that, for higher values of q, the linearity would disappear and would reach a steady value.

In this work, we have observed and measured r0 for various emitter discharges in tests carried out in uniform soils with the purpose to asses the validity of previous relations established between hs and q and to validate the theory of water movement in subsurface drip irrigation.