Modelling,soil water distribution under Moistube irrigation for cowpea (VIGNA unguiculata(L.) Walp.) crop(dagger)

ABSTRACT
Moistube irrigation (MTI) is a type of technology which uses a semipermeable membrane to emit water continuously in response to soil water potential and applied pressure. Soil water dynamics under MTI incorporating plant water uptake have not been studied. Therefore, this study aimed at determining the soil water distribution under MTI, using cowpea as a reference crop. The effect of Moistube placement depth on the soil water dynamics under MTI was also determined. The experiment was carried out in tunnels with MTI and subsurface drip irrigation (SDI) as a control. The HYDRUS 2D/3D model was calibrated and thereafter used to simulate soil water dynamics for different placement depths. The soil water content above the Moistube/drip lateral was higher under SDI than MTI, while the lateral movement of water was similar for both irrigation types. The simulated soil water contents closely matched (coefficient of determination [R-2] >= 0.57, root mean square error [RMSE] <= 0.029 cm(3)cm(-3), normalized root mean square error [NRMSE] <= 14.7% and efficiency [EF] >= 0.20) the observed values for both MTI and SDI. This showed that HYDRUS 2D/3D could be used to simulate water dynamics of irrigated cowpea. There was no significant difference (p> .05) between the root water uptake (RWU) in SDI and MTI. The Moistube placement depth did not significantly affect (p> .05) the RWU in loam soil but increased with increased placement depth in clay soil. The optimum placement depth of Moistube laterals for cowpea was 15 cm in loam and 20 cm in clay. This study forms the basis for design of MTI in terms of optimum placement depths for cowpea grown in loam and clay soils. (c) 2020 John Wiley & Sons, Ltd.

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