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“Bridging the gap between increasing knowledge and decreasing resources”

Low Pressure Sub-Surface Irrigation Technology for an Optimal Irrigation Management - An Auto-regulative Membrane Pipe

ANDREA DÜHRKOOP¹, ABDELAALI BENCHEIKH², TAREK ABDELMONEIM OUAMANE², AHMED MADJED DJOUDI², OLIVER HENSEL¹

¹*University of Kassel, Agricultural Engineering, Germany*

²*Scientific and Technical Research Center for Arid Regions (CRSTRA), Algeria*

Abstract

This paper presents analysis and results of a joint research project between the Technical and Scientific Research Center on Arid Regions (CRSTRA) in Biskra (Algeria) and the Institute for Agricultural Engineering of the Kassel University (Germany). An auto-regulative membrane pipe buried beneath the soil surface was tested in greenhouse trials at the experimental station El Outaya near Biskra (Algeria) where water is scarce, with annual rainfall varying between 70 and 120 mm. The new membrane irrigation system works at low pressure to allow an auto-regulative functioning of the pipe based on the close interaction between the pipe, the soil and the plant. When the soil is dry the water supply by the pipes is high because of the high soil water tension, when the soil humidity rises the soil water tension will decrease, subsequently water flow will decrease. To sustain a constant system head a mechanical float valve has to be installed in the water supply tank. This design ensures a continuous water filling of the pipe. The irrigation method works automatically and independent of energy supply.

To compare the new membrane system with the drip irrigation technique two greenhouses were equipped with drip irrigation and the membrane pipes respectively. The greenhouses were divided into different plots and planted with tomatoes. Two types of irrigation water were tested, surface water from a local dam and groundwater with higher salinity. Results for the membrane irrigation show a water saving potential of 70%. In this experiment the groundwater use had no impact on the soil structure, tomato crops indicate better parameter (plant height, fruit diameter and weight) compared to the drip plots. Further less diseases and weeds appeared.

For analysing the longevity and suitability of the membrane pipe material the experiment was running for two years. Results show that the pipes where groundwater was applied can be used for several years and the pipes where dam water was used showed clogging after each year. This clogging could be eliminated with a mix of detergent and water. After that procedure the pipe can be installed again.

Keywords: Auto-regulative, irrigation, subsurface irrigation, water saving