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Generation of a Uniform Dripping for a Micro-Irrigation Emitter

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Abstract

Worldwide water is becoming an increasingly scarce resource, imposing the need on irrigated agriculture to optimize water use efficiency. Micro-irrigation is the most water-saving irrigation technique, as water is applied locally. Among the several micro-irrigation techniques especially sub-surface drip-irrigation has a high water-saving potential, as water is directly applied to the root-zone, thus virtually no evaporative losses occur.

Uniformity of irrigation-water distribution is a key-issue in designing water-saving micro-irrigation schemes, as a non-uniform application causes leaching losses. As micro-irrigation systems operate at a low-pressure (around 1.0 bar) in undulating areas even small level differences may cause important distortions of uniformity. Therefore, a variety of methods for pressure compensation have been developed, generally on the base of a plastic membrane in a two-chamber emitter unit, which increases or decreases the flow-diameter according to incoming pressure. However, due to inhomogeneous production, the uniformity seldomly lays above 95 % and for cheap products even below 70 %, which is unacceptable according to both ASAE standards and ISO-norm.

At Hohenheim University an interrupting emitter is being tested, which can be operated independent of the incoming pressure. A weight switch regulates the filling height of a reserve chamber from where the water drips out with a constant discharge rate. In order to guarantee a constant outflow the shape and the width of the orifice has to be adequate. The common equation to calculate the outflow of a container approximates reality by coefficients for material and typical outlet shapes. The dripping is not well described by this formula. Therefore a variety of different orifices for such drip outlet openings have been tested on their constant outflow and corresponding coefficients for the shape of the openings have been determined. For the application in the dripper that openings were identified, for which least outflow variation on changing water levels occurs.

Keywords: Dripper, gravity, outflow, pressure-compensation

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