A SIMULATION MODEL FOR PREDICTING WATER DISTRIBUTION UNDER SELF COMPENSATING GATED PIPE IRRIGATION TECHNIQUE FOR SMALL HOLDINGS

By

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B.Sc. Agric. Sc. (Agric. Engineering), Cairo University, 2002
M.Sc. Agric. Sc. (Agric. Mechanization), Ain Shams University, 2009

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Approval Sheet

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ABSTRACT

Ahmed Faris Emam El-Shafie: "A Simulation Model for Predicting Water Distribution under Self Compensating Gated Pipe Irrigation Technique for Small Holdings". Unpublished Doctor of Philosophy Dissertation. University of Ain Shams, Faculty of Agriculture, Department of Agricultural Engineering, 2015.

The study aimed to build up and validate **GPIMOD** simulation model to predict water distribution under traditional and modified (SCGO) gated pipe irrigation technique. Another main objective was to study the hydraulic performance analysis of self-compensating gated outlet (SCGO) 50 mm outlet diameter. As well as, field evaluation for modified (SCGO) gated pipe irrigation technique compared with traditional. It was carried out using two P.V.C pipe lines of 110 mm diameter and 50 mm outlet diameter. The effect of both irrigation technique on soil moisture content, crop yield, dry matter and water productivity of potato were studied under three outlet spacings (0.7, 1.0 and 1.5 m) during two successive seasons 2011-2012 and 202-2013 on clay loam soil at Shalakan Farm, Faculty of Agricultural, Ain Shams University, Kalubia, Egypt. The field experimental results were used in calibration and validation of the SALTMED simulation model.

The discharge l s^{-1} was measured for (SCGO) under different operating pressure in rang (0.08-0.28 bar). The gate discharge under different operating pressure kept around 0.52 l s^{-1} for 50 mm, outlet diameter. The discharge l s^{-1} was measured for traditional and modified gated pipe at different gate spacings of 0.7, 1.0 1.5 m between gates, in the field test before the first growing season. In general there was a slight variation in discharge between first and last gate for modified gated pipe under 0.7, 1.0 and 1.5 m outlet spacings.

As the data indicated a slight discharge variation between all gates under 1.5 m spacing there was more discharge variation under 0.7, 1.0 m gate spacings for traditional gated pipe.

GPIMOD model was validated for discharge along pipeline for traditional and modified gated pipe under 0.7, 1.0 and 1.5 m gate spacings. The data gave a good indication of the model's ability to predict and estimate the water flow characteristics from the gated pipe. The high values of the coefficient of determination R^2 reflected a very good agreement between the model and observed values.

SALTMED is considered as a holistic model to simulate with good accuracy the growth of potato over clay loam soil in Egypt. The **SALTMED** model proved its ability to predict soil moisture availability, yield, water productivity and total dry matter for two growing seasons under gated pipe irrigation.

The spacings between gates has an effect on potato yield under modified gated pipe irrigation. The gate spacing of 1.5 m had relatively higher yield than 0.7 and 1.0 m spacings and water productivity in both type of gated pipe. The modified gated pipe under all gate spacings gave higher yield and water productivity in comparison with traditional gated pipe for the two seasons.

Generally, using simulation models is a good tool to estimate the expected net return of irrigation, as well as using **GPIMOD** and **SALTMED** models are acceptable for predicting water distribution for gated pipes irrigation under clay loam soil in Egypt to maximize irrigation efficiency and water productivity.

Keywords: simulation model, self-compensating, gated pipe, water productivity, yield, potato.

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