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Modelling the Soil Water - Yield of *Amaranthus cruentus* Grown under Drip and Sprinkler Irrigation Systems

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Abstract

Spinach (*Amaranthus cruentus*) is the most widely cultivated leafy vegetable of the humid tropics because of its nutritional and medicinal values. The aim of the study was to use soil moisture estimates in modelling the yield of *Amaranthus cruentus* grown under two irrigation systems (sprinkler and drip systems) and three (3) water stress levels (severe stress, medium stress and no stress) as determined by tensiometer threshold values. Soil moisture content at depths 10, 20, 30, 40, and 50 cm were monitored weekly with the aid of soil moisture metre (Echo Probe). Soil moisture calibration curve showed high correlation coefficients ($R^2 = 0.87$, $P < 0.05$) between the moisture stored in the soil and the moisture tension within the soil layers. It was generally observed that the moisture tension within the soil layers represents adequately well the wetness of the soil. A high correlation coefficient ($R^2 = 0.94$) was observed between model output and the measured value. The difference in soil moisture tension at the three soil depths considered is highly significant at P ($\alpha = 0.05$) level. Non-linear parametric model of the form $\alpha 1 * m^2 + \alpha 2 * m - \alpha 3$ was formulated for the simulation of soil moisture levels at different tensiometer readings. The dependent variables of model are the *Amaranthus cruentus* yield and the independent variables are the terminal soil moisture levels. Both linear and non-linear regressions were used to simulate the yield of the crop. The yield of *Amaranthus cruentus* was highly correlated ($R^2 = 0.74$, $P < 0.05$) to available soil moisture in the sprinkler plot. However, the coefficient of correlation of yield to soil moisture was higher ($R^2 = 0.79$, $P < 0.05$).

Keywords: Drip, irrigation, soil moisture, sprinkler, yield

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