Abstract

One of the essential information which is necessary to design an efficient irrigation system is knowledge of the characteristics of water infiltration into the soil. Determining of spatial variability in the soil infiltration process despite of complications, is one of the most important prerequisites to achieve precision agriculture. In recent years, scaling has been used to express the dynamics of soil water and to reduce the required measurements. In this study, a scaling method for predicting infiltration is presented that calculates infiltration properties in real time using the minimum field data (i.e. a reference infiltration curve and a measurement time) and for the different kind of soils. In the new method, the scale factor (Fs) for each infiltration equation was equaled to the infiltration depth after the specified time (ts). The data were achieved from 22 infiltration experiments by using double ring in campus filed of university of Zabol. The root mean square error (RMSE), coefficient of determination (R^2) and mean error deviation (MBE) were used to evaluate the accuracy of the proposed method in order to estimating cumulative infiltration. A new method was adopted to scaling Philip's equation and was compared with previous Philip equation scaling methods as sorptivity coefficient (α_S), transmissivity coefficient (α_A), the optimal factor obtained using the least squares error (α_{opt}), geometric, arithmetic and harmonic mean α_S and α_A among others. As results showed, scaling using F_s has the best results (R^2=0.99, MBE = 0.0006 and RMSE=0.001) compared to other Philip equation scaling methods. Furthermore, F_s accounted for the highest correlation coefficient R^2=0.96 with α_{opt}. In contrast with other infiltration equation scaling methods, the reference curve in the proposed method is optional and each infiltration equation can be selected as the reference curve. The method presented in this study was used to nineteen equations of intake families presented in SIRMOD. The results of surface irrigation (border) evaluation based on application efficiency, deep percolation and runoff percentage showed that there is no difference between the use of the cumulative intake families' equation and intake families curve obtained from the scaling process.

Keywords: Infiltration, spatial variability, Kostiakov- Lewis Equation , Philip Equation, Scaling.

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