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Root Water Uptake Research under Different Climatic Conditions

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Water resources play an important role in ecological balance and agricultural development. For optimal use of irrigation water, a better understanding of water uptake by roots is essential. To represent root water uptake, microscopic as well as macroscopic models are used. . A detailed review of various root uptake models is available in Shankar et al. [1]. Use of the microscopic models lead to calibration of a large number of model parameters and thus, their application to the field scale is constrained. On the other hand, macroscopic models are simple to use as the number of parameters needing calibration is greatly reduced.

Macroscopic models assume a pattern of root water uptake. Without due consideration to the root density variation with depth, there were attempts to assume simplified patterns of root water uptake along the length. These included constant as well as linear abstraction along the root zone depth. As the variation of root density is neither constant nor does it exhibit a linear variation across the root zone, the water uptake by roots is likely to be complex. In view of this, a non-linear root water uptake model was conceptualized at IIT Roorkee in 1996 [2]. In recent literature, this model is referred to as O-R model.

Subsequent to the development of O-R model, there was a need to assess its utility under different climatic conditions. This included collection of data on soil moisture within the root zone for different plants under different climatic conditions. The field experiments were carried out under controlled conditions at IIT Roorkee, India. The efficacy of O-R model over other non-linear and logarithmic root uptake models was established using field data [3]. Since reference crop evapotranspiration is one of the important parameters involved in development, validation and detailed investigations of the root uptake research, various models to compute irrigated reference evapotranspiration have been compared in a study by Kumar et al. [4]. Further to substantiate the non-linearity in root water uptake an empirical model for non-linear root uptake parameter β of O-R model was developed and validated using field crop and moisture uptake data [5]. O-R model was further validated by Kumar et al. [6] for stratified soils. In addition to the efficacy of non-linear root uptake parameter β of O-R model, another parameter α was investigated in their study by Shankar et al. [7], which suggests further work on this parameter. The work on prediction of root water uptake also involves several close collaborations with international institutes, namely McGill University, Canada in 2007-8, Purdue University, USA in 2009-12, and Heriot-Watt University and Cranfield University from U.K. (2012-continuing), in addition to several Institutes from India.

As an outcome of several studies, a model has been developed to simulate the one-dimensional vertical flow of moisture through unsaturated zone using fully implicit finite difference approximation of Richards equation with the sink term given by O-R model. The solution of the model is obtained by adopting appropriate boundary conditions. The field data required for checking the efficacy of model at various agro-climatic conditions includes collection of meteorological data, soil moisture measurement, soil factors, plant factors, salinity measurement, etc. In the present ongoing research in this direction experimental sites are located in different states including U.P., Uttrakhand, Haryana and Himachal Pradesh.

At this stage, a preliminary model for variation of non-linearity parameter in O-R model is ready and its further evaluation and refinement is in progress. The model holds promise for application in scheduling of irrigation and is expected to lead to optimum use of irrigation water, which may be helpful to drought stressed regions.

References

1. Shankar V, Hari Prasad KS, Ojha CSP, Govindaraju RS (2013) Optimizing Water Use in Irrigation – A review. Journal of the Indian Institute of Science 93: 209-226.
2. Ojha CSP, Rai AK (1996) Nonlinear root water uptake model. J of Irrig Drain Engg 122: 198–202.
3. Ojha CSP, Prasad KS, Shankar V, Madramootoo CA (2009) Evaluation of a non-linear root water uptake model. ASCE Journal of Irrigation & Drainage 135: 303-312.
4. Kumar R, Jat KM, Shankar V (2012) Methods to estimate irrigated reference crop evapotranspiration- A review. International Journal of Water Science & Technology 66: 525–535.
5. Shankar V, Prasad KS, Ojha CSP, Govindraju RS (2012) Model for Non-Linear Root Water Uptake parameter. ASCE Journal of Irrigation and Drainage Engineering 138: 905-917.
6. Kumar R, Shankar V, Jat MK (2013) Efficacy of Nonlinear Root Water Uptake Model for Multi-Layer Crop Root Zone. ASCE Journal of Irrigation and Drainage.
7. Shankar V, Govindaraju RS, Ojha CSP, Hari Prasad KS (2013) A non-dimensional relationship for root water uptake parameter. ASCE Journal of Irrigation and Drainage.

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