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A Methodology for Estimation of Wetting Front Length and Potential Recharge under Variable Depth of Ponding

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Abstract: A methodology for determining the length of advancement of wetting front and potential groundwater recharge under variable depth of ponding is presented. The methodology employs the approximated Green-Ampt equation, which has been derived by Ali et al. The methodology provides no restrictions to infiltration time period, depth and nature of ponding and soil types. Performance of the proposed methodology has been compared with Richards and Warrick *et al* models using the published laboratory and field experimental data. The quantitative statistics namely; coefficient of determination (R), index of agreement (D) and percent bias (PB) are utilized to assess the performance of the proposed methodology. Results show that the proposed methodology worked with same potential as the numerically rigorous solution of the Richards and implicit solution of the Warrick *et al.* models. The quantitative statistics; R^2 and D between the models estimates are approached unity. Analysed results shows that the proposed methodology for estimation of advancement of wetting front, cumulative potential recharge and rate of potential recharge has a maximum PB of -12.98, -14.33, and 12.62%, respectively in comparison to the Warrick *et al.* and the Richards models, which is within permissible limit of 25%. The derived methodology is also successfully applied with 3 years (2006-08) field data from a small recharge ponds located over a watershed in the semi-arid region of India. The response of the methodology is found most promising for simulating the length of advancement of wetting front and corresponding potential groundwater recharge from small recharge ponds. Results of the comparative and field studies of the proposed methodology under variable depth of ponding over variety of soils demonstrated the capability of the proposed methodology for their field uses to design artificial groundwater recharging facilities, irrigation systems and resolving solute transport problems.

Keywords: Richards, proposed methodology, Warrick et al, variable depth, potential recharge, wetting front