Accurate estimation of infiltration is a key input in watershed management. It plays very important role in planning and design of various water resources projects including design of dams. In addition soil infiltration characteristics are helpful for runoff estimation and irrigation management.

The study on estimation of infiltration characteristics of vertisols in Kopargaon region (M.S.) presented here comprises of two parts: i) measurement of field infiltration using double ring infiltrometer and fitting Kostiakov and modified Kostiakov models to the observed data; and ii) estimation of Kostiakov infiltration model parameters using, artificial neural network (ANN) using various soil properties with an objective of developing alternate procedure for finding the infiltration characteristic of clay soil and subsequently, determination of the cumulative infiltration.

Conventionally to derive the infiltration model parameters and infiltration characteristics of clay soil the investigators have to rely on field infiltration measurements. However, this study presented an ANN based approach for prediction of model parameters using various soil properties, the data of which is available from various data sources thus obviating the need of field experimentation.

The specific conclusions based on results and discussions are summarized below. Based on investigations carried out on clay soil, it was found that the basic infiltration rate varied between 0.15 to 6.40 cm/hr. The average steady infiltration rate was observed as minimum 0.245 cm/hr for land with grape cover and maximum 4.94 cm/hr for land with Bajra cover. The cumulative infiltration depth was 4.36cm for land with grape cover and maximum cumulative depth was observed to be 45.97cm for land with sugarcane cover.

The soil physical properties, moisture content, electrical conductivity, bulk density and soil texture affects the rate of infiltration, cumulative infiltration depths and the amounts of infiltration model parameters too. The soil texture in the study area is predominantly clay with maximum 67.75% clay. The minimum and maximum moisture content was observed to be 15.81 % and 36.96 % respectively; which show wide variation in moisture content. The
average bulk density was observed to be 1.73 gm/cm³ with minimum value of 1.57 gm/cm³ and maximum bulk density of 1.95 gm/cm³. Average electrical conductivity was 66.30µS/cm. The electrical conductivity value is higher as the soil is clay which matches with the studies by Cristine et al., (1997) and; Zagelin et al., (1989). The rate of infiltration of sugarcane for summer was observed twice the infiltration rate in winter. Also for land with weed cover the infiltration rate in summer was about 1.5 times that in winter, this reflects effect of various soil properties.

The Kostiakov and modified Kostiakov model parameters were estimated using field data and were used for determination of cumulative infiltration depths. It was found from graphical representation that, the field measured and model estimated cumulative infiltration depths matched closely. Kostiakov model provides better fit for initial as well as later stage of infiltration for the clay soil locally called as black cotton soil. The trends of absolute mean differences between field observed and model estimated cumulative infiltration depths suggest that, the Kostiakov and modified Kostiakov models has closer agreement with the field measured data.

In the second part of the study the feedforward backpropagation ANN was employed for evaluation of Kostiakov infiltration model parameters ‘a’ and ‘b’ for the clay soil. Three different ANN models were developed based on various input combinations, these models were named as ANN-1, ANN-2 and ANN-3. For ANN-1 model the input parameters used were four soil properties, similarly for ANN-2 model six soil properties, while for ANN-3 model all the eight soil properties under considerations were used as input data. The ANN approach was found to be more accurate in predicting Kostiakov infiltration model parameters. The ANN architecture developed having 12 neurons in hidden layer gave better results than other two models. The results of ANN-3 model are presented in table below.

<table>
<thead>
<tr>
<th>Table: Performance Evaluation Results of ANN-3 Model</th>
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<td><strong>ANN Model</strong></td>
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<td>ANN-3 (8-12-2)</td>
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The R² value is closer to unity it shows high accordance between estimated and ANN simulated values. The MAE and RMSE which are indicative of error index are very small.
Therefore the ANN-3 model had the best performance in predicting the Kostiakov model parameters value. The average N.S. efficiency is more than 95%, this indicates very good correlation among estimated and predicted values. All these performance assessment parameters indicated that ANN is satisfactory for evaluation of infiltration model parameters in clay soil.

The ANN-3 model with maximum inputs simulated model parameters more accurately, which had good accordance with model estimated parameters of the clay soil. The trained ANN model was able to satisfactory predict the required model parameters. Moreover to evaluate the predictive capabilities of ANN model the cumulative infiltration depths were estimated and compared graphically, which had overall good agreement. The present study demonstrated the application of ANN approach for prediction of infiltration model parameters and evaluation of infiltration characteristics of clay soil.

Hence, the use of soil properties as input to the ANN so as to get the Kostiakov model parameters is demonstrated successfully. This Kostiakov equation can subsequently be employed to get the cumulative infiltration or instantaneous infiltration at any time interval thus eliminating the need of cumbersome and time consuming experimentation using traditional techniques.