ESTIMATION OF INFILTRATION RATE FOR VARIOUS LAND COVERS

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Abstract - Infiltration is the process of penetration of water into the ground surface and the intensity of this process is known as infiltration rate. The infiltration rate is expressed in term of volume of water poured per ground surface per unit of time. For investigation of soil erosion, surface runoff & ground water recharge study of infiltration rate is necessary. In this work attempt was made to determine infiltration rates of soil under two land cover conditions i.e. barren and cultivated and to compare validity of different infiltration equations viz. Kostiakov, modified Kostiakov, Horton and Philip. The experiment on various land covers such as cultivated, barren lands were conducted in **Dr**. **Panjabrao Deshmukh Krishi Vidhyapeeth, District Nagpur, of Maharashtra region.** Observations were taken by using double ring infiltrometer from month of October. In this study we found that rate of infiltration is more for cultivated land than barren land.
KEY WORDS: Infiltration, Infiltration rate, Infiltration models, land covers.

INTRODUCTION

Infiltration is the movement of water into the soil from the surface. The water is driven into the porous soil by force of gravity and capillary attraction. First the water wets soil grains and then the extra water moves down due to resulting gravitational force. The rate at which a given soil can absorb water at given time is called infiltration rate and it depends on soil characteristics such as soil texture, hydraulic conductivity, soil structure, vegetation cover etc. The infiltration plays an important role in generation of runoff volume, if infiltration rate of given soil is less than intensity of rainfall then it results in either accumulation of water on soil surface or in runoff. The different soil conditions affect the soil infiltration rate. Compacted soils due to movement of agricultural machines have a low infiltration rate which is prone to runoff generation.

In the present study the constant infiltration rates of different soils under different soil conditions were calculated by double ring infiltrometer method, and compared with calculated values from Kostiakov, Modified Kostiakov, Horton's and Green-Ampt infiltration models. And assessment of the suitability of different models for estimation of infiltration rate of particular soil under particular soil condition was carried out with correlation coefficient and standard error as tools.

OBJECTIVE

The primary objective of this experimental module is to conduct a series of infiltration experiments to quantify soil intake properties using measurement devices know as infiltrometer. The present infiltration study is undertaken with the following main objectives:

i) To evaluate the infiltration capacity of the soil and to evaluate the reliability of infiltration tests,
ii) To determine the infiltration rate for month of October.

iii) To study the suitability and validity of various commonly used infiltration equations,

iv) To determine comparative difference among infiltration of various land covers.

MEASUREMENT OF INFILTRATION RATES:

Double ring infiltrometer method was used formeasurement of infiltration rates at all the sites. Inthis two concentric rings were used with 30cm deep,and diameter of 30cm for inner ring and 60cm forouter ring. The rings were driven at about 15cm deepin soil by using falling weight type hammer strikingon a wooden plank placed on top of ring uniformlywithout or undue disturbance to soil surface.Water was poured into the rings to maintain depth of 5 cm and the quantity of water was added to maintain this depth at regular time interval of 5,10,20,30 min etc. up to getting a constant infiltration rate.The observations for infiltration rate were carried out with a scale and stopwatch etc.

MATHEMATICAL MODELS FOR INFILTERATION

The following infiltration models were assessed for finding best fitting model to observed field infiltration rate data-

a) *HORTON'S MODEL*:

$f = fc + (fo - fc)\, e^{-kt}$

Where
f is infiltration capacity at any time t.
fc is final steady state infiltration capacity.
fo is initial infiltration capacity.
k Horton's constant representing rate of decrease in infiltration capacity.
t is time in hours.

b) *KOSTIAKOV MODEL*:

$F=at^{b}$

where
f is cumulative infiltration at any time t.
t is time in min.
a and b are constants

c) GREEN – AMPT MODEL:

$f=m+\frac{n}{F}$

Where
f is infiltration capacity.
F is cumulative infiltration.
m and n are Green - Ampt parameters of infiltration.

D) PHILIP'S MODEL:

$f=\frac{1}{2}st^{-0.5}+K$

Where
f is infiltration capacity.
t is time in min.
s and K are Philip's constant

RESULTS AND DISCUSSION:

Infiltration models for Barren land

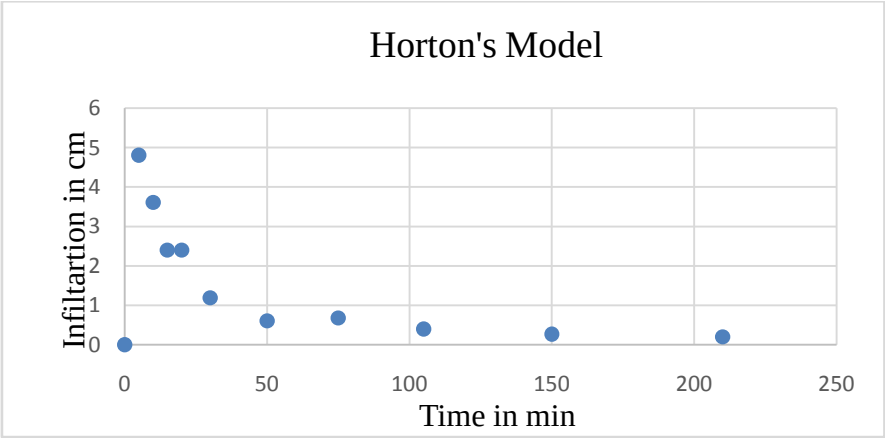
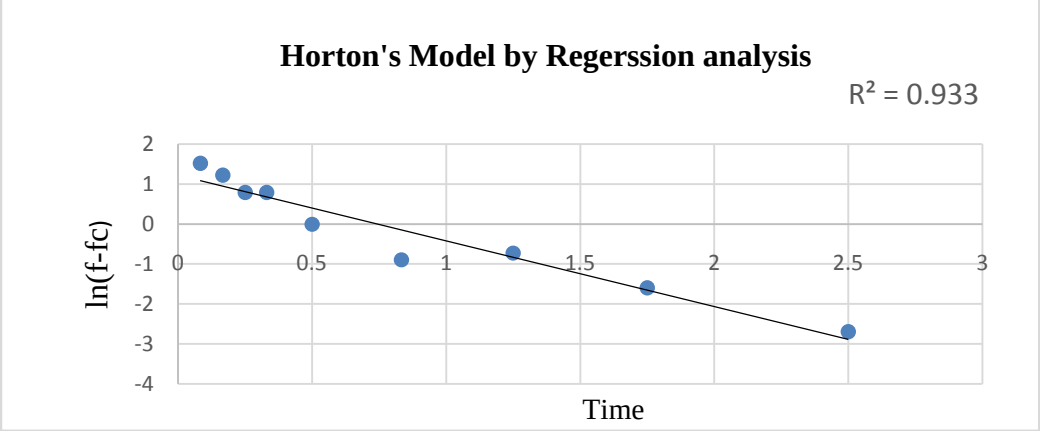


Fig no 1



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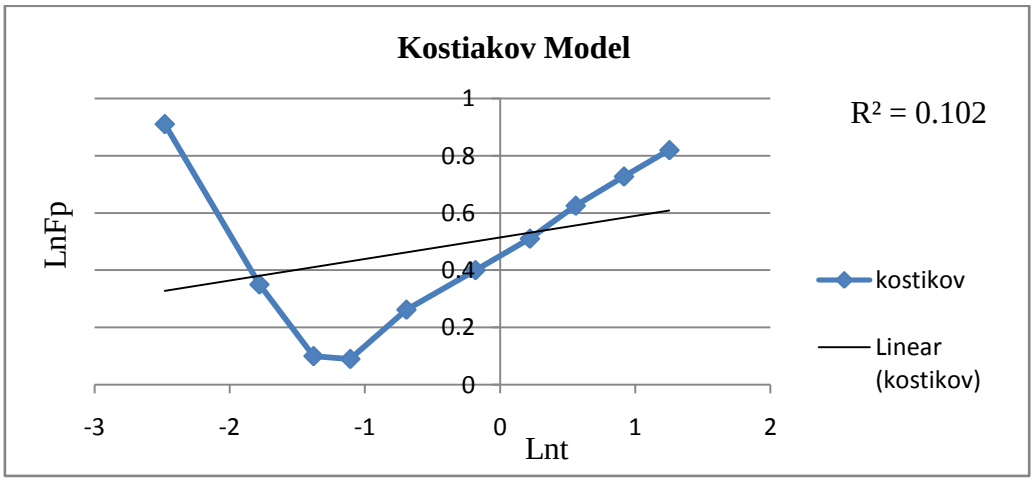

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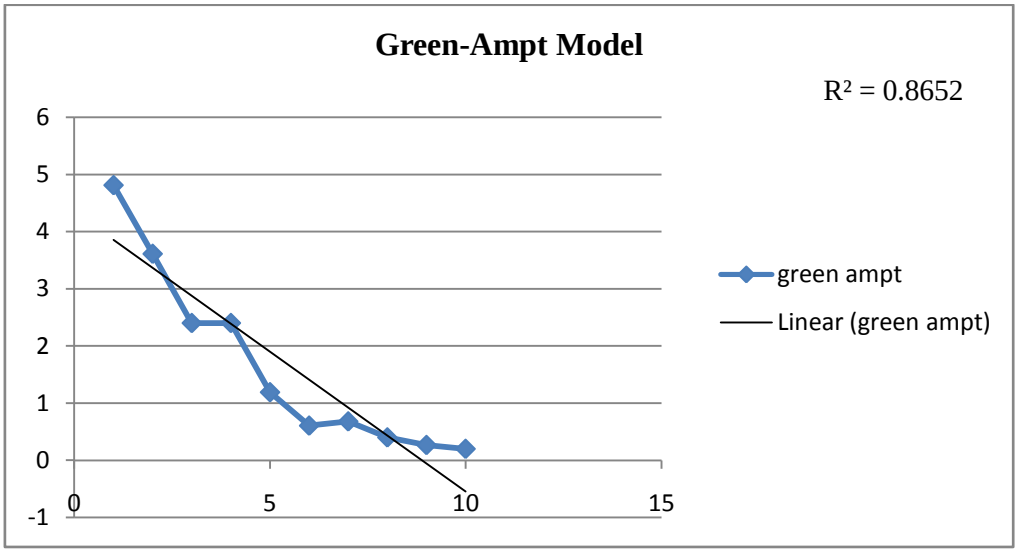

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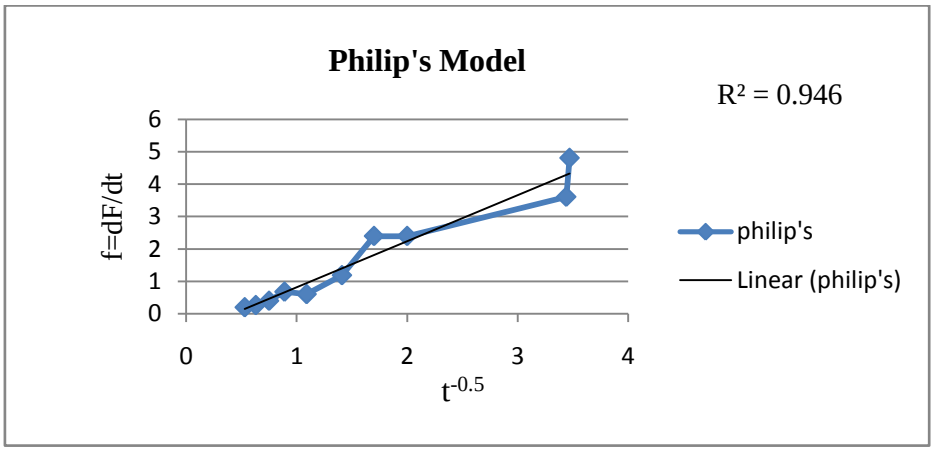

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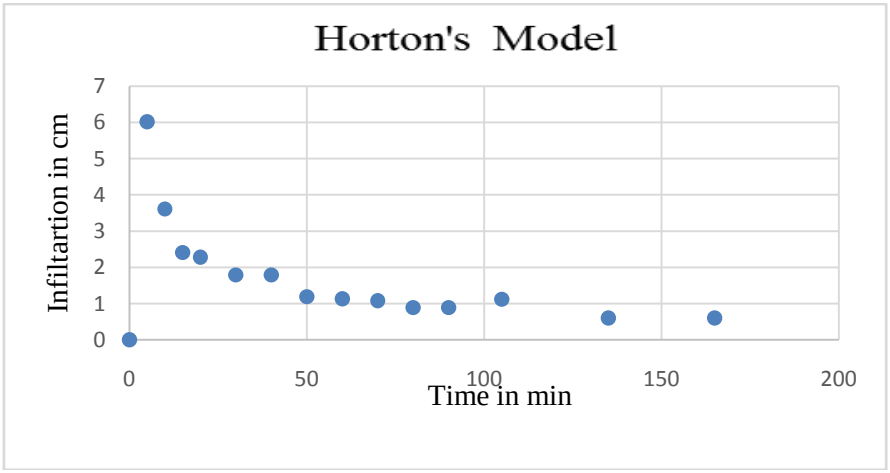
Infiltration models for Cultivated land



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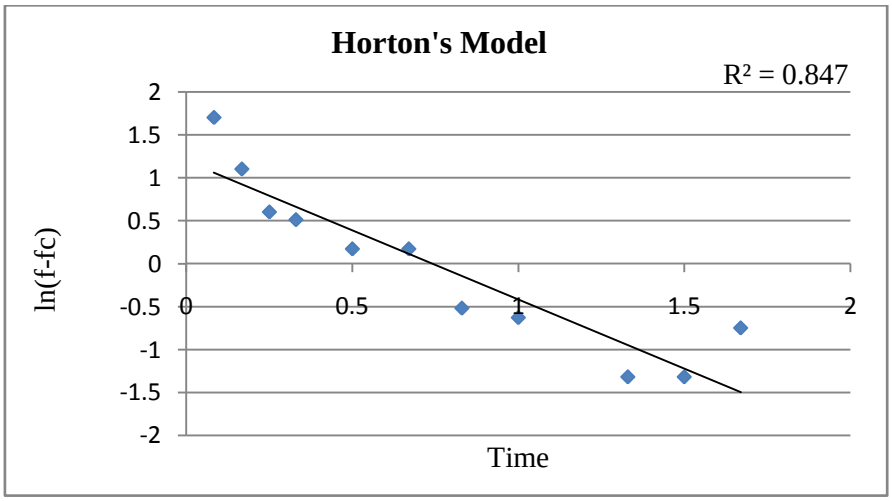

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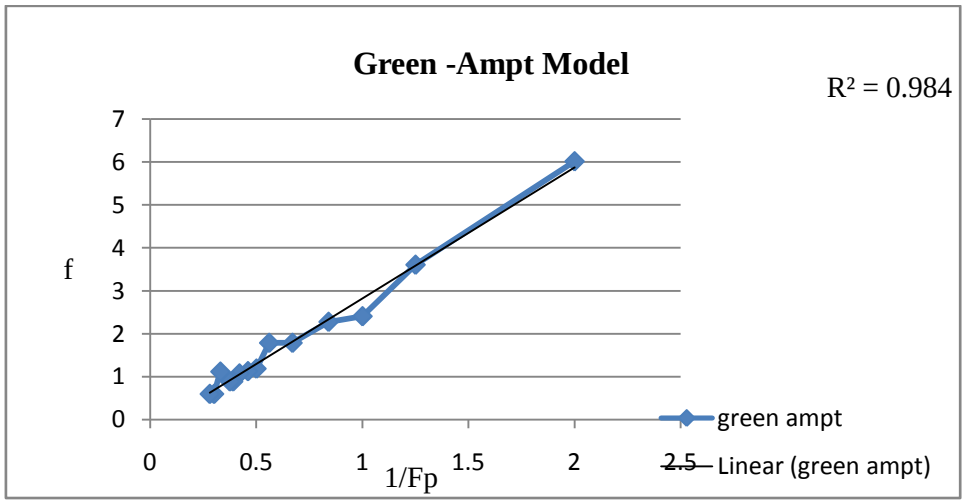

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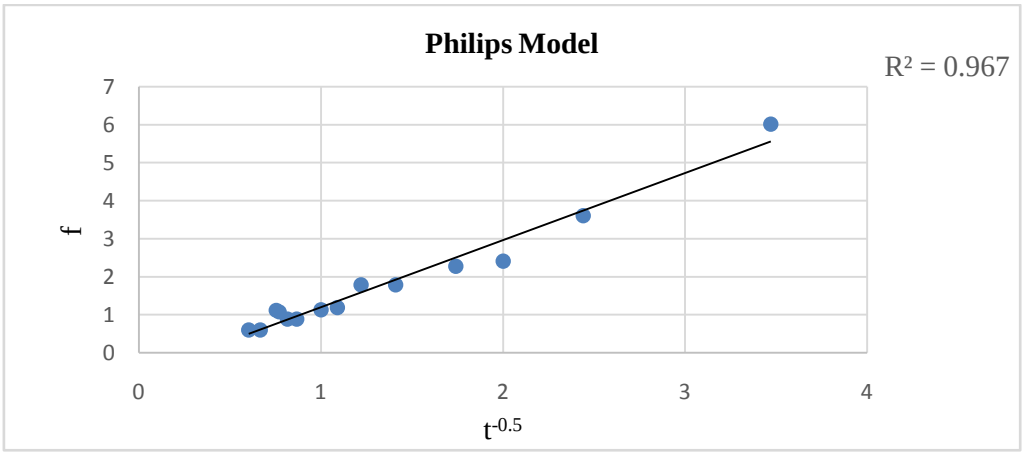

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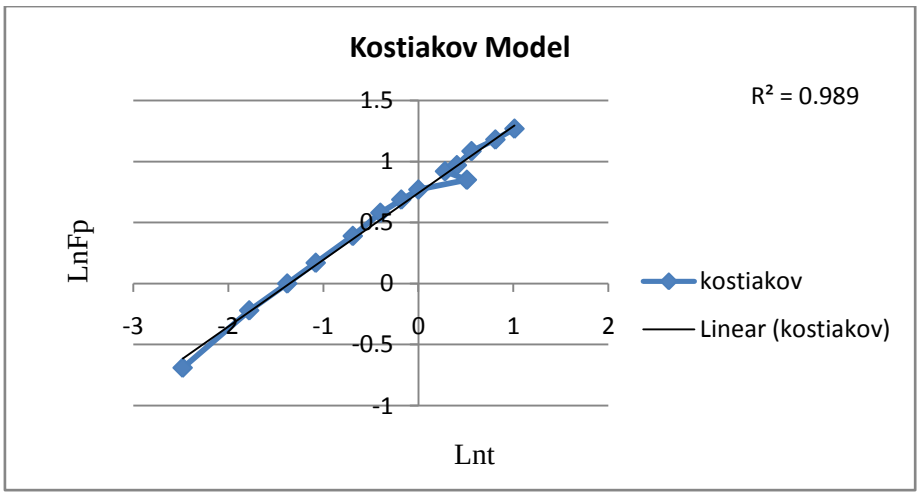

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CONCLUSION:

1. Data from infiltrometer experiments were processed using Horton's, Philip's, Kostiakov and Green-Ampt Models.

2. Infiltration rate is found to be more for cultivated land

3. For barren and cultivated land 'R' (regression value) are found out from above graph. From regression value it is concluded that for Barren land coverPhilip's Model is best suited and for cultivated Kostiakov Model is best suited.

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