https://doi.org/10.29321/MAJ.10.A02073

Madras Agric. J. 76 (12) : 666-670 December. 1989

RAINFALL EROSION INDEX OF COIMBATORE REGION

S.SANTHA BASU[1], O.PADMAKUMARI[2], R.K.SIVANAPPAN[3] and M.GANDHI[4]
Water Technology Centre,
Tamil Nadu Agricultural University, Coimbatore 641 003.

ABSTRACT

From the rainfall records of the Meteorological Observatory at the Tamil Nadu Agricultural University for the years 1938 to 1983, the kinetic energy of the storms was calculated using the method suggested by Wischmeier (1959). From the kinetic energy and the intensity of rainfall, the erosion index for each month and annual erosion index values were worked out. Monthwise and seasonwise erosion index values were analysed and conclusions were drawn based on the erosion index values of Coimbatore region in India.

KEY WORDS: Erosion index, Kinetic energy of storms, Rainfall intensity.

Erosion rate determination of an agricultural field involves the combination of numerous physical and management variables. The physical measurement of soil loss for each of this large number of combination of these variables under field condition is not feasible. To arrive at the erosion rate easily for many localities and conditions, soil loss equations were developed. The Universal Soil Loss Equation (USLE) developed at the National Runoff and Soil Loss Data Centre in 1954 by the Science and Education Administration, USA and Purdue University, is an erosion model designed to predict the long time average soil losses in run off from specific field areas in specified cropping and management systems. With appropriate selection of its factor values, the equation can be used to compute the average soil loss for a multiple crop system for a particular crop year in a rotation or for a particular crop stage period within a crop year. The numerical values for each of the six factors of the USLE were derived from analysis

[1]Assistant Professor, [2]Associate Professor and [3]Retired Director, Water Technology Centre, Tamil Nadu Agricultural University, Coimbatore-3.
[4]Executive Engineer (Agri. Engg.), Erode

of the assembled research data for USA. As far as India is concerned, now only studies have been taken up to evolve the factors for Indian conditions. In Tamil Nadu, as a first step, the erosion study was initiated in Coimbatore district by the Tamil Nadu Agricultural University under PL 480, USA funds. Among the six factors of the USLE, this paper illustrates the analysis taken up for the Rainfall factor (R).

The numerical value used for R in the Soil Loss Equation must quantify the raindrop impact effect and must also provide relative information on the amount and rate of runoff likely to be associated with rain. The rainfall erosion index derived by Wischmeier (1959) appears to meet these requirements better than any other of the many rainfall parameters and groups of parameters tested against the assembled plot data. It is found that when factors other than rainfall is held constant, storm soil losses from cultivated fields are directly proportional to rainstorm parameter identified as Erosivity index (EI). Wischmeier (1959) found that one hundredth of the products of the kinetic energy of the storm (KE) and the 30 minutes intensity (I 30) is the most reliable single estimate of rainfall erosion potential and was termed as EI_{30}. Annual total of storm EI_{30} value is referred to as the rainfall erosion index. In India, at Dehra Dun, Coimbatore and Ootacamund, attempts have been made to find out correlations between EI values and the soil loss from bare plots. The results indicated that EI_{30} values gave a better correlation ($r = 0.74$) with soil loss in Dehra Dun (Rambabu **et al.**, 1970). At Coimbatore, highly significant correlation coefficients ($r = 0.89$ to $r = 0.96$ for varying slopes) were noticed between the product of kinetic energy and maximum 30 mintues intensity (EI_{30}) with soil loss (Balasubramanian and Sivanappan, 1981). However, it did not give a correlation at Ootacamund, where EI_5 value proved better (Das **et al.**, 1967). The relation of soil loss to EI parameter is linear and its individual storm values are directly additive. The sum of the storm EI values for a given period is a numerical measure of the erosive potential of the rainfall, within that period. The average annual total of the storm EI values in a particular locality is the rainfall erosion index for that locality. That is known as Rainfall Factor 'R'.

Table 1. Average monthly and seasonal erosion index (EI) (Average of 45 year)

Month	Monthly EI	Season	Seasonal EI
January	4.89	Winter (January and February)	7.75
February	2.86		
March	10.62	Summer (March-May)	72.79
April	29.44		
May	32.73		
June	7.62	Southwest Monsoon (June-September)	48.08
July	7.76		
August	5.63		
September	27.07		
October	109.71	Northeast Monsoon (October-December)	220.32
November	89.44		
December	21.17		

Table 2. Average annual erosion index recorded in ten stations in Southern zone - India

S. No.	Location	Average annual erosion index
1.	Mangalore	1457
2.	Trivandrum	820
3.	Madras	753
4.	Tiruchirapalli	545
5.	Vishakhapatnam	534
6.	Kodaikanal	433
7.	Bangalore	429
8.	Coimbatore	349
9.	Ootacamund	315
10.	Hyderabad	215

MATERIALS AND METHODS

For calculating the Rainfall Erosion Index of Coimbatore, the automatic raingauge records available at the Meteorological Observatory, Tamil Nadu Agricultural University since 1938 were collected and analysed. For the computation of the Erosivity Index, Wischmeier (1959) method was made use of since at Coimbatore, highly significant correlation coefficients were noticed between EI_{30} with soil loss by Balasubramanian and Sivanappan (1981)

The value of EI of a given rainstorm equals the product, the total storm energy (E) times the maximum 30 min - intensity (I_{30}) where E is kinetic energy and I is the rainfall intensity. The energy of a rainstorm is a function of the amount of rain and of all the storm's component intensities. Median rainy drop size increases with rain intensity and terminal velocities of free falling water drops increase with increased drop size. Since the energy of a given mass in motion is proportional to velocity, squared rainfall energy is directly related to rain intensity. The relationship is expressed by the equation:

$$KE = 210.3 + 89 \log_{10} I$$

where KE = Kinetic energy in metric ton. metres per hectare per centimetre of rain and

I = Rainfall intensity in centimetres per hour (Wischmeier and Smith, 1978).

$$R = \frac{KE \times I_{30}}{100}$$

Where I_{30} = Maximum 30 minutes rainfall intensity of the storm

KE = Kinetic energy of the storm

RESULTS AND DISCUSSION

The erosivity index worked out for the period 1938 to 1983 (45 years) was analysed, monthwise and seasonwise. The average monthly, annual and seasonwise erosion index values of the forty five years were studied (Table 1). The average annual erosion index of Coimbatore is worked out to be 348.92.

From the yearwise EI analysis, it is observed that the maximum erosivity index is during 1979 (1063.62). The erosivity index values of 1977 (834.50) and 1980 (683.26) come next. From the 45 years data, we can conclude that the maximum erosion causing storms occured mostly during seventies.

Analysing the seasonwise erosion index values, it is found that the value is maximum during North East monsoon period.Therefore at Coimbatore, the North East monsoon rainfall causes severe erosion because of high erosive potential. Summer rains come next to North East monsoon rains in erosive power. In North East monsoon period, the erosive potential of rain is high in the initial period, then it decreases, whereas in summer, the erosive power of rain increases from the start. The severe erosion causing storms are occuring during the months of October and November. During winter, the rainfall is meagre. The average annual EI of Coimbatore (348.92) is compared with EI values of nine stations situated in Southern zone of India reported by Rambabu **et al.** (1978) (Table 2). EI of Coimbatore is lower than all the reported stations except Hyderabad and Ootacamund

Based on this present study on the Rainfall erosion index of Coimbatore, we can infer that the surface should have more cover crops/vegetation to retard the erosion potential of falling rain drops during October and November. It is suggested to have the crops season in such a way to have maximum vegetative cover during October and November. It is better to go for erosion resistant crops in the northeast monsoon period.

ACKNOWLEDGEMENT

The authors are thankful to the United States Department of Agriculture, Office of International Co-operation and Development,authorised by Public Law 480 for financing this research study.

REFERENCES

BALASUBRAMANIAN, G. and SIVANAPPAN, R.K. 1981. Effect of degree of slope and rainfall erosivity on soil erosion and the influence of mulching on runoff and soil loss. Proc. South East Asian Regional Symposium on Problems in Soil Erosion and Sedimentation, Asian Institute of Technology, Bangkok. 29-36.

DAS,D.C. RAGHUNATH,B., POORNACHANDRAN,G. 1967. Rainfall intensity energy and erosion index. **Jour. Indian Soc. Agric. Engg.,** 4 (2) : 9-18.

RAMBABU, GUPTA, S.K. and TEJWANI,K.G. 1970. Correlation of soil loss with various energy intensity products. **Indian Forester., 96** (10): 771-774.

RAMBABU, TEJWANI, K.G., AGARWAL, M.C. and BHUSHAN,L.S. 1978. Distribution of erosion index and iso-erodent map for India. **Indian J. Soil Conservation. 6**(1): 1-12.

WISCHMEIER, W.H. 1959. A rainfall erosion index for a Universal Soil Loss Equation. **Soil Sci. Soc. Am. Proc., 23**: 246-249.

WISCHMEIER, W.H. and SMITH, D.D. 1978. Predicting rainfall erosion losses- A guide to conservation planning. **Agricultural Hand Book** No.537,USDA.