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A NOTE ON THE USE OF RAINFALL EROSION INDICES FOR PREDICTING SOIL AND WATER LOSSES FROM THE SLOPY FIELDS OF KERALA

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USE of equations and relationships as an aid in the calculation of field soil loss has been attempted[1,2]. The major contribution to the prediction of soil loss was made in U.S.A. by studies on rainfall erosion index and evaluation of the cropping management factor[3]. In 1961, the universal soil loss equation was formulated[4]. The science of soil conservation had advanced much with the introduction of universal soil loss equation. Work on this line can be rarely done in India.

The present authors report the results of a pilot study conducted to select the proper rainfall erosion indices to be used in the universal soil loss equation for predicting soil and water losses from the slopy fields of Kerala.

An one year field experiment was conducted in the moderately acidic oxisols of the Kerala Agricultural University Campus, Vellanikkara with the above objective. The soil series established for the location was called the "Vellanikkara series" of Kerala. The experiment was laid out in RBD on a 15% uniform slope with 5 treatments and 4 replications in a soil having a basic infiltration rate of 14.85 cm/hr and sandy clay loam surface soil with crumb structure. The aggregate analysis, stability index, structural coefficient, percentage of aggregate stability and the mean weight diameter of the soil at the start and 6 months afterwards are presented in tables 1 and 2. The water dispersable aggregates of the surface soil as determined by shaking for 24 hr were 12%. The treatments consisted of, T_1—cassava alone on mounds, T_2—cassava on mounds with peanut intercrop, T_3—cassava alone on ridges across the slope, T_4—cassava on ridges across the slope with peanut intercrop and T_5—uncultivated bare fallow as the control. The mounds and ridges are illustrated in figures 1 and 2. The plots (24.3 m long, 2.7 m wide) were tilled with a spade (except T_5), ridges and mounds were taken and cassava and peanut were raised according to the requirements using cassava cultivar M_4 and peanut cultivar TMV-2 with the normal package of practices recommended. The control plot (T_5) was untilled, but all the weeds were removed as soon as noticed. The run-off and soil loss from each plot were collected directly into waterproof polythene-lined tanks constructed at the

Table 1 *Mean aggregate analysis of the surface soil (%)*

Aggregate size (mm)	At the start of the experiment	6 months after start of the experiment
> 5	11.01	4.78
2.5–5	14.00	10.16
1.0–2.5	20.10	13.19
0.5–1.0	20.48	21.78
0.25–0.5	21.11	23.80
< 0.25	13.30	26.79

Table 2 *Stability index, structural coefficient, percentage of aggregate stability and mean weight diameter of the surface soil*

Character	At the start of the experiment	6 months after start experiment
Stability index (%)	45.14	33.28
Structural coefficient	0.79	0.64
Aggregate stability (%)	79.00	64.00
Mean weight diamenter (mm)	1.70	1.21

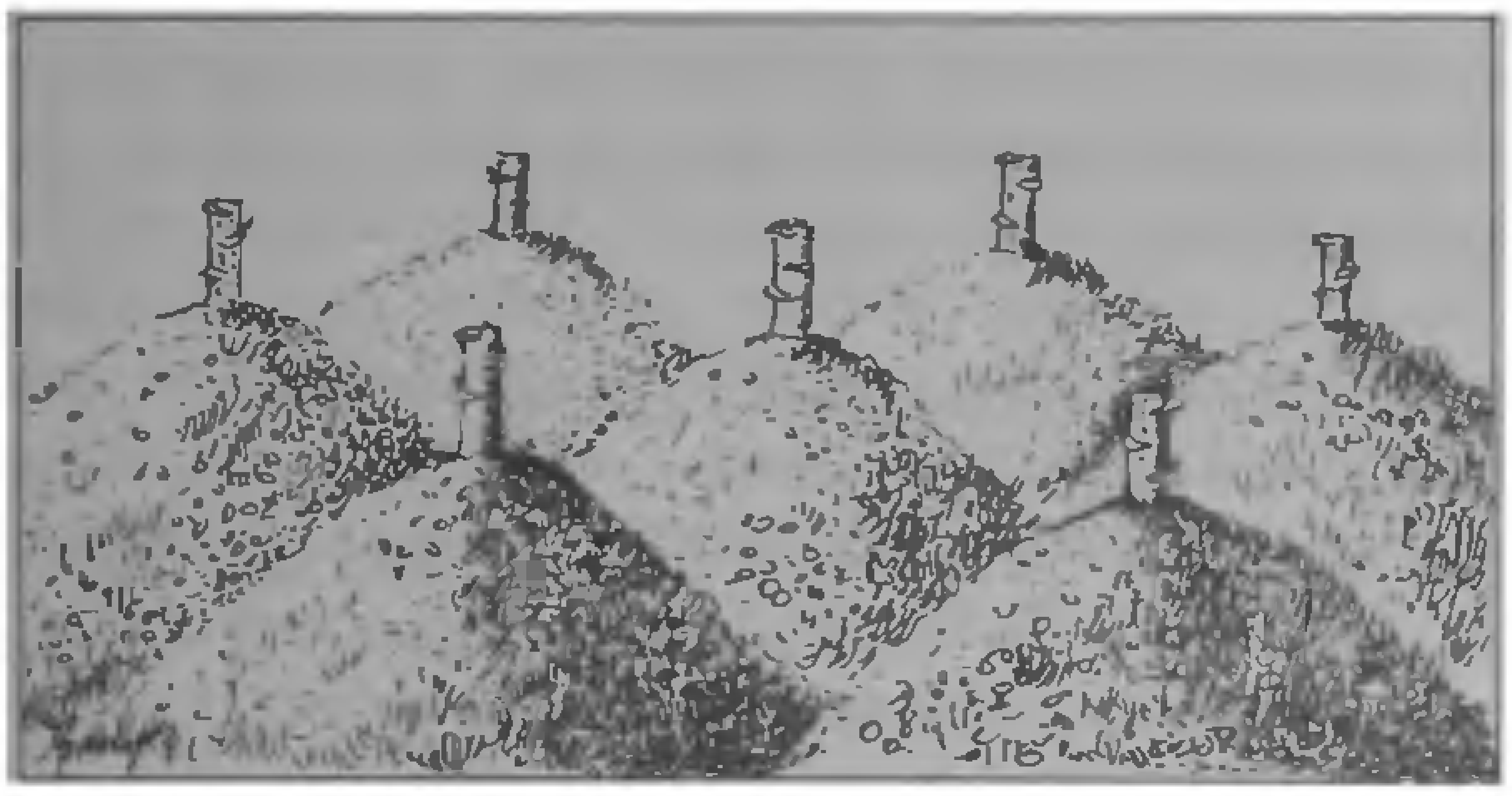

Figure 1. Mound method of planting cassava.

lower end of the plot and measured after the occurrence of each raintall. The run-off was measured as litres and converted to mm of rainfall. For determining soil loss, the run-off water with the sediments was stirred thoroughly and a sample of 500 ml was quickly taken and this was dried in a water bath and the sediments were calculated[5]. The soil losses of each rainfall were expressed as t/ha. Only rainfalls > 12.5 mm were taken for the study since only they were required for computing the EI values and the expressible amounts of erosion and run-off did not occur under lower rains[6]. If the rains were separated by > 6 hr, they were considered as different storms[b]. Since a simple expresssion of the relationship between rainfall and erosion was desired, only those characters which can be taken directly from a recording rainguage chart were considered. For this, an automatic recording rainguage was installed at the experimental site. The rainguage chart was used for studying the following specific characters and factors of rianfall: (1) amount of rainfall (mm), (2) maximum observed rainfall intensities for 5, 15, 30 or 60 min intervals, (3) maximum rainfall intensity observed, (4) total kinetic energy of rainstorm calculated according to the following equation[7,8].

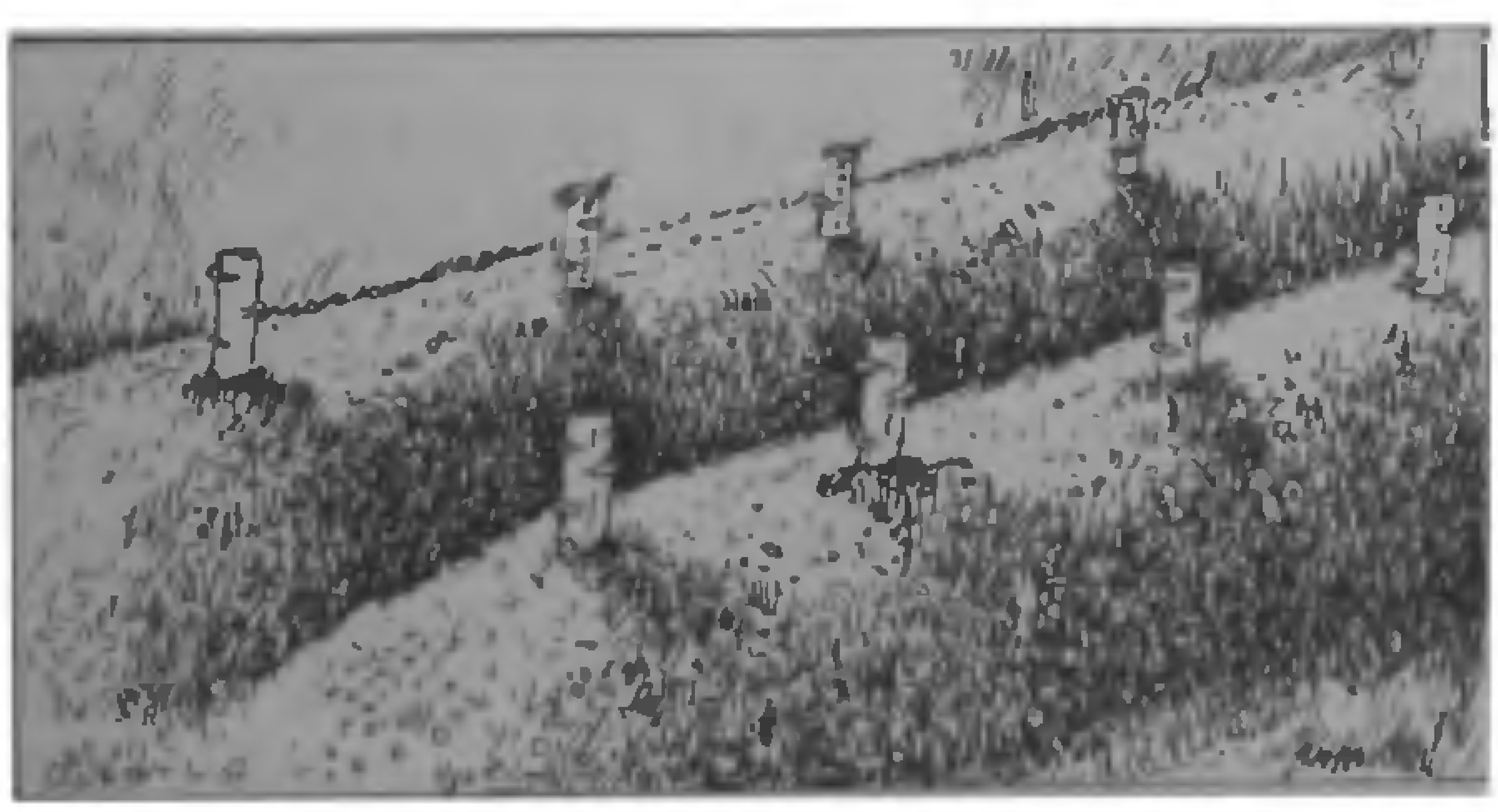

Figure 2. Ridge (across slope) method of planting cassava.

Table 3 *Coefficient of determination (r^2) for testing the linear relation between erosion indices and run off* under various treatments*

Rainfall erosion indices	Treatments					
	T_1	T_2	T_3	T_4	T_5	Mean
EI_5	0.7753	0.8055	0.7954	0.6221	0.9051	0.7807
EI_{15}	0.5795	0.6883	0.6167	0.4806	0.7748	0.6280
EI_{30}	0.5285	0.6652	0.5769	0.4471	0.7216	0.5894
EI_{60}	0.6678	0.7453	0.7031	0.5535	0.8484	0.7036
Total kinetic energy	0.6144	0.6199	0.6058	0.4982	0.7935	0.6264
$KE > 1$	0.7116	0.7764	0.7615	0.6266	0.7843	0.7321
AIm	0.8046	0.8341	0.8267	0.6608	0.9108	0.8074
Total rainfall	0.6216	0.6331	0.6086	0.5070	0.7721	0.6285

*n = 18

$Ek = 210.3 + 89 \log I$, where,
Ek = kinetic energy of rainstorms in metre tonnes per ha cm of rainfall.
I = rainfall intensity in cm/hr.
(5) The kinetic energy thus obtained was multiplied by the maximum intensity recorded during 5, 15, 30 or 60 min intervals. The erosion indices thus obtained were termed EI_5, EI_{15}, EI_{30}, and EI_{60} respectively. (6) The cumulative kinetic energy of storms with intensities > 2.5 cm/hr ($KE > I$) and the product of total rainfall and peak storm intensity

Table 4 *Coefficient of determination (r^2) for testing the linear relation between erosion indices and soil loss* under various treatments*

Rainfall erosion indices	Treatments					
	T_1	T_2	T_3	T_4	T_5	Mean
EI_5	0.8549	0.6335	0.7944	0.6985	0.8832	0.7729
EI_{15}	0.6944	0.8344	0.9153	0.8635	0.9528	0.8592
EI_{30}	0.6432	0.8753	0.9336	0.8913	0.9541	0.8523
EI_{60}	0.7596	0.7418	0.8624	0.7895	0.9200	0.8147
Total kinetic energy	0.6320	0.3753	0.4899	0.4229	0.5835	0.5007
$KE > 1$	0.7950	0.6063	0.7726	0.6892	0.8315	0.7389
AIm	0.8652	0.5847	0.7527	0.6506	0.8476	0.7402
Total rainfall	0.6105	0.3192	0.4282	0.3537	0.5256	0.4474

*n = 18

(*AIm*) were recorded as other erosion indices[9,10]. The data were subjected to statistical analysis.

Simple correlations were worked out between run-off soil loss and various rainfall erosion indices described earlier such as EI_5, EI_{15}, EI_{30}, EI_{60}, total kinetic energy of rainfall, $KE > 1$, *AIm* and total rainfall. The coefficient of determination (r^2) obtained from the analysis is presented in tables 3 and 4. It may be noted that, in the case of run-off (table 3), the maximum correlation was exhibited by *AIm* index (mean $r^2 = 0.8074$). This shows that *AIm* index can predict the run-off better than other indices. In the case of soil loss (table 4), maximum correlation was exhibited by EI_{30} index (mean $r^2 = 0.8592$). This shows that EI_{30} can predict the soil loss better than other indices. Corroborative results were reported by other workers[11,12]. In Dehra Dun EI_{30} explained 54% of variation in soil loss whereas in Ootacamund EI_5 was found to be superior to EI_{30} index. In our study, *AIm* index best explained run-off while EI_{30} was the best index for soil loss. Such variations were also observed by earlier workers[3].

Regression equations were worked out with the best fitted indices for predicting run-off and soil loss from the various treatments and are presented below.

Run-off

Treat. 1 : $y = 0.343\,x + 0.828$
Treat. 2 : $y = 0.181\,x + 0.511$
Treat. 3 : $y = 0.099\,x + 0.121$
Treat. 4 : $y = 0.048\,x + 0.306$
Treat. 5 : $y = 0.618\,x + 2.128$

where y represent run-off in mm and x represent *AIm* units.

Soil loss

Treat. 1 : $y = 0.0628\,x + 0.238$
Treat. 2 : $y = 0.0191\,x - 0.122$
Treat. 3 : $y = 0.0078\,x + 0.025$
Treat. 4 : $y = 0.0055\,x + 0.033$
Treat. 5 : $y = 0.1957\,x - 0.872$

where y represent soil loss in t/ha and x represent the number of EI_{30} index in metric units.

In conclusion, these equations can be used to predict soil and water losses from the slopy fields of identical farming situations. However, corrections are necessary for factors such as length of slope, soil erodibility and slope gradient, for its wider application. The equations also suggest the efficiency of groundnut intercrop in controlling soil and water losses from cassava plots. Use of the equation for calculating run-off and soil loss for the entire cropping season will be more accurate than its use for individual rain storms.

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SEM STUDIES ON SPORES OF *RICCIA FROSTII* AUST.

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LIGHT microscopic (LM) details of the spores of *R. frostii* have been studied[1,2]. SEM details are presented in figures 1–4.

Spores 42–46 μm in diameter, yellow to dark brown, anispolar, triangular. Proximal surface with a prominent raised tri-radiate mark (figure 1:tm) with more or less three equal faces; lamellate-