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Studies on the Erodibility of Ootacamund Soils

by

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Introduction: Large scale accelerated soil erosion was taking place in the Nilgiris, till the State Government launched the Soil Conservation Scheme in the District (Krishnamoorthy 1965). Heavy and erratic rainfall, steepness of slopes in the undulating topography and clay loam texture of soils were considered as the main causes of this erosion. The soils of upper Nilgiris plateau are lateritic in their origin (Raychaudhuri *et al* 1963, John Durairaj, 1964). The present study was taken up to evaluate them for their erodibility, to aid in making suitable recommendations for effective soil conservation planning.

Material and Methods: The upper plateau of Nilgiris having an elevation of 1050 to 2400 metres above M.S.L. is characterised by undulating hills, divided by narrow valleys and streams. The hill tops and the sloping lands are covered with grass vegetation and the hollows of the hill sides nestle 'sholas' or evergreen forests. It is the hill slopes that are mainly used for

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cultivation of potato, which is the major crop of the area The climate is equitable with annual rainfall of 1300 mm to 1800 mm received in about 130 to 170 rainy days and having temperatures between 23°C and 7°C (average maximum and minimum respectively). Potato is a row crop, which is clean cultivated and hence capable of contributing to a large scale erosion, if adequate soil conservation measures are not followed.

The research farm of the Soil Conservation Research, Demonstration and Training Centre represents the area of this upper plateau. The soils of this area are covered by the Ootacamund series and Ketti series as described by Govindarajan and Basawanna (1959). The profile characteristics are described elsewhere (Annon, 1962-64). Three profile samples have been utilised for studying the inter-relationship of the different properties, while 44 samples were used for working out mathematical relationship.

Standard analytical methods were used as described by Piper (1950) and Jackson (1958), for determination of mechanical composition, moisture-equivalent, organic carbon, total N_2, cation exchange capacity and pH (by Photovolt pH meter). Dispersion ratio and erosion ratio, were calculated using the methods employed by Middleton and Buoyoucos as described by Mehta *et al* (1963). Clay content was taken to represent the colloid content of the soil.

Results and Discussion: The resuls of analysis and the computed values on physical characteristics are presented in Table 1 and 2 respectively. From

TABLE 1. *Mechanical composition, Organic carbon, nitrogen and cation exchange capacity*

Profile	Depth (cm)	Coarse sand %	Fine sand %	Silt %	Clay %	Cation Exchange capacity m.e/100g	Total N_2 %	Organic carbon %
Ootacamund Series 1	0-18	18.3	10.5	25.7	38.4	10.91	0.247	2.87
	18-65	20 4	7.4	17.3	45.9	10.96	0.116	1.59
	65-73	62.0	12.6	5.1	19.1	4.08	0.107	1.04
	73-84	31.8	7.6	13.9	40.2	7.78	0.046	0.40
	84-130+	9.5	18.8	35.3	30.3	4.91	0.015	Nil
Ootacamund Series 1 (Eroded phase)	0-26	36.3	9.5	12.4	34.7	10.92	0.164	2.36
	26-44	64.3	14.0	5.3	13.8	3.74	0.111	1.33
	44-56	20.3	14.1	17.4	41.8	9.50	0.078	1.00
	56-106+	15.6	24.0	42.5	17.1	5.50	0.080	Nil
Ootacamund Series 2 (Ketty series)	0-13	11.5	14.6	20.4	46.2	12.02	0.202	2.29
	13-90	13.4	15.5	14.5	51.4	9.95	0.096	0.82
	90-102+	15.3	15.9	14.6	50.4	10.54	0.051	0.19

the data it is observed that the surface soil of profile 2 contains a larger percentage of sand than the corresponding layer in profile 1. This indicates that profile 2 is an eroded phase of Ootacamund series. This is also substantiated by presence of stone layer at a depth of 26 to 44 cm in profile 2 as against the occurrence at 65 to 73 cms in profile No. 1.

The texture varies from sandy loam to clay excepting for the last harizons of profiles 1 and 2.

The different values for suspension percentage (Silt+clay), dispersion ratio, moisture-equivalent, clay-ratio, clay/M.E. ratio, erosion ratio and silt/clay ratio are presented in Table 2. Correlation between the different factors is expressed in Table 3. The value for D.R. are observed to be in the

TABLE 2. *Computed Ratios of Physical constants*

Profile	Depth (cm)	Silt+Clay % (Middleton's method)	Dispersion Ratio (D.R.)	Moisture equivalent (M.E.)	Erosion ratio (E.R.)	Clay/ M.E. ratio	Clay ratio (C.R.)	Silt/ Clay ratio
Ootacamund Series 1	0–18	0.820	1.28	32.93	1.10	1.17	1.42	0.67
	18–65	1.625	2.54	27.51	1.52	1.67	0.98	0.38
	65–73	0.6213	2.54	14.80	1.96	1.29	4.17	0.27
	73–84	0.6774	1.25	20.66	0.64	1.95	1.33	0.35
	84–130+	0.445	9.82	32.02	10.36	0.94	2.10	1.16
Ootacamund Series 1 (Eroded phase)	0–26	1.875	3.75	24.51	3.75	1.42	1.68	0.36
	26–44	0.791	4.13	18.99	5.68	0.73	6.07	0.39
	44–56	1.620	2.73	22.08	1.43	1.90	1.24	0.42
	56–106+	4.440	7.46	31.63	13.80	0.54	4.81	2.40
Ootacamund Series 2 (Ketty series)	0–13	2.290	3.44	29.82	2.21	1.55	1.01	0.44
	13–90	0.741	1.13	23.91	0.52	2.15	0.85	0.28
	90–102+	1.970	3.03	22.39	1.34	2.25	0.91	0.29

TABLE 3. *Correlation between different variables*

Variables	r	Remarks
E.R. & D.R.	+ 0.91 **	E.R. = Erosion Ratio
		D.R. = Dispersion Ratio
E.R. & CR	+ 0.59 *	C.R. = Clay Ratio
E.R. & C/M.E.	− 0.81 **	C/M.E. = Clay/Moisture Equivalent
E.R. & C.E.C.	− 0.58 *	C.E.C. = Cation Exchange capacity
E.R. & S/C	+ 0.89 **	S/C = Silt/Clay
E.R. & T.N_2	− 0.32 (N.S.)	T. N_2 = Total Nitrogen
E.R. & O.C.	− 0.37 (N.S.)	O.C. = Organic Carbon

** Significant at 1% level * Significant at 5% level N.S. – Not Significant range of 1.13 to 9.82 which means that, even if the maximum value is taken, out of 100 gms of silt and clay in the soil, only 10 gm can be easily suspended by water. This is an indication that soil is not highly erodible, especially due to the fact, that certain horizons contain as high as 67% of silt and clay. The values of E.R. fall much below 10, the value prescribed by Middleton and are ranging from 0.5 to 5 68 in all the horizons excepting the lowest horizons of profiles 1 and 2. This is explained by the fact that this layer was found to be enriched in silt sized kaolin and weathered feldspars. It is observed that significant positive correlation exists between E.R. with D.R., silt/clay ratio and clay ratio. Significant negative correlation has also been observed in the case of E.R. with clay/M.E. and C.E C. No significant correlation could be observed between E.R. and organic carbon or total nitrogen.

This suggests that instead of calculating E.R. to find out the erodibility or otherwise of Nilgiris soils, it would be enough if analysis of even D.R. would be done. This necessitates setting up a maximum value for D.R. for Nilgiris soils. A number of samples were analysed in order to work out an equation between D.R. and E.R. It has been observed that the data fits itself into a straight line, of the form—D.R.=2.54+0.52 ER. Substituting the value of Middleton, viz., 10, for E.R., it is observed that the maximum value of D.R. works out to 7.74. Hence, for Nilgiri soils to determine whether they are erodible or not, the maximum value of D.R. can be taken as 7.5. If the value exceeds 7.5, then the soil can be considered as erodible and if less than 7.5, they are non-erodible.

Thus, it is seen that the soils of Ootacamund as represented by Soil Conservation Research, Demonstration and Training Centre Farm, are to be classed as non-erodible. Factors other than the soil thus appear to play major role in inducing accelerated erosion in this area. This emphasises the need for bench terracing for Nilgiris, which is the mechanical measure for breaking the slopes and providing flat areas for cultivation.

Summary: The physical and physico-chemical properties of three soils representing the upper plateau of Nilgiris have been studied to evaluate their erodible nature. It has been observed that the soils are non erodible. Correlation amongst the different values have been worked out and a value of 7.5 is suggested as the maximum value for dispersion ratio, beyond which the soils can be classed as erodible.

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Rosette Disease of Groundnut—Transmission Studies

by

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Introduction: The occurrence of a virus disease of groundnut in the Madras State was first reported by Sundararaman (1926) at Palur Agricultural Experimental Station and he named it as "clump disease". As very little is known about the various aspects like transmission, mode of spread, influence of various agronomic practices like manuring, spacing, roguing, weeding *etc.* on the incidence of rosette disease occurring in Madras State, a scheme was initiated at the Agricultural College and Research Institute, Coimbatore with the financial assistance of Indian Central Oilseeds Committee. The pattern of spread of rosette disease and the assessment of crop loss due to rosette disease were dealt in the previous two papers (1965 & 1967). This paper deals with the different modes of transmission of the disease.

Materials and Methods: Rosette disease culture obtained from Coimbatore location was used in these studies. The culture was maintained by using *Aphis craccivora*, as vector under insect-proof glass house conditions. All transmission studies were carried out under insect-proof glass house conditions. TMV 2, a bunch variety of groundnut, was selected for these studies.

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