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CHEMICAL CHARACTERISTICS OF LATERITIC SOILS IN THE RIBBON-VALLEYS AND CORRESPONDING UPLANDS OF KERALA*

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The lateritic soils cover more than 60% of the cropped area in Kerala. The midland regions of the State, where such soils are found, are occupied by a number of ribbon-valleys formed from the lateritic alluvium brought down by rain water, and these soils are cropped with rice. The principal crops cultivated in the uplands are coconut and cassava.

Materials and Methods

Thirty locations representing different ribbon-valleys of the State were selected. Soil samples to a depth of 1--15 cm from the valley bottoms and the corresponding uplands were collected. Standard procedures (Jackson, 1967) were adopted for the determination of soil pH, total N and K, total and exchangeable Ca, Mg, C E C, organic carbon, total and available P (Bray No. 1 extractant). Available N was determined by the method of Subbiah and Asija (1956), available K by the method of Toth and Prince (1949) and Stanford and English (1949) and exchangeable Fe by the method of Snell and Snell (1949) and exchangeable Al in NH_4OAc leachate of the soil (Chenery, 1954).

Results and Discussion

The upland soils in general had a lower pH than the corresponding low land soils before air drying. But air drying the rice soil brought down their pH the magnitude of which was highly variable. Thus in soils No. 1b, 2b, 3b, 4b, 6b 17b, 22b and 30b (Table 1) the shift in pH ($\triangle$pH) on drying was of the order of 1.0 unit or more. The aerobic nature of the upland soils was mainly responsible for their lower pH as compared to the fresh soil samples from the rice fields.

Both the upland lateritic soils and the corresponding low land lateritic soils were poor in organic matter content. The lateritic alluvium in each of the 30 ribbon-valley locations studied had a higher organic matter content than the corresponding upland locations. This can be attributed to the heavy application of green and green leaf manure as well as cowdung to the rice fields.

Both the upland and lowland lateritic soils in the midland regions had a low status of total and available P (Tables 2,3). Similar observations have been made by Koshy and Varghese (1972). A comparison of upland lateritic soils and

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Table 1

Soil acidity, organic carbon, organic motter, total nitrogen, available nitrogen and C/N ratio of soil samples (0.15 cm)

Soil No.	Location		pH (1:2,5 soil water suspension), field sample pH of fresh samples in brackets	Organic carbon (%)	Organic matter (%)	Total nitrogen (%)	Available nitrogen (kg/ha)	C/N ratio
1	2		3	4	5	6	7	8
1a	Vettinad		5.1	0.89	1.53	0.074	121.0	12.0
1b	Vettinad		4.8 (5.9)	1.14	1.97	0.089	163,6	12.8
2a	Venjaramoodu	Trivandrum Dt.	4.00	1.19	2.05	0.091	197.1	13.1
2b	Venjaramoodu		4.6 (5.8)	1.28	2.21	0.099	219.5	12.9
3a	Kilimanoor		4.6	0.73	1.26	0.063	121.0	11.6
3b	Kilimanoor		4.2 (5.4)	0.92	1.59	0.075	161.3	12.3
4a	Nilamel		4.5	1.03	1.71	0.105	1120	9.8
4b	Nilamel		4.5 (6.1)	1.36	2.35	0.121	129.9	11.2
5a	Vayakal		4.3	0,53	0.91	0.045	118.7	11.9
5b	Vayakal	Quilon Dt.	4.5 (4.8)	1.39	2.40	0.085	163.7	16.4
6a	Panaveli		4,3	1.14	1.87	0,095	142.0	12.0
6b	Panaveli		4.5(5.5)	1,36	2.35	0:112	165,8	12.1
7a	Inchakad		5.0	1.17	2.02	0.101	114.2	11.6
7b	Inchakad		4.7 (5.1)	1.25	2.16	0.108	268.8	11.6
8a	Vadakadethukavu		4.9	1.25	2.16	0.108	121.0	11.6
8b	Vadakadathukavu		4.4 (4.6)	1.36	2.35	0.117	147.9	11.6
9a	Parenthol	Alleppey Dt.	4.6	1.27	2.19	0.104	147.9	12.2
9b	Parenthol		4.2 (4.6)	1.33	2.29	0.133	197.1	11.8
10a	Karakkad		4.6	0.79	1.36	0.068	183.7	11.6
10b	Karakkad		4.3 (4.8)	1.12	1.93	0.096	210.6	11.7
11a	Venpally		4.0	1.39	2.40	0.113	138.8	12.3
11b	Venpally	Kottayam Dt.	4.7 (5.5)	1.91	3.29	0.164	246.4	11.6

1	2	3	3	4	5	6	7	8
1[illegible]	Pa[illegible]vally	Era[illegible]ku[illegible] Dt.	4.5	1.44	2.48	0.121	129.9	11.9
1[illegible]b	Pa[illegible]vally		4.6 (5.4)	2.33	4.[illegible]2	0.20[illegible]	136.6	1[illegible].7
1[illegible]	Mazh[illegible]va[illegible]herry		6.3	1.23	2.12	0.105	71.7	11.8
1[illegible]b	[illegible]azhuva[illegible]herry		4.8 (5.2)	1.32	2.4[illegible]	0.113	135.6	1[illegible].3
14[illegible]	K[illegible]nipayur	Trichur Dt.	4.4	1.06	1.83	0.092	136.6	11.5
14b	K[illegible]nipayur		4.5 (4.7)	1.23	[illegible]	0.104	156.[illegible]	11.8
15a	Pula[illegible]hol		5.6	1.00	1.72	0.086	1[illegible]3.0	11.6
15b	Pulamanthol		4.6 (4.8)	1.48	2.55	0.122	188.2	12.1
16a	Angadipuram		5.0	0.92	1.59	0.080	141.1	11.5
16b	Angadipuram	Malappur[illegible] Dt.	5.0 (5.4)	1.19	2.02	0.090	183.8	13.2
17a	Makkarapara[illegible]		6.0	1.17	2.02	0.080	1[illegible]6.5	14.6
17b	Makkarapar[illegible]		5.0 (6.0)	27	2.19	0.104	2[illegible]8.5	1[illegible]2
18a	Pookottoor		4.2	1.58	2.72	0.120	188.2	13.2
18b	Pook[illegible]ttoor		4.7 (4.9)	69	2.91	0.128	188.0	13.2
19a	R[illegible]ttuk[illegible]		4.7	1.48	2.55	0.131	185.9	11.3
19b	R[illegible]ttuk[illegible]		4.4 (5.1)	1.81	3.12	0.155	2 8 5	11.7
20[illegible]	F[illegible]		5.3	1.25	2.16	0.101	177.0	1[illegible]4
[illegible]0b	Fe[illegible]	C[illegible]licut Dt.	4.3 (4.7)	.81	2.19	0.105	199.4	12.1
21[illegible]	P[illegible]ur		4.4	1.44	2.48	0.112	229.0	12.9
21b	Pu[illegible]r		5.2 (5.3)	2.11	3.64	0.165	259.0	12.8

1	2	3	4	5	6	7	8
22a	Edarikkode		4.6	1.33	2.39	0.109	259.0	12.1
22b	Edarikkode		4.6 (6.1)	1.48	2.55	0.113	267.4	13.1
23a	Valancherry		5.3	1.14	1.97	0.096	219.6	11.1
23b	Valancherry	Malappuram Dt.	5.0 (5.4)	1.44	2.48	0.109	237.4	13.1
24a	Edappal		4.6	0.84	1.45	0.061	174.7	13.8
24b	Edappal		4.6 (4.9)	1.25	2.16	0.100	241.9	12.4
25a	Kurakkad		5.4	1.58	2.72	0.128	112.9	12.3
25b	Kurakkad		4.2 (4.8)	1.72	2.97	0.139	201.6	12.4
26a	Mammom		5.1	1.12	1.93	0.095	235.2	11.8
26b	Mammom	Trivandrum Dt.	4.2 (4.7)	1.66	2.86	0.141	236.4	11.8
27a	Varkala		4.9	0.87	2.50	0.075	172.5	11.6
27b	Varkala		4.4 (5.3)	2.08	1.54	0.174	250.0	12.0
28a	Cheruvatoor		4.8	1.27	2.19	0.104	203.8	12.2
28b	Cheruvatoor		5.0 (5.1)	1.44	2.48	0.108	284.5	13.3
29a	Kothamangalam	Ernakulam Dt.	5.3	1.47	2.53	0.107	163.5	13.7
29b	Kothamangalam		4.4 (4.8)	1.88	3.24	0.161	257.6	11.7
30a	Muvattupuzha		4.8	1.94	3.34	0.121	206.9	16.0
30b	Muvattupuzha		5.0 (6.5)	2.12	3.65	0.128	211.6	16.6

a Upland lateretic soil.
b Lateritic alluvium,

Table—2

Available and total P, available and total K, exchangeable Fe, exchangeable Al and Ca, Mg, exchangeable Ca, exchangeable Mg, CEC of surface samples (0-15 cm) from uplands

*Soil No.	Available P. kg/ha	Total P (%)	Available K (Kg/ha;	Total K (%)	Total Ca (%)	Total Mg (%)	Exchange-able Ca (me/IOOg) (%)	Exchange-able Mg (me/100g) (%)	Exchange-able Fe (me/100g)	Exchange able Al (me/IOOg)	CEC (me/ 100g)
1	2	0.021	12	0.12	0.12	0.12	2.01	1.08	0.04	0.21	4.55
2	2	0.028	12	0.12	0.12	0.12	2.02	1.07	0.06	0.72	6.10
3	4	0.040	12	0.08	0.22	0.09	2.10	1.02	0.05	0.55	4.05
4	2	0.024	12	0.12	0.15	0.08	2.20	1.80	0.11	0.84	5.00
5	2	0.020	12	0.11	0.12	0.12	1.80	1.08	0·05	0.33	7.15
6	8	0.085	17	0.13	0.15	0.12	1.11	1.06	0.02	0.44	6.05
7	5	0.053	17	0.22	0.12	0.13	2.02	1.04	0.10	0,42	6.95
8	9	0.091	17	0.13	0.10	0-09	2.18	0.98	0.04	0.44	4.55
9	3	0.034	25	0.13	0.10	0.10	2,09	1.01	0.05	0.32	5.90
10	7	0.067	12	0.12	0.15	0.09	2.02	1.01	0.02	0.80	4.45
11	4	0.037	17	0.12	0.17	0.08	1.98	1.10	0.13	0.78	6.40
12	2	0.018	25	0.29	0.25	0.16	2.20	1·12	0.04	0.42	6.85
13	2	0.025	12	0.18	0.12	0.16	2.02	1.00	0.13	0.27	4.80
14	1	0 015	12	0.12	0.15	0.12	2.80	1.10	0.04	0.77	5.75

15	2	0.023	20	0.24	0.17	0.09	2·75	0.08	0.44	0.44	6.10
16	2	0,022	62	0.11	0.15	0.11	2.93	1.00	0.04	0.41	6.80
17	1	0.014	17	0 11	0 27	0.17	2 85	2.00	006	0.08	4.90
18	1	0.018	27	0.15	0.22	0,24	2.34	1,22	0.08	0.52	6.00
19	2	0.021	17	0.10	0.22	0.18	3.85	1.01	0,13	0.40	5.35
20	3	0.031	37	0.11	0.15	0.12	3,85	1.00	0 03	0.22	6.12
21	2	0.024	17	0.11	0.20	0.18	2.75	1.20	0 08	0.30	7.00
22	1	0.013	12	0 09	0.18	0.12	2,08	1.13	0.02	0.41	6·35
23	3	0.028	30	0.11	0.18	0.20	1.01	1.08	0.06	0.34	6.30
24	3	0.038	12	0.06	0.18	0.12	2.68	1.04	0.13	0.30	5.75
25	4	0.038	12	0.03	0.08	0.12	1.12	1.09	0.11	0 43	6.00
26	3	0.032	37	0.22	0.08	0.12	2.75	1 08	0.03	0,65	5.10
27	7	0.067	12	0.03	0.10	0.15	2.88	1.01	0-04	0.30	4.25
28	1	0.012	15	0.13	0.10	0.13	2.70	1.10	0.02	0.33	6.60
29	3	0.034	12	0.11	0.16	0.27	1.90	1.08	0.02	0.34	6,90
30	4	0.038	75	0.44	0.12	0.29	2.86	1.30	0.04	0.40	7.00

* Locations are given in Table 1.

Table-3

Available and total P, available and total K, exchangeable Fe, exchangeable Al and Ca, Mg, exchangeable Ca exchangeble Mg and CEC of surface samples (0—15 cm) from low lands

Sl. * No.	Available P/kg/ha	Total P (%)	Available K (kg/ha)	Total K (%)	Total Ca (%)	Total Mg (%)	Exchange-able Ca (me/100g) (%)	Exchange-able Mg (me 100g) (%)	Exchange-able Fe (me 100g)	Exchange-able Al (me/100g)	CEC (me/100g)
]	6	0.056	26	0.13	0.15	0.15	2.08	1.18	0.08	0.67	5.00
2	8	0.078	25	0.16	0.15	0.17	2.05	1.08	0.09	0.78	6.10
3	8	0.075	100	0.28	0.22	0.13	2.30	1.22	0.06	0.59	4.20
4	7	0.064	25	0.17	0.15	0.15	2.30	1.99	0.11	0.44	6.95
5	5	0.050	17	0.12	0.17	0.13	1.88	1.12	0.05	0.33	8.45
6	12	0.140	50	0.23	0.15	0.12	2.10	1.26	0,06	0.54	6.60
7	21	0.190	75	0.24	0.15	0.15	2.30	1.24	0.10	0.54	6.50
8	20	0.220	27	0.18	0.12	0.09	2.78	1.12	0.11	0.53	7.07
9	14	0.130	62	0.28	0.15	0.11	2.90	1.2S	0.05	0.43	6.55
10	22	0.220	17	0.13	0.17	0.09	2.80	1.32	0.02	0.82	5.65
11	4	0.040	37	0.17	0.26	0.15	2.35	1.21	0.14	0.88	7.45
12	2	0.021	30	0.25	0.30	0.21	2.88	1.34	0.08	0.89	8 90
13	43	0.510	112	0.22	0.17	0.17	2.95	1.13	0.16	0.82	6.55

14	8	0,078	25	0.13	0.22	0.21	3.25	1.18	0.06	0.81	6.45
15	25	0,230	125	0.45	0.22	0.12	3.15	1.48	0.10	0.67	6.90
16	3	0.028	225	0.67	0.26	0.15	3.18	1.48	0.06	0,69	7.45
17	6	0.056	125	0.37	0.32	0.27	2.88	2.58	0.18	0.89	6.99
18	7	0.068	30	0.13	0,30	0.24	4.15	1.91	0.10	0.60	7.98
19	9	0.088	25	0,36	0.25	0.18	4.25	1.61	0.14	0.78	7.00
20	65	0.580	50	0.24	0.15	0.12	4.35	1.32	0 05	0.39	8.40
21	2	0.018	25	0.13	0.22	0.18	3.25	1.53	0.09	0.30	7.44
22	4	0.038	50	0.33	0.24	0.20	2.18	1 44	0.07	0.47	6.96
23	9	0.091	107	0.41	0.20	0.20	4.12	1.61	0 06	0.34	7.44
24	9	0.326	17	0.08	0.20	0.18	2.88	1.12	0.16	0.77	5.83
25	35	0051	12	0.05	0.10	0.13	3.78	1.21	0.13	0,86	7.48
26	5	0.038	40	0.23	0.16	0.19	2·89	1.11	0.17	0.72	6.84
27	4	0.030	12	0.05	0.12	0.15	3.13	1.42	0.14	0.30	6.89
28	2	0.018	50	0.24	0.18	0 30	2.12	1.34	0.06	0.54	7.00
29	6	0.056	50	0.38	0.18	0.38	2.02	1.14	0.06	0.41	8.44
30	6	0.055	100	0.49	0.20	0.36	2.92	1.58	0.12	0.52	7.50

* **Locations** are given in Table 1

lowland lateritic alluvium with regard to K shows that their total and available contents were more in the latter than in the former, The higher content of K observed in the lowlands may be attributed to the washing down of highly soluble K in solution as well as through suspension into the valley bottoms.

The total and exchangeable Ca and Mg were higher in low-lands than in the uplands. Similar trend was observed in the case of exchangeable Fe and Al. The higher C E C observed for the lateritic alluvium may be attributed to the higher organic matter status.

Summary

A comparative study of the chemical characreristics of the upland lateritic soils and the corresponding lateritic alluvium in the ribbon–valleys of the midland regions of Kerala State was conducted. The C E C, exchangeable cations, level of organic matter, total and available nutrients were all found to be low.

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