

## Distribution of Organic Phosphorus in Tamil Nadu Soils

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Thirty eight soil samples collected from nine profiles representing the major soil groups viz., red black, laterite and alluvial soils were examined for organic P content. The organic P content of the soils ranged from 26 to 467 ppm and its percentage to total P was from 9.11 to 56.81. Highest organic P was recorded in the high level laterite soils. Organic P was rich in the surface layers and it was found to decrease with depth in most of the profiles. The range of organic C/org. P ratio was from 5.05 to 123.4. Organic P significantly correlated with total P, organic carbon, total N and C/N ratio. Org. C/Org. P significantly correlated with C/N ratio.

The soil organic P is a part of the organic matter content and it is well known that during mineralisation of soil organic matter, both N and P are converted into inorganic forms. Thus, there is some indirect evidence that the organic P is important in plant nutrition. An examination of the reported determination of organic P in soils elsewhere reveals wide variation in its content. According to Kaila (1963), the organic P constituted 17 to 68 per cent of total P in Finnish soils. The amount of organic P for Indian soils was found to range from 2.6 to 75 per cent of total P (Ghani and Aleem, 1943). Many soil properties have been correlated with organic P by various investigators (John *et al.*, 1965).

Though the soil organic P often comprises more than half of the total

P, very little work has been done to study its behaviour in soils. No data exist on the distribution of organic P in Tamil Nadu soil profiles. Therefore the present investigation was taken up to study the distribution of organic P in soils and its relation with some soil properties.

### MATERIALS AND METHODS

Thirty eight soils were collected from nine profiles representing the four major soil groups viz., red, black, laterite (both high level and low level) and alluvial soils. The pH of the soil was determined in a Beckman pH meter using a soil water ratio of 1:2.5. Organic carbon was estimated by Walkly and Black method as described by Piper (1950). Total N was estimated by the modified Kjeldahl's method (Jackson, 1958). Organic P was estimated

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by the method of Mehta *et al.*, (1954) and total in P by perchloric acid digestion method as described by Jackson (1958).

## RESULTS AND DISCUSSION

The general soil properties and organic P and its percentage to total P

are given in Table. The results have shown that the organic P of the soils varied from 26 to 267 ppm and its percentage to total P ranged from 9.11 to 56.89. This fraction was high in the high level laterite soils (from 46 to 467 ppm) followed by red soils (from 122 to 248 ppm). Black soils (profile No.3

TABLE. Soil Chemical Properties and Organic Phosphorus

Soil and Profile No.	Depth in cm	pH	Organic C %	Total N. %	C/N ratio	Organic P ppm	Total P ppm	% of organic P to total P	Org. C/org. P ratio
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<b>Red soil</b>									
1. Kovilpatti	0-22	7.4	0.39	0.025	15.60	248	586	42.32	15.72
	22-38	7.2	0.12	0.018	6.16	194	368	52.72	6.18
	38-54	6.7	0.24	0.026	9.22	164	392	31.84	14.63
	54-68	6.1	0.15	0.026	5.76	122	523	23.33	12.29
2. Coimbatore	0-10	8.4	0.15	0.016	9.37	128	307	41.69	11.71
	10-30	8.0	0.26	0.018	14.44	128	313	40.89	20.31
	30-50	7.6	0.15	0.018	8.33	153	339	45.13	8.80
	50-70	7.7	0.15	0.021	10.00	145	342	42.40	14.48
	70-105	8.3	0.08	0.010	7.50	139	448	31.03	5.39
<b>Black soil</b>									
3. Kovilpatti	0-15	8.3	0.23	0.018	12.77	85	262	32.44	27.05
	15-45	8.1	0.12	0.016	7.50	98	312	33.41	12.24
	45-75	8.1	0.17	0.016	10.62	60	286	20.98	28.33
	75-105	8.2	0.18	0.013	13.84	29	185	15.68	62.06
4. Coimbatore	0-15	8.3	0.29	0.021	13.80	143	548	26.09	20.27
	15-30	8.3	0.27	0.021	12.85	82	549	14.84	33.92
	30-45	8.5	0.32	0.022	14.54	68	551	12.34	47.05
	45-75	8.4	0.30	0.024	12.50	99	601	16.31	30.30
<b>Low level laterite soil</b>									
5. Mudukulam	0-17	5.8	0.18	0.015	12.00	89	257	34.63	8.98
	17-64	5.7	0.08	0.018	4.44	79	227	34.80	10.12
	64-102	5.7	0.08	0.015	5.33	26	178	14.61	30.76

[Contd.]

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<b>High level laterite soil</b>									
6. Kumuli	0-30	4.7	0.24	0.043	5.58	248	356	40.78	16.21
	30-75	4.4	0.53	0.033	16.06	146	358	44.54	36.30
	75-113	4.6	0.60	0.024	25.00	159	357	35.54	37.73
	113-180	5.0	0.32	0.016	20.00	118	332	20.61	27.11
	180-225	5.1	0.20	0.012	16.66	47	228	20.61	42.55
7. Kodaikanal	0-45	4.9	5.76	0.240	24.00	467	822	56.81	123.34
	45-90	5.3	0.17	0.015	11.33	250	737	33.92	68.00
	90-135	5.2	0.17	0.013	13.07	114	408	27.94	14.91
	135-183	5.2	0.17	0.013	13.07	106	638	16.88	16.03
	183-223	5.0	0.17	0.018	9.44	356	1319	25.50	5.05
	223-273	5.0	0.18	0.015	12.00	239	1140	19.03	7.53
<b>Alluvial soil</b>									
8. Chitrasavadi	0-15	8.3	0.53	0.032	16.56	155	491	31.52	34.13
	15-75	8.3	0.29	0.019	15.26	125	284	40.01	23.20
	75-105	8.6	0.26	0.017	15.30	89	236	37.71	29.21
9. Aduthurai	0-16	7.0	0.87	0.054	16.11	195	394	49.49	44.61
	16-60	7.4	0.12	0.010	12.00	56	289	19.38	21.42
	80-108	7.8	0.05	0.005	10.00	35	384	9.11	14.28
	108-138	7.8	0.05	0.005	10.00	157	1296	12.11	31.84

and 4) and low level laterite soils (profile No.5) were low in organic P content. When the mean values were considered it was in the order of laterite soils (163 ppm), red soils (158 ppm), alluvial soils (116 ppm) and black soils (83 ppm).

All the surface layers of the profiles were rich in organic P compared to the sub-soil horizons. In general the organic P and its percentage to total P were found to decrease with depth. The decrease of organic P with depth was also reported by Gupta and Singh (1972) in Vindhyan soils and Misra and

Ojha (1969) and Chandrabhan and Tripathi (1973) in Uttar Pradesh soils. The decrease of organic P in the soil profiles may be attributed to the decrease of organic matter with depth.

Organic P was found to correlate with total P ( $r=0.707^{***}$ ) and similar correlation was also reported by Pavanasivam and Kalpage (1970) and John and Gardner (1971). The close relationship between the organic P and organic carbon ( $r=0.654^{***}$ ) established in the present study was also reported by Goel and Agarwal (1959). Organic P significantly correlated with total N

( $r = 0.670^{***}$ ) and C/N ratio ( $r = 0.699^{**}$ ) as reported by John *et al.* (1965).

The ratio of org. C/org. P of the soil profiles varied from 5.05 to 123.34 and the highest ratio was observed in the high level laterite soils of Kodaikanal. This may be due to high organic carbon content present and mostly in the non-mineralised form in the surface layer of this profile. The significant relationship of org.C/org.P ratio with organic carbon obtained ( $r = 0.790^{***}$ ) supports the above findings. Low org. P ratios ranging from 45.4 to 89.2 in black soils and from 108.2 to 132 in red soils of Uttar Pradesh was also reported by Misra and Ojha (1969). The low ratios observed in Tamil Nadu soils may be due to the highly mineralised form of organic P compounds because of tropical climatic conditions. McDonnell and Walsh (1957) stated that increased mineralisation results in a lowering of the org.C/org.P ratio thus, the paralleling the C/N ratio. The significant relationship obtained between org.C/org.P ratio with C/N ratio ( $r = 0.665^{***}$ ) supports the view of the above workers. Stage of weathering has been suggested by Goel and Agarwal (1959) as a possible factor in influencing the org.C/org. P ratio. John *et al.* (1965) reported that soils in the drier regions failed to show any consistent pattern and pH seemed to be dominant factor for the variation in the org.C/org.P ratio.

The org.C/org.P ratio was found to decrease with depth in red soil profiles No. 1 and 2, high level laterite soil profile No. 7 and alluvial soil profile

No. 8 and this may be associated with the decrease of organic carbon with depth. Similar decrease of the ratio with depth was also reported by Bornemisza and Kozen Igvae (1967) in Costa Rican soils. The ratio was high in the deep layers of the soil profiles No. 3, 4, 5 and 6 and this may be due to low organic P with depth as reported by Kaila (1963) in Finland soils.

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