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A COMPARATIVE STUDY OF THE FORMS OF PHOSPHORUS IN TWO RED LOAM SOIL SERIES OXISOL OF KERALA STATE

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ABSTRACT

A study of the different forms of P in the Vellayani and Neyyattinkara series of the red loam soils (oxisols) of Kerala indicated that organic P constituted about 48 - 51 % of the total P in both soil series. The different fractions of inorganic P were in the order, Red-P Fe-P Saloid-P Al-P Occl-P Ca-P in the Vellayani series; whereas in the Neyyattinkara series it was in the order Red-P Saloid-P Fe-P Occl-P Al-P Ca-P. Available P showed significant positive correlation with Al-P and Organic-P and no significant correlation was obtained with Saloid-P and Fe-P.

Key Words : Forms of phosphorus, Oxisols.

The red loam soils of Kerala are located mainly in the southern parts of Trivandrum district in two major soil series, Viz., Vellayani and Neyyattinkara, identified by the Soil Survey Wing of the Department of Agriculture, Kerala State. An accurate knowledge of the nature of the native soil P with reference to the forms in which they occur is of considerable value in the fertilizer management of these soils. Hence the present study was undertaken with a view to understand the forms of P and their distribution and interelationships in the surface and the subsurface layers of these soils.

MATERIALS AND METHODS

Surface (0-20 cm) and subsurface (20-40 cm) soil samples were collected from 15 locations under each soil series (Table 1).

Table 1 Location of soil samples

Sl.No	Vellayani series	Neyyattinkara series
1	Punkulam	Thozhukkal
2	vandithadam	Vazhuthur
3	Pachaloor	Vlangamuri
4	Thiruvallam	Krishnancovil
5	Pallichal	Amaravila
6	Venniyoor	Chaikorrukonam
7	Balaramapuram	Dhanuvachapuram
8	Kalliyoor	Udiyankulangara
9	Vellayani	Kodavilakom
10	Kattachalkuzhi	Parassala
11	Uchakada	Inchivila
12	Kottukal	Cheruvarakonam
13	Aralummoodu	Kochottukonam
14	Neyyattinkara	Ashramom
15	Kakkamoola	Mariapuram

The soils were air-dried, powdered, passed through a 2 mm sieve and stored. Total P was estimated in the HCl extract by the standard procedure and available and organic P using the procedure outlined by Jackson (1973). The fractionation of soil P excepting reductant soluble P Was carried out using the modified procedure outlined by Peterson and Corey (1966). The Red-P was determined as described by Chang *et al.* (1966). Standard analytical procedures as given by piper (1950) were used for the other estimations. From the results of analysis of the fifteen samples of each series the mean values were calculated and the date were subjected to statistical scrutiny.

RESULTS AND DISCUSSION

The mean general physico-chemical characteristics of the soils are given in Table 2 and the mean values of the diffrent forms of P are presented in Table 3.

The mean contents of total P, available P, organic P did not differ significantly between Vellayani series and Neyyattinkara series. The level of organic P, the variation in the distribution of total P; available P and Organic P between the surface and subsurface layers of the two series were also not significant.

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Table 2. Mean general physico-chemical characteristics of the soils

Sl. No.	Soil character	Vellayani series	Neyyattinkara series
1.	Texture	Sandy loam	Sandy loam
2.	Reaction (pH)	4.2	4.5
3.	CEC (me/100 g)	2.9	3.0
4.	Organic C (%)	0.5	0.5
5.	Exch. Ca (ppm)	133	169
6.	Exch. Fe (ppm)	77	57
7.	exch. Al (ppm)	180	155

Of the different fractions of inorganic P reductant soluble P (red-P) was the largest fraction in both the series. However. the variation in the content of Red-P in the different series, as well as between the surface and subsurface samples was not significant.

The smallest fraction in both the series was Ca-P. It is to be noted that the soils of these two series had very low cation exchange capacities (2.9 and 3.0 me/100g) and very low levels of exchangeable Ca (133 and 169 ppm), which would explain the low status of Ca-P in these soils.

As regards to other P fractions, viz., Saloid-P, Fe-P, Al-P and Occl-P, their contents varied significantly in the Vellayani and Neyyattinkara series. The order of dominance of these fractions also differed in the two series of soils.

Next to Red-P, Fe-P was the second abundant fraction in the Vellayani series, followed by Saloid-P, Al-P and Occl-P. In the Neyyattinkara series Saloid-P was the second largest fraction after Red-P, followed in order by Fe-P, Occl-P and Al-P. The difference in the contents of Fe-P and Saloid-P in the two series was also statistically significant.

There was a significant variation in Al-P. The variation in the content of Occl-P in the two series was also significant. However, between the surface and the subsurface samples in the two series, these fractions did not show any significant variations.

Correlation studies have shown that the available P was positively correlated with total P ($r=0.2870^{**}$), Al-P ($r=0.3219^{**}$) and organic P ($r=0.2297^{**}$) in both the series, similar to the findings of Agarwal *et al.* (1987) but not significantly with Fe-P and Saloid-P. Al-P was positively correlated with Fe-P ($r=0.3068^{**}$) and negatively with Ca-P ($r=0.5386^{**}$).

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Table 3. Mean values of native soil phosphorus in the Vellayani and Neyyattinkara sries

Series & Depth	Total P	Av. P	Org.P	Saloid P	Al-P	Fe-P	Red-P	Occl.P	Ca-P
					ppm				
Vellayani									
0-20 cm	103.6	28.1	53.9	10.9	7.6	12.2	12.1	5.1	2.6
20-40cm	97.4	24.8	42.5	10.8	7.7	13.2	14.3	6.6	2.4
Neyyattinkara									
0-20	101.9	25.9	49.2	13.6	5.2	10.3	14.0	6.6	3.8
20-40	101.9	25.8	52.7	13.8	4.3	8.6	14.4	6.6	3.5
Vellayani									
0-40	100.5	26.5	46.2	10.8	7.7	12.7	13.2	5.8	2.5
Neyyattinkara									
0-40cm	101.9	25.9	51.0	13.7	4.7	9.4	14.2	6.6	3.6
Both series									
0-20cm	102.8	27.0	51.6	12.2	6.4	11.2	13.1	5.8	3.2
20-40	99.6	25.3	47.6	12.3	6.0	10.9	14.3	6.5	2.9
CD (P=0.05)(Between depths within series	15.5	3.3	16.5	3.3	1.2	2.6	3.2	1.0	0.4
CD (P=0.05) (Between series)	11.0	2.3	11.7	2.3	0.9	1.8	2.2	0.7	0.3