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AVAILABLE NUTRIENT STATUS OF SOME RED SOILS (ALFISOLS) FROM DIFFERENT REGIONS IN KERALA*

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Soils with red colour occur extensively in the tropics and have great potentials for crop production. In Kerala, deep red soils (Alfisols) occur in patches as catenary sequences associated with soils having a laterite pan. These soils occur in the upper midslope positions in the midlands regions of Kerala (Venugopal, 1980). Some studies based on isolated sampling sites have been reported by Nair (1 973) and Iyer (1979). The present investigation involves study of red soils occurring in different regions of Kerala State with soil series as the basis.

Materials and Methods

Soil samples from 0-15 cm depth were collected from widely distributed areas within a soil series, from sixty sites belonging to six soil series, identified and mapped earlier by the Soil Survey Unit of the Department of Agriculture, Kerala State. The particulars of samples collected are presented in Table 1.

The air dried 2 mm sieved samples were analysed for available nitrogen by the alkaline permanganate method (Subbiah and Asija, 1956). Available P_2O_5 was extracted with Bray 1 and determined by the molybdophosphoric acid method outlined by Jackson (1958). Available potassium was extracted using neutral *N* NH_4OAc and determined using a flame photometer, pH and electrical conductivity were measured as per Jackson (1958). Phosphorus fixing capacity was carried out by the method of Hesse (1971). Micro-nutrients viz., iron, manganese, zinc and copper were extracted using DTPA (Lindsay and Norwell, 1978) and di-acid (0.05 *N* HCl + 0.025 *N* H_2SO_4) proposed by Perkins (1970) and estimated using an atomic absorption spectrophotometer.

Results and Discussion

The available nitrogen, phosphorus and potassium content of the soils (mean and range values) are given in Table 2.

The available nitrogen was highest in Kunhimangalam series followed by Bharanikkavu, Chirakkal, Beypore and Cheriniyoor series. The lowest content was recorded for Vellayani series. The soil test rating indicated that available nitrogen was low to medium in Vellayani, Cheriniyoor and Bharanikkavu series while it was medium for all the other soils under investigation.

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Table 1

Details of the soil samples collected

Samples collected	Soil series	Location
10	Vellayani	Trivandrum
10	Cheriniyoor	Quilon
10	Bharanikkavu	Quilon
10	Beypore	Calicut
10	Chirakkal	Cannannore
10	Kunhimangalam	Pilicode

The Bray 1 phosphorus of all the soils was in general high, the maximum being recorded by Beypore series and the lowest in Kunhimangalam series. The soil test ratings were high for all the soils under investigation. The NH_4OAc extractable potassium recorded the highest value in Chirakkal series varying from 12.09 to 113.58 ppm while the lowest content was observed in the case of Kunhimangalam series. The soil test rating indicated low levels in Vellayani and Kunhimangalam series and low to medium levels in all the other soils. Nair (1973) obtained low values for N, P and K content of red soils from Vellayani area and attributed this to the low organic matter status and low cation exchange capacity of these soils. All the areas sampled are intensively cultivated to coconut and other inter-crops and the soil management practised in these areas can be a possible reason for the variations observed in the available nutrient status of the ploughedlayer.

The soil reaction, electrical conductivity and phosphorus fixing capacity of the soils are presented in Table 3. The soils were in general acidic, the lowest being recorded in Kunhimangalam series and the highest in Vellayani series. The differences in acidity between locations can be explained as due to the variations in rainfall which has caused differences in leaching intensities. The electrical conductivity recorded very low values 0.02 to 0.03 mmho/cm as is expected of these highly leached upland soils.

The P fixing capacity of the soils was very high in all the soil series recording values greater than 100 mg P/100 g soil. Not much of variation was observed between the various soil series investigated. High P fixing capacity is characteristic feature of the highly weathered, sesquioxide rich soils. Nair and Padmaja (1983) have reported high rates of P fixation for rice soils of Kerala as observed in the present study.

Table 2

Mean, range values and soil test rating of available major nutrient elements in different soil series

Soil series and location	N			P			K		
	*Mean (ppm)	Range (ppm)	Soil test rating	Mean (ppm)	Range (ppm)	Soil test ratings	Mean (ppm)	Range (ppm)	Soil test rating
Vellayani Trivandrum	112.5	82.0—135.5	Low medium	71.7	52.6- 99.4	High	23.7	12.1— 36.6	Low
Cheriniyoor Quilon	118.5	101.4—155.8	Low medium	69.9	31.6—111.5	High	34.2	12.3— 68.1	Low medium
Bharanikkavu Quilon	156.1	143.4—178.6	Low medium	82.1	25.3-188.6	High	44.4	20.4— 75.1	Low medium
Beypore Calicut	134.5	92.1—152.7	medium	645.8	114.1—770.6	High	36.8	6.0-112.7	Low medium
Chirakkal Cannanore	150.9	134.0—170.2	medium	284,5	64.6-639.3	High	40.8	12.1—113.6	Low medium
Kunhimangalam Kasargod	158.9	141.7—179.0	medium	59.2	18.9—136.8	High	19.6	4.5- 34.3	Low

* Mean of 10 values

Table 3

Mean and range values for pH, electrical conductivity and P fixing capacity of soils

Soil series and location	pH		Electrical conductivity, mmho/cm		P fixing capacity mg/P/100 g soil	
	Mean	Range	Mean	Range	Mean	Range
Vellayani Trivandrum	5.57	5.15—5.80	0.03	0.02-0.03	124.9	119.1—135.9
Cheriniyoor Quilon	5.06	4.85—5.35	0.03	0.02-0.07	118.4	112.9-135.9
Bharanikkavu Quilon	5.19	4.60-5.40	0.02	0.01—0.03	119.2	112,7—136.0
Beypore Calicut	5.15	4,80—5.90	0.03	0.02-0.04	105.9	86.1-120.5
Chirakkal Cannannore	5.26	5.00—5.95	0.03	0.02—0.04	105.0	95.3—120.2
Kunhimangalam Kasargod	4.89	4.50—5.15	0.03	0.02-0.05	119.8	114.2—133.2

The extractable micronutrients content of soils are presented in Table 4.

In general DTPA extracted more quantities of iron than di-acid (0.05 *N* HCl+0.025 *N* H_2SO_4). The DTPA extractable iron was highest in Chirakkal series with a mean valueof 56.9 ppm followed by Kunhimangalam, Cherinniyur, Vellayani and Bharanikkavu series. The lowest value of 14.6 ppm was recorded for Beypore series. The highest content (19.6 ppm) for di-acid extractable iron was observed in Cheriniyoor series followed by Chirakkal, Kunhimangalam; Vellayani, Beypore and Bharanikkavu series.

Manganese extracted by DTPA also recorded higher values as in the case of iron. Vellayani series recorded the highest manganese centent ranging from 17.9—68.1 ppm while the lowest was noted in Beypore series varying from 2.8 to 5.1 ppm. The manganese content in the other soils series decreased in the order Chirakkal, Bharanikkavu, Kunhimangalam and Cheriniyur. Manganese extracted by diacid was lowest in Kunhimangalam series with a mean value of 4.6 ppm while the highest content of 23.4 ppm was observed in Vellayani series.

In the case of zinc di-acid extracted more of the element as compared to DTPA. Vellayani series with mean of 5.5 ppm recorded the highest content of this element followed by Bharanikkavu, Cheriniyoor, Kunhimangalam, Chirakkal and Beypore series with mean values of 5.1, 4.0, 3.9, 3.3 and 1.5 ppm respectively. The DTPA extractable zinc was very low and was less than 2 ppm for all the soil series investigated. Very little variation between soil series was observed.

Table 4

Mean and range values for available micronutrients, ppm

Soil series and location	Iron		Manganese		Zinc		Copper	
	DTPA	Diacid	DTPA	Diacid	DTPA	Diacid	DTPA	Diacid
Vellayani Trivandrum	26.0—41.6 (35.1)*	11.6—16.9 (14.6;	17.9—68.1 (41.5)	11.4-30.5 (23.4)	0.36—2.75 (0.85)	0.96-14.3 (5.51)	Trace—1.0 (0.37)	0.41-2.10 (0.84)
Cheriniyoor Quilon	32.3-52.0 (38.1)	10.4—46.9 (19.6)	4.7—17.7 (8.8)	Trace—10.2 (5.2)	0.34-1.15 (0.89)	0.69-14.9 (4.0)	0.09—0.36 (0.19)	0.08-1.08 (0.69)
Bharanikkavu Quilon	19.9—50.6 (33.2)	1.5-15.9 (10.8)	4.4-23.4 (15.1)	Trace—28.9 (9.3)	0.33—1.19 (0.86)	0.84—11.5 (5.1)	0.32—0.97 (0.48)	0.50—1.73 (0.88)
Beypore Calicut	30.3-64.9 (14.6)	8.9-27.5 (11-9)	2.8- 9.1 (5.9)	2.4—11.9 (4.9)	0.80—4.7 (1.9)	0.81— 5.5 (1.5)	0.71-1.0 (0.79)	0.95-1.57 (1.13)
Chirakkal Cannannore	37.2—72.1 (56.9)	12.8-26.6 (17.5)	8.7—34.6 (20.2)	0.12-35.0 (12.6)	0.72—3.4 (1.6)	0.57—12.3 (3.3)	0.61—1.45 (0.96)	0.95—1.93 (1.39)
Kunhimangalam Kasargod	28.2 52 0 (40.8)	10.7-26.5 (16.8)	4.7-16.7 10.0)	Trace—10.8 (4.6)	0.38-3.39 (1.5)	0.31—11.4 (3.9)	0.17-0.56 (0.41)	0.12—2.63 (1.30)

* Figures in brackets are mean of 10 values

Among the trace elements, copper recorded very low levels for both the extractants, with di-acid extracting more copper. In this case also very little variation between soil series was observed.

As discussed earlier, DTPA extracts more iron and manganese than di-acid, in all the soils investigated. Rajendran (1981) obtained similar results using DTPA and acid extractants for lateritic alluvium from Kerala and has concluded that DTPA is a versatile extractant for iron, manganese and zinc. The results of the present investigation lend support to the above observations. In respect of copper the content of copper extracted by di-acid was more as compared to DTPA and agrees with the findings of Cottenie *et al.* (1981) working on Nigerian soils.

Judged from the critical levels of Viets and Lindsay (1973) the following general conclusions are drawn with regard to the ratings of the different soil series in respect of DTPA extractable trace elements. Table 5 presents the ratings of the various soil series investigated. Wide variations in the amount of iron extracted by DTPA do not exist in various soil series. The DTPA critical values of iron indicate that the surface soils of all the soils are more than adequate in respect of this element. Manganese recorded appreciable variations between soil series but was more than adequate in all the soils.

The status of zinc did not show variations between soils, but was deficient to adequate in Vellayani, Bharanikkavu and Kunhimangalam series and marginal to adequate in Cheriniyoor, Beypore and Chirakkal. This clearly indicates the importance of zinc management in these intensively cultivated soils.

Variations in the amounts of extractable copper was narrow between soil series. Defecient to adequate levels were observed in Vellayani, Cheriniyoor and Kunhimangalam series while adequate status of this element was observed in Bharanikkavu, Beypore and Chirakkal series.

Table 5

Soil test rating for DTPA extractable micronutrients

Soil series	Iron	Manganese	Zinc	Copper
Vellayani	Adequate	Adequate	Deficient	Deficient to adequate
Cheriniyoor	Adequate	Adequate	Adequate	Deficient to adequate
Bharanikkavu	Adequate	Adequate	Deficient to adequate	Adequate
Beypore	Adequate	Adequate	Adequate	Adequate
Chirakkal	Adequate	Adequate	Adequate	Adequate
Kunhimangalam	Adequate	Adequate	Deficient to adequate	Deficient to adequate

Summary

A study was made on the available nutrient status of sixty surface samples collected from red soil (Alfisols) series identified in different regions in Kerala. Among the major nutrients, Bray 1 extractable phosphorus recorded high values for all the soil series. Nitrogen was low to medium in Vellayani, Cheriniyoor and Beypore, while it was medium in Chirakkal, Bharanikkavu and Kunhimangalam series. Low to medium levels of available potassium was observed in Chirakkal, Bharanikkavu, Beypore and Cheriniyoor series while Kunhimangalam and Vellayani series showed low levelsof available potassium. All the soils showed high phosphorus fixing capacity. DTPA extractable iron and manganese were more than adequate in the surface soils of all the soils investigated. Zinc was deficient to adequate in Vellayani, Bharanikkavu and Kunhimangalam series and marginal to adequate in Cheriniyoor, Beypore and Chirakkal series. Copper was deficient to adequate in Vellayani, Cheriniyoor and Kunhimangalam series while, adequate levels were observed in Bharanikkavu, Beypore and Chirakkal series.

സംഗ്രഹം

കേരളത്തിലെ വിവിധ പ്രദേശങ്ങളിലെ ചെമ്മണ്ണിന്റെ (ആൽഫിസോൾ) ഉപരിതല ത്തിൽനിന്ന് മണ്ണു സാമ്പിളുകൾ എടുത്ത്, അതിലെ ലഭ്യമായ ffl^ejc&KJBg^sis അളവ് on ിർ ണ്ണയിക്കുകയുണ്ടായി. മുഖ്യപോഷകമൂലകങ്ങളിൽ ഭാവഹമാണ് , എല്ലാ പരമ്പരകളിലും അധികമായികണ്ടത്. വെള്ളായണി, ചെറിനിയൂർ, ബേപ്പൂർ എന്നീ പരമ്പരകളിൽ പാക്യ ജനകം, കുറവ്–മദ്ധ്യമം എന്ന അനുപാതത്തിൽ കാണപ്പെട്ടപ്പോൾ ചിറക്കൽ, ഭരണിക്കാവ്, കുഞ്ഞിമംഗലം എന്നീ പരമ്പരകളിൽ ffls^'co^ffliEacal കാണപ്പെട്ടു. എല്ലാ മണ്ണിലും ഭാവഹക യൌഗികീകരണം കൂടുതലാണെന്നു കണ്ടു. ഇരുമ്പ്, മാംഗനീസ് എന്നീ മൂലകങ്ങൾ മണ്ണി ന്റെ ഉപരിതലമണ്ഡലങ്ങളിൽ ഏറെക്കുറെ കൂടുതലാണെന്ന് കാണാൻ കഴിഞ്ഞു. ചിറ ക്കൽ, ഭരണിക്കാവ്, ബേപ്പൂർ, ചെറിനിയൂർ എന്നീ പരമ്പരകളിൽ ലഭ്യമായ കഷാരത്തിന്റെ അളവ് കുറവ്-മദ്ധ്യമം എന്നതോതിലാണെങ്കിൽ കുഞ്ഞിമംഗലം, വെള്ളായണി എന്നീ പര മ്പരകളിൽ കുറവായും നിർണ്ണയിക്കപ്പെടുകയുണ്ടായി.

സിങ്ക് എന്ന മൂലകം വെള്ളായണി, ഭരണിക്കാവ്, കുഞ്ഞിമംഗലം എന്നീ പരമ്പരക ളിൽ കുറവായും, ചെറിനിയൂർ, ബേപ്പൂർ, എന്നീ പരമ്പരകളിൽ ഏതാണ്ട് പര്യാപ്തമാ യും കാണുകയുണ്ടായി. സസ്യലഭ്യമായ ചെമ്പിന്റെഅംശംCTnjggocoJsmT, ചെറിനിയൂർ, കുഞ്ഞിമംഗലം എന്നീ പരമ്പരകളിൽ കുറവായും, ഭരണിക്കാവ്, ബേപ്പൂർ, ചിറക്കൽ എന്നീ പരമ്പരകളിൽ പര്യാപ്തമായ അളവിലും ഉണ്ടെന്ന് പരീക്ഷണങ്ങൾ തെളിയിക്കുകയു ണ്ടായി

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