

## AVAILABLE NUTRIENT STATUS OF THE RUBBER (*HEVEA* *BRASILIENSIS*) GROWING SOILS OF TRIPURA

Tripura state in North East India now occupies second position in area and productivity among the rubber growing states of India with over 24000 ha under cultivation. The soils of this region are mainly derived from parent rocks of sandstone, silt stone and shale (Battacharya *et al.*, 1996; 1998). The soil temperature regime is hyperthermic and moisture regime udic. The area experiences a short water deficit of 100-150 mm during post monsoon period. An attempt has been made to assess the status of available major nutrients and magnesium (Mg) in the soil covering the main rubber growing areas of Tripura.

Soil samples collected from rubber growing areas of Tripura for advisory purpose were utilized for this study. One thousand seven hundred and fourteen soil samples were collected during 1996 to 2000 from the districts of West, South and North Tripura. A few samples from barren lands were also collected and analysed for comparison. The samples were air dried, passed through 2 mm sieve and then analysed for major nutrients. Organic C content was determined by wet digestion method. This was taken as a measure of available N in the soil. Bray-I extractant was used for extracting the available soil P. Neutral, normal ammonium acetate was used for K estimation. pH was measured in 1:2.5 soil water solution (Jack-

son, 1973). Mg was determined with the help of an atomic absorption spectrophotometer. After analyzing the samples, the soil test values were classified as low, medium and high for organic C, available P, K and Mg. The nutrient rating (critical levels) for rubber cultivation followed in the present study are given in Table 1. Nutrient index values for N, P, K and Mg were calculated using the concept of Parker *et al.* (1951). The limits suggested by Ramamoorthy and Bajaj (1969) were adopted for interpretation of nutrient indices.

Table 1. Critical levels of soil nutrients for rubber cultivation in Tripura

Nutrient	Low	Medium	High
Organic carbon (%)	< 0.75	0.75 - 1.50	> 1.50
P (mg/100 g)	< 1.00	1.00 - 2.50	> 2.50
K (mg/100 g)	< 5.00	5.00 - 12.50	> 12.50
Mg (mg/100 g)	< 1.00	1.00 - 2.50	> 2.50

Soil analysis data of the rubber growing areas and barren lands in Tripura are given in Tables 2 and 3 respectively. The barren land had low soil organic C status taking into consideration the critical level fixed for rubber. The available P and K were low while available Mg was high. Low organic C content in the soils of this region may be due to the indiscriminate jhuming preceded by burning of litter debris (Krishnakumar and Potty, 1989; Krishnakumar *et al.*, 1990, 1991). Continuous removal of thatch grass in huge

Table 2. Soil characteristics of rubber growing areas in Tripura

Location	No. of samples	pH	Organic carbon (%)	Available nutrients (mg/100 g)			
				P	K	Ca	Mg
Sabroom	100	4.68 (4.30-5.33)	0.82 (0.23-1.71)	0.33 (0.05-2.40)	4.84 (1.20-15.6)	9.54 (2.90-32.35)	2.77 (0.70-8.95)
Belonia	302	4.68 (4.06-5.73)	0.78 (0.23-1.71)	0.32 (0.01-1.86)	4.89 (1.20-21.0)	11.06 (2.10-37.50)	3.48 (0.90-10.10)
Amarpur	78	4.36 (4.00-4.72)	0.81 (0.32-1.39)	0.40 (0.01-0.6)	4.80 (2.30-13.90)	14.33 (5.40-45.80)	10.45 (2.30-13.90)
Udaipur	120	4.93 (4.20-5.82)	0.85 (0.21-1.45)	0.24 (0.01-1.96)	5.96 (1.80-21.6)	19.41 (4.95-49.85)	3.05 (0.35-10.10)
Sonamura	434	4.80 (4.01-5.57)	0.86 (0.27-1.94)	0.43 (0.01-1.97)	4.94 (1.40-15.10)	14.49 (2.05-6.60)	3.62 (0.75-10.45)
Bisalgahar	318	4.73 (4.12-5.37)	0.82 (0.22-1.56)	0.28 (0.02-1.42)	4.92 (1.10-12.50)	11.89 (3.10-35.35)	2.52 (0.60-6.60)
Sadar	100	4.80 (3.98-5.14)	0.81 (0.16-1.39)	0.34 (0.01-1.55)	3.36 (1.10-6.50)	8.70 (3.05-16.50)	1.50 (0.60-4.10)
Khawai	78	4.62 (4.28-4.88)	0.86 (0.30-2.08)	0.30 (0.01-1.00)	6.88 (3.10-17.70)	6.68 (3.35-11.30)	2.30 (1.10-4.00)
Kailashahar	30	4.88 (4.51-5.43)	0.91 (0.56-1.30)	0.36 (0.07-1.50)	6.14 (3.10-11.60)	14.36 (2.75-29.45)	4.42 (1.65-9.10)
Dharmanagar	126	4.63 (4.04-5.30)	0.79 (0.23-1.57)	0.28 (0.01-0.86)	6.09 (1.70-15.10)	11.24 (2.90-38.75)	3.54 (1.35-9.75)
Kanchanpur	28	4.83 (4.55-5.16)	0.83 (0.38-1.20)	0.25 (0.05-1.17)	4.10 (1.30-6.50)	12.28 (6.40-21.95)	2.99 (1.75-5.60)
Mean	1714	4.74 (3.98-5.82)	0.83 (0.16-2.08)	0.32 (0.01-2.40)	5.17 (1.10-21.60)	12.48 (2.05-49.85)	3.43 (0.35-13.90)

Figures in parentheses indicate the ranges

quantities may be another reason (Laskar *et al.*, 1983). An overall improvement in soil organic C content in rubber growing areas as compared to barren land (Table 2) has been observed. More than fifty per cent

samples from Udaipur, Amarapur, Dharmanagar, Kanchanpur and Bishalgahar areas had low organic C content while in Belonia, Sabroom, Sadar Khawai, Kailashahar and Sonamura it was medium

Table 3. Soil characteristics of barren lands in Tripura

pH	Organic carbon	Available nutrients (mg/100 g)			
		P	K	Ca	Mg
4.70 (3.75-5.60)	0.57 (0.16-0.67)	0.11 (0.01-0.31)	2.90 (1.10-4.70)	3.35 (2.05-6.70)	3.19 (0.85-4.60)

Figures in parentheses indicate the ranges

Table 4. Nutrient values in rubber growing soils of Tripura (% soil samples)

Location	Organic carbon			Available nutrients								
				P			K			Mg		
	L	M	H	L	M	H	L	M	H	L	M	H
Subroom	44.0	54.0	2.0	97.0	3.0	0.0	55.0	43.0	2.0	3.0	52.0	45.0
Belonia	48.7	51.0	0.3	95.1	4.9	0.0	59.3	38.7	1.9	0.3	36.8	62.9
Amarpur	61.5	38.5	0.0	100	0.0	0.0	66.6	30.8	2.6	0.0	0.0	100
Udaipur	50.8	49.2	0.0	95.8	4.0	0.0	45.8	51.6	2.5	13.3	39.2	47.5
Sonamura	36.63	61.8	1.61	98.84	1.2	0.0	76.96	22.1	0.92	1.38	44.4	53.92
Bisalgargh	58.2	41.5	0.31	97.8	2.2	0.0	90.0	9.1	0.0	1.3	56.0	42.7
Sadar	38.0	62.0	0.0	99.0	1.0	0.0	98.0	2.0	0.0	29.0	59.0	12.0
Khowai	39.7	56.5	3.8	76.9	23.1	0.0	23.1	73.1	3.8	12.5	26.4	61.1
Kailashahar	10.0	90.0	0.0	93.3	6.7	0.0	40.0	60.0	0.0	0.0	20.0	80.0
Dharmanagar	65.9	32.5	1.6	100	0.0	0.0	34.9	60.3	4.8	0.0	31.7	68.3
Kanchanpur	53.6	46.4	0.0	96.4	3.6	0.0	96.4	3.6	0.0	0.0	39.3	60.7

L : low; M : medium; H : high

(Table 4). Good cultural management practices including maintenance of leguminous cover crop in the immature phase of rubber cultivation could be the reason for build up of organic matter in certain areas. The slow pace of oxidation inside the closed canopy of rubber plantation helps to maintain the high organic matter status. The cultural operations with nearly zero tillage also favour stabilization of organic matter at a relatively high level (Krishnakumar and Potty, 1992).

In majority of the soil samples, available P was low. All soil samples from Dharmanagar and Amarpur and more than 90 per cent from all other areas except Khowai were low in available P. The low availability of P may be attributed to the acidic nature of the soil with high iron and aluminium content which makes it prone to fixation of applied P (Bhattacharya *et al.*, 1998). Besides utilization of the native P by the plants and fixation, inadequate application of phosphatic fertilizers may be another reason for the low P status.

Available K content in soils showed wide variations and more than 50 per cent of the samples from Belonia, Sabroom, Amarpur, Sadar, Kanchanpur, Bishalgargh and Sonamura were low in available K. Majority of the soil samples from Udaipur, Khowai, Dharmanagar and Kailashahar showed available K in the medium range. Dominance of 1:1 type of clay mineral (kaolinite) in the soils of Tripura and the resultant leaching loss of native as well as applied K may be the reason for low K availability (Das *et al.*, 1976).

Available Mg content was medium to high in most of the areas. All soil samples from Amarpur areas tested high while 29 per cent samples from Sadar region tested low. More than 50 per cent samples from Sabroom, Bishalgargh and Sadar areas showed medium range of available Mg.

From the soil test summary and nutrient indices of N, P, K and Mg (Tables 4 and 5) it can be concluded that most of the rubber growing soils of Tripura are low in available

Table 5. Nutrient indices and fertility rating of rubber growing soils of Tripura

Location	Nutrient index				Fertility rating			
	Organic carbon	Available nutrients			Organic carbon	Available nutrients		
		P	K	Mg		P	K	Mg
Sabroom	1.58	1.03	1.47	2.42	L	L	L	H
Belonia	1.51	1.04	1.43	2.62	L	L	L	H
Amarpur	1.38	1.00	1.36	3.00	L	L	L	H
Udaipur	1.49	1.04	2.03	2.34	L	L	M	H
Sonamura	1.65	1.01	1.24	2.53	L	L	L	H
Bisalgarh	1.42	1.02	1.09	2.42	L	L	L	H
Sadar	1.62	1.01	1.02	1.83	L	L	L	M
Khowai	1.64	1.23	1.81	2.49	L	L	M	H
Kailashahar	1.90	1.07	1.60	2.80	M	L	L	H
Dharmanagar	1.36	1.00	1.70	2.68	L	L	M	H
Kanchanpur	1.46	1.04	1.04	2.61	L	L	L	H

L : low; M : medium; H : high

P, low to medium in organic C and available K and medium to high in available Mg. These results suggest that fertilizer application for rubber in Tripura should be based on soil analysis.

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