NUTTAL, W.F. (1970). Effect of organic amendments on some physical properties of Luvisolic soils in relations to emergence of rapeseed in a growth chamber. **Can. J. Soil Sci. 50** : 397-402.

RAMAMOHANA RAO, M .S., RAO, Y.N. and KATHAVADE, Y.V. (1973). Effect of compaction of the physical properties of soils and yield of wheat and uptake of nutrients by tomato. **Indian J. Agric. Sci. 43** : 273-75.

(Received : March 1999 Revised : May 2000)

Madras Agric. J., 86 (10-12): 549-551 October - December 1999
https://doi.org/10.29321/MAJ.10.A00654

EFFECT OF NATURAL FOREST ON THE CHEMICAL PROPERTIES OF SOILS

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ABSTRACT

The effects of natural forest on the chemical properties of soil at different depths (0 to 30, 30 to 60 and 60 to 90 cm) were studied. There was a slight increase in pH in the sites under vegetation compared to open space, whereas no appreciable change in EC was observed. But substantial increase in cation exchange capacity, organic carbon content, total and available primary nutrients were recorded in the sites under vegetation compared to the contents in the open space. The effect of natural forest was more in surface soil (0 to 30cm) than in subsurface soil (30 to 60 and 60 to 90cm). The underwood vegetation in the study area, leaf litter production over the period of establishment and nutrient concentration in leaf litter were also recorded.

Tree plantations improve soil chemical properties through addition of leaf litter. The effects on soil chemical properties differ with the kind of vegetation the soil supports (Yadav, 1968). Mongia and Bandyopadhyay (1994) reported higher organic carbon content under natural forest than under paddock, rubber, teak and red oil palm. The high carbon content of soil under tree plantations was due to highest litter fall (Hosur and Dasog, 1995). Singh *et al.*,(1985) observed that soil under *Cryptomeria japonica* had maximumCEC than the soil under mixed and *Pinus* species plantation. Information on effect of tree vegetations on the soil properties in Tamil Nadu is scanty. This study was, therefore, undertaken to understand the changes in chemical properties in relation to natural forest in Madurai District of Tamil Nadu.

MATERIALS AND METHODS

The study area selected for present investigation was Alagarkovil natural forest. The latitude of the study site was 9°54' N and the longtitude was 78°54' E. Soil samples were collected from two profiles in open space and two profiles under vegetated area. In each profile, soil samples were collected from three different depths of 0 to30, 30 to 60 and 60 to 90 cm. The salient site

Table 1. Study site characteristics of soil profiles under natural forest

Particulars	Study site characters
Forest division	Trichirappalli
Forest range	Alagarkovil
Soil group	Red lateritic
Soil depth	Shallow
Mode of soil formation	Primary
Parent material	Granite
Topography	Hill slope
Slope	20
Aspects	Western
Erosion	Very severe
Ground water	Deep (>5m)
Drainage	Excessive
Climate	Subtropical
Soil order	Alfisol

Table 2. *In-situ* litter accumulation and percentage contribution of different vegetative components to total *in-situ* litter accumulation and nutrient concentration in leaf litter

In situ litter accumulation		Nutrient concentration of leaves	
Components	Litter quantities (t ha^{-1})	Nutrient	Concentration (%)
Leaves	5.25 (60.00)	Nitrogen	0.58
Large twigs	2.00 (22.90)	Phosphorus	0.08
Small twigs	1.50 (17.10)	Potassium	0.51
		Calcium	2.61
Total	8.75	Magnesium	1.32

Figures in parenthesis indicate the percentage contribution of different vegetative components to total *in-situ* litter accumulation.

characteristics and biometric characteristics are described in Table-1 and leaf litter accumulation, percentage contribution of different vegetative components to total *in-situ* litter accumulation and nutrient concentration of leaf litter are given in Table-2. The samples were analysed for pH and EC in 1 :2 soil: water slurry. The soil organic carbon was determined by the chromic acid digestion.The soil CEC was estimated by leaching with N-N NH_4OAc. The soil total nitrogen was determined by Kjeldahl method and total phosphorous by vanadomolybdate yellow colour method. The total and available potassium of soil were determined using a flame photometer, whereas the available nitrogen in soil was estimated by alkaline $KMnO_4$ method and the available phosphorous by Bray no 1. method. The results were interpreted by comparing the analytical results of soil samples.

RESULTS AND DISCUSSION

Changes in the soil chemical properties are given in Table-3. The pH ranged from 6.1 to 6.5 in the study site of the open space, whereas it ranged from 6.4 to 6.8 in the site under natural forest. The results show that the slight increase in pH in the soils of natural forest may be due to the addition of more bases through their leaf litter besides higher addition of leaf litter. The EC in the study site of open spaces ranged from 0.11 to 0.19 dSm^{-1},whereas it ranged from 0.13 to 0.20 dSm^{-1} in the sites under natural forest.

The results showed that the electrical conductivity did not change appreciably under vegetation compared to that in the open space. The CEC ranged from 8.8 to 9.9 c.mol(p+) kg^{-1} in the open spaces of study sites, whereas it varied from 10.0 to 18.1 c.mol (p+) kg^{-1} in the sites under natural forest. The data revealed that there was an increase in CEC of the soil under vegetation over that of open space.This may be due to the variation in rate of decomposition of organic matter added through leaf litter. Similar results were reported by Antony (1981).

The organic carbon content varied from 0.14 to 0.42 per cent in the open space, whereas it ranged from 0.15 to 0.78 per cent in the sites under natural forest. This result showed that there was an increase inorganic carbon in the sites under vegetation. This may be due to the addition of litter fall and their decomposition under different vegetations. The important input for organic carbon in soil may be overall root biomass which is greater under tree canopy.

The available N, P and K in the open space of study sites ranged from 34 to 84; 8.4 to 12.5 and 108 to 124 kg ha^{-1} respectively. The available N, P and K in the sites under natural forest varied from 37 to 137; 10.3 to 17.0 and 147 to 174 kg ha^{-1} respectively. The total N, P and K in the open spaces of all study ranged from 0.013 to 0.014, 0.130 to 0.192 and 0.168 to 0.195 per cent respectively. The total N,P and K in the sites under natural forest varied from 0.015 to 0.064; 0.148 to 0.254 and 0.220 to 0.266 per cent respectively. The increase in total N, P and K contents in the sites under vegetation were 58, 33 and 31 per cent respectively and the available N,P and K contents in the sites under vegetation were 65, 37 and 35 per cent respectively.

The effect of natural forest vegetation on soil chemical properties was more pronounced in surface soil than in the sub surface soil. The effect of natural forest to enrich nutrient status varied depending upon the behaviour of nutrient, nature and type of soil, organic matter accumulation, microbial activity and quantity and degree of

Table 3. Influence of natural forest on the chemical properties of soil

Parameters		Depth (cm)					
		0-30		30-60		60-90	
		O	V	O	V	O	V
pH	SI	6.2	6.8	6.3	6.6	6.5	6.7
	SII	6.1	6.7	6.1	6.4	6.4	6.6
EC (dSm^{-1})	SI	0.12	0.14	0.15	0.16	0.19	0.20
	SII	0.11	0.13	0.14	0.15	0.17	0.18
CEC (c. mol	SI	8.8	17.8	9.5	16.9	9.8	10.0
(P^+) kg^{-1})	SII	9.1	18.1	9.7	17.7	9.9	11.8
OC (%)	SI	0.42	0.78	0.19	0.24	0.15	0.16
	SII	0.40	0.77	0.20	0.26	0.14	0.15
Total - N (%)	SI	0.038	0.064	0.019	0.022	0.014	0.016
	SII	0.041	0.062	0.020	0.024	0.013	0.015
Total - P (%)	SI	0.192	0.254	0.164	0.208	0.132	0.154
	SII	0.190	0.252	.167	0.205	0.130	0.148
Total - K (%)	SI	0.170	0.220	0.184	0.248	0.195	0.264
	SII	0.168	0.222	0.187	0.245	0.192	0.266
Available - N	SI	84	137	38	43	34	37
(kg ha^{-1})	SII	78	131	46	51	34	39
Available - P	SI	12.5	16.9	10.8	13.8	8.5	10.4
(kg ha^{-1})	SII	12.3	17.0	10.6	13.9	8.4	10.3
Available - K	SI	108	147	114	164	120	168
(kg ha^{-1})	SII	114	153	120	158	124	174

SI : Site I SII : Site II
O : Open Space V : Under Vegetation

weathing of nutrient bearing minerals.

REFERENCES

ANTONY, P.C. (1981). **Studies on the physical properties of the major soil groups of Kerala with special reference to the effect of salinisation and desalinisation.** Ph.D Thesis submitted to the Kerala Agri. University.

HOSUR, G.C. and DASOG, G.S. (1995). Soil characteristics under three different plant communities of North East India. **J.Indian Soc. Soil Sci. 43**: 256-259.

MONGIA, A.D. and BANDYOPADHYA, A. (1992). Soil nutrient under natural and planted forest in island ecosystem. **J.Indian Soc. Soil Sci. 40**: 420 – 424.

SINGH, S.B., NATH, S., PAL, D. K. and BANARJEE, S.K., (1985). Changes in soil properties under different plantations of the Darjeeeling Forest Division. **Ind. For., 111** : 90 – 98.

YADAV, J. S. P. (1968). Physico-chemical characteristics of some typical soils of Indian forests. **Ind. For., 93:** 95-98.

(Received: January 1999 Revised : April 2000).