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COMPARATIVE EVALUATION OF SOIL ORGANIC MATTER STATUS OF RUBBER GROWING SOILS IN RELATION TO FOREST ECOSYSTEM

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Abstract: A study was undertaken to compare the organic carbon content of soils under forest and rubber plantations. The results indicated that the average soil organic C content in the soil profiles of rubber was significantly lesser than that of the forest. The average content of organic C in 0 -60 cm layer of different cycles of rubber also have significantly lower values with respect to forest. The removal of total biomass and the breakdown of soil organic matter taking place during the repeated deforestation cycles as encountered in rubber plantations could be the reason for low organic C levels in rubber.

1. Introduction

Soil organic carbon has been defined as the organic fraction of the soil including plant animal and microbial residues fresh and at all stages of decomposition and the relatively resistant humus. It has been estimated that the mass of soil organic carbon (30.1×10^{14} kg) was greater than the total other surface reservoirs (20.8×10^{14} kg). Forests contribute to a great extent to the soil reserve of organic carbon and thereby controlling carbon cycle. Deforestation and subsequent breakdown of soil organic matter into CO_2 has attracted equal attention of environmentalists as that of fossil fuel burning and CO_2 emission in the context of global environmental issues. Over and above, from the agricultural point soil organic matter is an important factor in maintaining desirable physical and chemical properties of soil (Martel and Paul 1974). The rate at which organic matter is accumulated or depleted is controlled by the overall influence of climate, plant community, human interference and time (Verma et al 1990).

Conversion of humid tropical forest into agricultural land has been happening since the early settlement of human beings. In Kerala, commercial cultivation of rubber started in 1902 and the majority of the area comprised of converted forest land. Rubber is a tree crop and tree crops are commonly believed to be the only viable means for a sustainable crop production as tree stand most closely resemble the forest ecosystem and their management requires less inputs with least soil disturbances. However mono culturing of plants coupled with repeated deforestation afforestation cycles as encountered in rubber cultivation will defenitely make some impact on the physico chemical properties and the biotic flora and fauna of soil. But studies on comparison of rubber plantations with natural forests are sparse and the ecological implications of plantation forestry in tropics and that of rubber in particular have been studied only to a limited extent (Aweto 1987)

With this background, a study was taken upto study and characterise soil organic matter present in rubber and forest ecosystems. In this paper we report the result of a comparison of soil organic mater content in forest and different cycles of rubber plantations.

2. Materials and Methods

In order to study the changes occurred to soil organic matter as a consequence of rubber cultivation, four locations were selected in the major agroclimatic zones of rubber cultivation viz., Nilambur, Chimoni, Vithura and Mundakkayam. Sites for the soil collection were so chosen that rubber plantations in the third cycle of the crop and natural forest land could be located side by side with similar physiographic features. Profiles were dug in those sites and samples were collected from different horizons. The samples were air dried, sieved through 2 mm sieve and the organic carbon estimated by the procedure of Walely and Black as described by Jackson (1964)

For studying the sequential changes in the soil organic matter status of the soil under different cycle of rubber in comparison to forest, 3 locations were selected where plantations could be located in first, second and third cycle of rubber cultivation and where adjacent forest lands are available. From these sites samples were collected from three depths viz., 0-15, 15-30, and 30-60 cms and analysed for the organic carbon content. The data were statistically analysed and results interpreted.

3. Results and Discussion

(a) Comparison of forest and rubber plantation at third replanting cycle:

The results of comparison of rubber plantation at third replantation cycle with forest is presented in table. 1. The results indicate that there is a significant decrease in the soil organic matter content between the rubber and forest soil. The

two sets differed much though not significantly, in the top three horizons. The four locations studied also had significantly different organic matter levels, Chomoni having the highest content. Excepting Vithura, in all other locations the soils of rubber plantations contained significantly less amounts of soil OM. One probable explanation for this decline may be the removal of timber at the end of each plantation cycle. This biomass removal comes to approximately 445 tons per hectare (Shorrocks 1965 a). The annual addition of leaf litter at the rate of 5-10 tons per hectare add sizeable amounts of organic matter in the forest (Lal 1986). In natural forest, recycling of nutrients is an important aspect as considerable amounts are returned to soil through leaf fall. Balagopal (199) has reported high organic matter content in natural ...s of Kerala as compared to teak, eucalyptus and rubber ..antations.

(b) Sequential changes in organic matter content due to rubber cultivation:

The samples collected from three depths viz., 0 - 15, 15-30 and 30 - 60 cm from the three locations representing three cycles of rubber and forest were compared for the organic C content. Results are shown in Fig.1. All the three cycles had significantly lower levels of organic matter when compared to forest. Though cycle 2 and 3 had comparatively higher
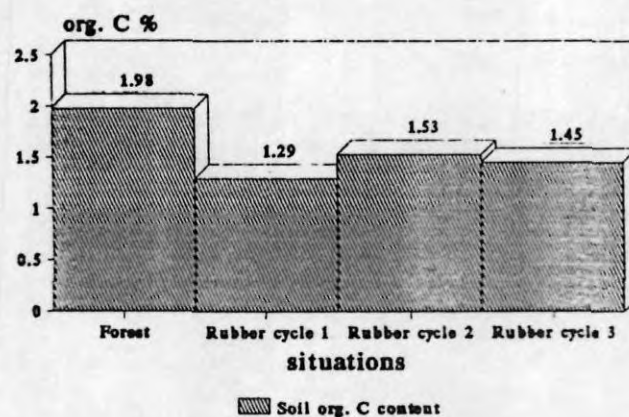

Fig 1. Soil organic C% in Forest and the three cycles of rubber. (0-60 cm Depth)
C.D. for comparison of Forest with rubber = 0.43

values than cycle one, the difference was not significant. Slight but gradual decline in organic matter content was reported in Ultisols under rubber in Malasia and oil palm in Ivory Coast (Sanchez 1985).

Table 1. Comparison of soil organic C% in different horizons of the third cycle of rubber in four locations

Situation	Horizons					
	H1	H2	H3	H4	H5	Mean
Rubber	2.090	1.305	0.858	0.865	0.668	1.150
Forest	2.822	1.700	1.220	0.890	0.877	1.502
Mean	2.456	1.502	1.039	0.877	0.773	

CD (0.05) for comparison of rubber & forest = 0.17
"   "   Horizons = 0.26
Situation X Horizon   NS

Situation	Places			
	Nilambur	Chimoni	Vithura	Mundakkayam
Rubber	1.096	1.236	1.118	1.178
Forest	1.088	2.084	1.490	1.346
Mean	1.092	1.660	1.304	1.262

C.D. (0.05) for Places   =   0.235
"   Situation x place   =   0.33

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