ABSTRACT

Rubber growing soils are acidic in reaction and under acidic conditions normally Zn is available for plant growth. However, the soils under rubber are highly weathered and are prone to severe leaching losses due to intense rainfall. Low Zn content of the rubber growing soils in the traditional belt of rubber cultivation was reported by Joseph et al., (1995). Further, in an extensive study with 9682 surface soil samples covering the traditional rubber growing tract of Kerala and Tamil Nadu it was reported that 41.0 per cent of the soils in the traditional rubber growing tract is deficient in available Zn(NBSS and LUP,1999). In the traditional belt of rubber cultivation plantations are in the second or third planting cycle. Repeated cycles of cultivation might have reduced the Zn status of the soil further and Zn deficiency in young plants in the replanting fields is a common phenomenon these days.

The present investigation on Dynamics of Zinc in rubber growing soils was studied under four major heads viz., i) collection of profile soil samples from nine major soil series, and assessment of the status and distribution of total and different forms of Zn, ii) assessment of Zn availability in these soils using different extractants iii) modeling of Zn adsorption in the surface soils of these nine major soil series and iv) pot culture experiment to study the response of rubber plants to application of Zn.

On the basis of the soil survey report of the rubber growing soils of Kerala and Tamil Nadu (NBSS and LUP 1999), nine major soil series were identified for the study. The soil series selected were Kanjirappally (Kpl) Vijayapuram (Vpm), Thiruvanchoor (Tvr), Vazhoor (Vzr), Lahai (Lah) Thrikkannamangal (Tmg), Kunnathur (Ktr), Panachikkad (Pck) and Kaipuzha (Kpa). Series were located at the type location and pits were taken up to the parent rock or to a depth of 200cm if deeper). Samples were collected horizon wise from each profile and horizons were identified.
The organic carbon content of the horizon wise soil samples ranged from low to high. In general, the Kunnathur and Thrikkannamangal series recorded the lowest organic carbon content and Lahai series recorded the highest organic carbon content. The cation exchange capacity values were very low. In the Ap horizon, the values are comparatively high in all most all the series except in Kaipuzha series where the CEC values are low in all the horizons.

The base saturation values were less than 35 in all the series studied except in Kunnathur series. Among the nine series, the per cent base saturation values were extremely low in Kaipuzha and Lahai series. Wide variation in the values of exchangeable Ca, Mg and K was recorded among the series. The exchangeable Ca values were extremely low in the Kanjirappally and Lahai series in all the horizons and comparatively high in Kunnathur series. Similarly, exchangeable Mg values were extremely low in Kanjirappally, Lahai and Kaipuzha series. Exchangeable K values were low in Vazhoor, Panachikkad and Kaipuzha series. Exchangeable Na values showed the same trend as that of K. The soils are dominated by coarse sand and clay. In general, the clay content is found to increase with depth of the soil.

Assessment of the status and distribution of Zn in the nine major soil series in the traditional belt of rubber cultivation indicated that the total Zn status of the soil is comparatively low. Similarly, the water soluble plus exchangeable fraction of the soil is very low and the values reduced down the horizons. Major share of the Zn is in the residual fraction and is not available for plant growth. Though the water soluble plus exchangeable fraction is high in some series in the Ap horizon, drastic reduction in values in the subsurface horizons were recorded indicating that Zn availability is restricted to the Ap horizon ie only to the 0-15 cm layer of the soil and down the layers the availability is low. Kanjirappally, Lahai, Thiruvanchoor and Kunnathur series are found to be extremely
low in available fraction of the Zn. Added to that the total Zn status of these soils are found
to be low indicating chances of depletion of Zn reserve in the long run.

Zinc availability was assessed through five extractants viz., DTPA, Mehlich-1, Mehlich-2, 0.1N HCl and DTPA HCl. DTPA extracted Zn values were the lowest and the DTPA-HCl extracted the highest values. DTPA extractant is found to be good for estimating the available Zn status of these acid red ferruginous soils. The available Zn values for the Ap horizon recorded wide variation between series and the Kanjirappally, Lahai and Thiruvanchoor series were found to be extremely deficient in available Zn. Even though the other six series recorded sufficiency in available Zn in the Ap horizon, low values were recorded in the lower layers. Added to that the total Zn status was found to be low. The data generated from Zn adsorption studies were fitted to linear forms of Langmuir and Freundlich adsorption equations. Among the nine soil series, data generated for five series were fitting the linear models of these two equations. Both the equations were equally good for explaining the adsorption characteristics of Zn in these soils. Positive response to Zn application was recorded on the availability of Zn in the soil and on the leaf Zn status and dry matter yield and uptake of Zn by rubber plants. Application of Zn fertilizer to these soils, especially to Kanjirappally, Lahai, Thiruvanchoor and Kunnathur soils may be beneficial for improving the plant growth and maintaining the Zn status.