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## Compendium Abstracts



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## FORMS OF ALUMINUM IN THE ACID SOILS OF SOUTH INDIA UNDER RUBBER CULTIVATION

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### Abstract

Total as well as different forms of Al in the major soil series of the rubber growing soils of South India were assessed. Wide variation in the total as well as in the different forms of Al and in the Al saturation per cent was recorded between series. Significant negative correlation between pH and Al saturation per cent was recorded. Among the major eight series high Al saturation was recorded in Vijayapuram, Thiruvanchoor, Kanjirappally, Thrikkannamangal and Lahai series indicating the necessity of replenishing these soils with cations for improving the fertility and productivity of these soils.

### Introduction

In India, the traditional belt of rubber cultivation is confined to a narrow tract in the western side of the Western Ghats mainly in Kerala and Kanyakumari district of Tamil Nadu. The soils of this tract are highly weathered acid soils with pH ranging from 4.5–6.0. These soils were characterized as per modern soil taxonomy in to 62 soil series of which 51 were under Ultisols, nine under Inceptisols and two under Entisols (NBSS&LUP, 1999). In acid mineral soils of tropical climate regions, the high aluminum (Al) content, associated to high acidity and low fertility, is one of the main constraint for agricultural production (McLean, 1965).

### Materials and Methods

Horizon wise soil samples were collected from eight major soil series viz., Kanjirappally (Clayey-skeletal, kaolinitic, isohyperthermic, Ustic Kandihumults) Vijayapuram (Clayey, kaolinitic, isohyperthermic, Ustic Kandihumults), Lahai (Clayey, kaolinitic isohyperthermic, Ustic Kanhaplohumults), Thiruvanchoor (Clayey-skeletal, kaolinitic, isohyperthermic, Ustic Kanhaplohumults), Vazhoor (Clayey-skeletal, kaolinitic, isohyperthermic, Ustic Kanhaplohumults), Thrikkannamangal (Clayey-skeletal, kaolinitic, isohyperthermic, Ustic Kandihumults), Kunnathur (Clayey, kaolinitic, isohyperthermic, Ustic Kanhaplohumults) and Panachikkad (Clayey-skeletal, kaolinitic isohyperthermic, Ustic Kanhaplohumults) and the forms of Al and Al saturation percent were assessed. Total Al was determined by HCL-HF method as per Hossner (1996) and estimated colorimetrically with aluminon, and the intensity of the colored complex was measured at 535 nm (Hsu, 1963; Jayman and Sivasubramhian, 1974). Exchangeable Al was estimated by leaching the soil with un buffered 1M KCl in the ratio 1:10 (McLean, 1965). Extractable Al in the soil was extracted with normal ammonium acetate (pH 4.8) in the ratio 1:10 and equilibrating the soil suspension for 2 hrs (McLean, 1965). Non exchangeable Al was calculated as the difference between extractable Al and exchangeable Al. Soluble Al was estimated by extracting the soil with 0.01 M CaCl<sub>2</sub> (soil solvent ratio 1:2.5) and shaking for 5 minutes and the Al in the extract was estimated colorimetrically by aluminon method. Effective cation exchange capacity was determined by summation of exchangeable Na, K, Ca, Mg and Al in the 1M KCl extract (Reeuwijk, 1993). Aluminum saturation percent was expressed as per cent to the ECEC.

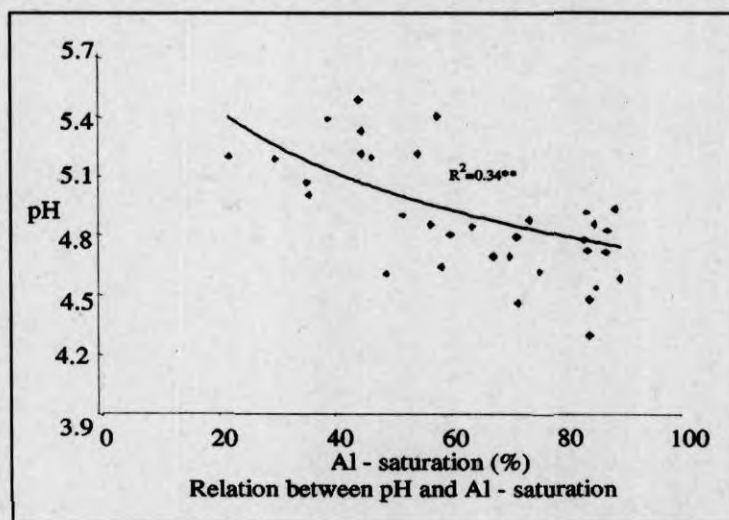
### Results and Discussion

Forms of Al in the Ap horizon is presented in Table.1. Wide variation in total Al ranging from 2.0 to 6.0 per cent was observed in the surface horizon. No regular pattern was observed in the distribution of exchangeable Al. Exchangeable Al was high in Lahai, Panachikkad, Thiruvanchoor, and Vijayapuram and low in Vazhoor and Kunnathur series. Soluble Al ranged from 1.13 to 6.38 ppm between series. Soluble Al was found to be high in the subsurface layers compared to the surface layer. Lower soluble Al in the surface layer might be due to the presence of organic matter. Extractable Al values ranged from 1.67 to 8.20 cmol/kg in the surface horizon. In Vijayapuram, Vazhoor, Kanjirappally, Thrikkannamangal and Kunnathur series extractable Al was higher in the lower horizons than in the surface layer. Among the series, low extractable Al was recorded in Vazhoor series. In all the pedons the amount of Al extracted by 1M NH<sub>4</sub>OAc buffered at pH 4.8 was higher than the Al extracted by 1M KCl, which indicate that extractable Al<sup>3+</sup> includes exchangeable Al<sup>3+</sup> and soluble Al (OH)<sub>3</sub> and the hydroxy-Al monomers or polymers. Non exchangeable Al is associated with organic matter, interlayer Al and hydroxy Al polymers. No regular pattern was observed in the distribution of non-exchangeable Al in the profiles. The values ranged from 0.97 cmol/kg in Kunnathur series to 5.56 cmol/kg in Lahai series in the surface layer.

Table1 : Forms of Al in the surface (Ap) horizon.

Series	Total Al (%)	Soluble Al (ppm)	Exch.Al	Extr.Al	NonExc.Al	ECEC	Al saturation(%)	pH (H <sub>2</sub> O)
Vijayapuram	3.8	5.63	2.20	3.89	1.19	3.06	71.90	4.46
Thiruvanchoor	2.2	5.50	2.27	6.11	3.84	3.49	65.04	5.02
Vazhoor	2.0	3.50	0.55	2.20	1.65	1.41	39.01	5.38
Kanjirappally	4.2	5.75	1.76	4.44	2.68	2.33	75.54	4.61
Lahai	5.8	3.25	2.64	8.20	5.56	3.03	87.13	4.71
Thrikkannamangal	6.0	6.38	1.65	3.61	1.96	2.34	70.60	5.04
Kunnathur	3.8	1.13	0.70	1.67	0.97	3.20	21.88	5.20
Panachikkad	4.2	2.75	2.50	4.20	1.70	4.31	58.00	5.40

Effective cation exchange capacity ranged from 1.41 cmol/kg in Vazhoor series to 4.31 cmol/kg in Panachikkad series in the surface soil. The surface layers had generally lower Al saturation per cent and the values increased with depth. Values ranged from 21.88 per cent in Kunnathur series to 87.13 per cent in Lahai series. pH ranged from 4.58 to 5.40 and with in this pH range, significant negative correlation between pH and Al saturation per cent was recorded (Figure 1). The higher the Al saturation, the more the soils will be deficient in Ca, Mg and K. In Kunnathur, Vazhoor and Panachikkad series the Al saturation was less than 60.0 per cent in the surface and subsurface horizons, while in the rest of the series viz., Vijayapuram, Thiruvanchoor, Kanjirappally, Thrikkannamangal and Lahai the Al saturation was high indicating clearly the necessity of replenishing the exchange complex with cations viz., Ca, Mg and K for maintaining the fertility and productivity of these soil.



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