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Potassium Status and its Relationship with Various Soil Properties in Nilgiris Soils

N. S. BOLAN and U. S. SREE RAMULU*

Different forms of potassium, their interrelationships and their relationships to other soil properties were investigated in twenty seven soil profiles of high level laterite soils of Nilgiris District (Tamil Nadu). Total K content in the soils ranged from 0.05 to 0.70 per cent and water-soluble, exchangeable, non-exchangeable and lattice K constituted 0.56, 3.85, 3.97 and 91.35 per cent respectively of the total K. Including total K, all forms of K showed a decreasing trend with increasing depth of soil profile. Significant positive correlation was obtained among different forms of K, which showed the existence of equilibrium between these forms. Positive correlations were obtained between different physico-chemical properties of soil like pH, EC, exchangeable cations (Ca, Mg) and organic carbon and different forms of K. There existed a negative correlation between rainfall and forms of K and positive correlation between elevation and forms of K.

Potassium produces considerable response in potato grown extensively in Nilgiris District. Hence a study of the distribution of different forms of K in soil profiles of this district would be useful to plan K fertilization. This study was undertaken to characterise the Nilgiris soils with regard to their K status.

MATERIAL AND METHODS

One hundred and twenty three soil samples from 27 profiles were collected covering wide range of elevation and rainfall in Nilgiris District (Table). The soils were analysed for total K (HCl extract), water soluble K (Toth and Prince, 1949), exchangeable K (Stanford and English, 1949), non-exchangeable (fixed) K (Wood and Deturk, 1940) and tenaciously held (Lattice form) K (by difference from total K). Various soil Physico-chemical properties like pH, EC, organic carbon, CEC, exchangeable cations were determined. Simple correlations were worked out to determine the relationships between different forms of potassium and various soil physico-chemical properties of the 27 surface soil samples.

RESULTS AND DISCUSSION

Forms of K:

TOTAL K: Total K content in the soils ranged from 505 to 6,975 ppm. The high K content in these laterite soils might be attributed to the possibility of K feldspar being their parent rock (Droupathi Devi, 1963). Except a few, in all the profiles the total K con-

* Agricultural College and Research Institute, Coimbatore 641 003.

tent decreased with depth due to decrease in organic matter content as confirmed by the existence of positive correlation between organic carbon and total K. Allision (1973) observed higher total K in soils with high organic matter. The three profiles showing increasing trend in totol K with depth were from lower altitudes. This suggests the possibility of the accumulation and deposition of K in the lower horizons through leaching from upper reaches (Balaguru, 1970).

WATER SOLUBLE K: This form ranged from 1.0 to 210 ppm which constituted 0.56 per cent of total K. This low amount of water soluble K might be due to leaching of water soluble K in this hilly tract. In all the profiles, the water soluble K decreased with depth as observed in the case of total K. Reitemeier (1946) reported that trees were able to draw nutrients from the subsoil and these nutrients were left in the surface layer when the roots decayed.

EXCHANGEABLE K: This form ranged from 14 to 750 ppm which constituted 3.85 per cent of total K. Low content of exchangeable K in these soils can be attributed to the predominance of hydrogen ions in the exchange complex (Jeyaraj 1969). The decreasing trend in exchangeable K with increasing depth also might be due to drawing up of nutrients from lower regions.

NON-EXCHANGEABLE (fixed) K: Fixed K ranged from 13 to 1120 ppm which constituted 3.97 per cent of total K. The low content of this form of K might be due predominance of kaolinite type of clay in these soils which does not fix K (Balasundaram, 1971).

TENACIOUSLY HELD K (Lattice form): This ranged from 450 to 6708 ppm which constituted the major portion (91.35 per cent) of total K. Presence of such large amount of this form of K might be attributed to the predominance of K bearing minerals (Nambiar, 1972).

Interrelationships between different forms of K of the 27 surface soil samples were worked out. Positive correlation ($r=0.94^{**}$) obtained between total K and lattice K confirmed the dependency of total K on lattice K. Similarly positive correlations were noticed between exchangeable form and water soluble form ($r=0.85^{**}$) and exchangeable form and non-exchangeable form ($r=0.39^{**}$) which supported the equilibrium concept of K. Relationships between forms of K and other soil physico-chemical properties of the surface soil samples. Were also worked out Positive correlations were obtained between pH and forms of K like water soluble ($r=0.39^{*}$), exchangeable ($r=0.67^{**}$) and non-exchangeable forms ($r=0.44^{*}$) This might be due to presence of more of K-ions in the exchange complex at higher pH (Rajakkannu *et al*, 1970).

The positive correlations established between organic carbon anp

TABLE Elevation, Rainfall and Location of Profiles selected for study

Profile No.	Location	Soil sample Numbers	Elevation (in meters)	Rainfall (mm)
1.	Aravenu	1 to 5	1677	1854
2.	Furliar	6 to 10	939	1524
3.	Coonoor Pomological Station	11 to 14	1825	1448
4.	Jakanarai	15 to 18	1921	1855
5.	Kallar	19 to 22	457	1524
6.	Kattabattu	23 to 27	2012	1448
7.	Kengarai-Kilhatty village	28 to 31	1681	1854
8.	Kodanad	31 to 33	1749	1525
9.	Kotagiri	34 to 38	1951	1930
10.	Melur—Horcuchi village	39 to 42	1805	2032
11.	Shoulurmattan	43 to 46	1767	1990
12.	Glenwas Estate	47 to 52	1605	2540
13.	Gudalur-Devershola Road	53 to 56	1698	2286
14.	Mudumalai	57 to 60	983	3835
15.	Nadugani	61 to 65	875	3835
16.	Naduvattam	66 to 69	1829	2692
17.	O Valley Road	70 to 74	1204	2285
18.	Bickatty-Karapad village	75 to 77	1828	2032
19.	Doddabetta peak	78 to 81	2634	1525
20.	Emeralad Camp	82 to 86	1982	2490
21.	Gaikandi High Road	87 to 92	1828	2032
22.	Ithalar Tea Factory	93 to 97	2134	1625
23.	Kinnakarai Highway Road	98 to 102	1677	2032
24.	Kundah-Ketchiketti Village	103 to 107	1735	2032
25.	Nanjanad Highway Road	108 to 112	2058	2057
26.	Ootacamund Lake Road	113 to 116	2195	1400
27.	Parsen Valley	119 to 123	2210	2134

total (r=0.40) water soluble (r=0.44*) and exchangeable (r=0.42*) K suggested the possibility of addition of K through plant residues.

EC was positively correlated with water soluble K (r=0.41*) and exchangeable K (r=0.48*). From this follows that these two forms might

have contributed to the salt concentration of the soil solution. Relationship of elevation and rainfall with forms of K.

Negative correlations between rainfall and all forms of K were obtained. This may be attributed to the high leaching of K. The correlations between elevations and forms of K was found to be positive. Biddappa and Venkata Rao (1975) reported that because of greater amount of vegetation at higher elevation, the organic matter content was more on the surface layer which in turn might have resulted in increase in total K in the surface layers.

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