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Distribution of magnesium fractions in the Nilgiris soil profiles. III Distribution in typic hapludalfs, ultic hapludalfs, typic paleudalfs and plinthic paleudalfs.

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Soils of the sub-group Typic Hapludalfs contained high reserve magnesium. Organic complexed Mg might be the probable source of additinal magnesium to the surface layers. The profiles of the Ultic Hapludalfs were characterised by strongly weathered top soil lying over weakly weathered sub-soils. Accumulation of magnesium fractions were seen in horizons of clay pan and in some profiles leaching conditions were indicated. The soils of Typic paleudalfs were highly weathered. Distribution pattern of the fractions of magnesium were observed to be influened by the combined effect of weathering, leaching and organic cycle. plinthic paleudalfs soils contained higher amounts of reserve magnesium Well weathered surface soils were lying over weakly weathered parent material. These characters indicated that there need not be any alarm about deficiency magnesium in the near future.

Distribution of magnesium fractions in soils is observed to be associated with the parent material, degree of weathering and soil developments Nilgiris soil offers a wide array of materials for the study of such natures in view of the fact that the Nilgiris are a lofty range of mountains at the southern extremity of Mysore table-land, where the Eastern and Western Ghats converge and are situated between the parallel of 11° and 12° of North latitude, and 76° and 77° of East longitude. The altitude ranged between 1220 and 2637 meters above mean sea level and is exposed to the full burst of the monsoonic rains. The mean annual rainfall recorded for all the localities ranged between 1300 and 2540 mm. Hence to assess the depthwise distribution and the nature of soil development the present investigation was taken up. In this paper distribution pattern of soils the sub-group Typic hapludalfs, Ultic hapludalfs, Typic paleudalfs and Plinthic paleudalfs are discussed

MATERIAL AND METHODS

Nine representative soil profiles of the Nilgiris namely, Yedakad, Doddabetta (middle), Melur, Kodand, Nanjanad, Melkundha, Maragal, Kambetty and Kavaratty were taken up for the investigation. The horizonwise soil samples collected were processed and analysed for the important physico-chemical properties (Jackson, 1973) and for the discrete forms of magnesium (Mokwunye and Melsted, 1972).

RESULTS AND DISCUSSION

Instead of individual profiles, group average of the sub-groups were cal-

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culated and presented in Tables 1and 2. For descriptive purposes, the rating 'low' 'medium' and high was used for all the above parameters. The grades were worked out using the means and standard deviations.

-Typic Hapludalfs : Areas in Yedakad and mid portions of Doddabetta represented this sub-group. Both the profiles contained medium amounts of Mgt throughout the profiles. Organic complexed magnesium constituted 27.7 to 45.3 per cent of Mgt in different horizons indicating the presence of organic cycle in both. In Yedakad profile Mg^m and Mg^{oc} were consistent throughout the profile. Higher amounts Mg^r was observed in the upper horizons which steadily decreased down the profile. About 45.7 to 63.9 per cent of tne total inorganic magnesium comprised of Mg^e which though decreased slightly with depth, still maintained a higher status at the lower horizons. This might be due to the free drainage that is characteristic of this sub-group. In Doddabetta profile Mg^r values were medium to high throughout the profile and comparatively higher than in Yedakad profile whereas the Mg^e values were lower then Yadakad soils. A gradual decrease of Mg^m and Mg^t throughout the profile was recorded. Higher amounts of Mg^{oc} throughout the profiles coupled with higher amounts of Mg^e in the surface soil indicated the presence of moderate organic cycle. Medium to high amounts of Mg^r in the sub-soil depths indicated that the soils were adequately supplied with reserve magnesium and the deficiency of magnesium nutrient might not be exhibited in the near future. Further the amount of Mg^r indicated the basaltic nature of the parent material, confirmed by high base saturation of the profiles.

Mineral Mg and Mg^t in the top soils were substantially higher than the sub-soils indicating magnesium additions to the top soil. This was associated with higher clay content in the top soil. Increase in Mg^e and Mg^{oc} in the top soil was very small while Mg^r actually decreased. This indicated the organic cycle effect as the possible source of additional Mg^t to the top soil. A sort of mineralisation and fixation of the released magnesium in the Octahedral sites were the probable causes for the increase in Mg in the top soil.

Ultic Hapludalfs : Melur, Kodanad and Nanjanad profiles represented this sub-group.

In the surface soils of Melur profile medium amounts of all fractions were observed. Mineral magnesium fraction was consistent throughout the profile, while Mg^r did not show any regular pattern. Presence of a weakly weathered parent material and organic cycle were reflected by the presence of very low Mg^e in the lower layers and very high amounts at the surface soil coupled with high Mg^{oc}. Accumulation of Mg^e at the depth 10-30 cm was associated with the highest clay content (62.5 per cent). Higher amounts of Mg^m and Mg^r constituting 60.4 to 72.8 per cent of Mg^t was the distinguishing feature of Kodanad profile. There was not much variation with depth in respect of these two fractions. Only 7.5 to 15.7 per cent of Mg^t was constituted by Mg^{oc}. Increase of Mg^t and Mg^e with depth

which got accumulated at the bottom layer indicated the presence of a leaching regime. This was reflected in the increase of Mg saturation percentage and the clay content with depth.

Surface soils of Nanjanad profile contained higher amounts of Mg^e and medium amounts of other fractions and of Mgt. About 43.2 to 74.6 per cent of Mg^t comprised of Mg^m plus Mgr. Accumulation of inorganic fraction of magnesium in higher amounts was observed at 35 to 60cm depth. This layer was associated with the highest clay content (53.9 per cent) and CEC (28.4 me/100g soil). Association of a clay pan with accumulation of total and fractions of magnesium was reported by Metson and Gibson (1976).

A decrease in Mg^m of the top soil had resulted in corresponding increase in Mgr in the same horizon. Increase of Mg_r and Mg_e in the top soil over the sub-soil fractions indicated the influence of organic cycle. The soils, in general, seemed to have fairly weathered top soil with higher amount of Mgr. Hane and Woodruff (1976) reported that sub-soil magneium was an important source of magnesium for crop growth.

Typic Paleudalfs : Soils from the area Maragal, Melkandha and Kambatty constituted the sub-group, Typic paleudalfs. Mineral magnesium in Melkundha profile constituted 33.8 to 37.8 per cent of Mgr which was consistent throughout the profile. Medium amount of Mgr observed in the upper horizons decrsased drastically to low levels (0.2 me/100 g soil) in the sub-soils below 110 cm, while this pattern of distribution was reversed in the case of Mge. The above observations indicated a well weathered profile with a leaching regime. Higher amounts of Mgoc.in the surface layer decreasing to medium levels in the sub-soils indicated the presence of organic cycle.

Maragal profile was dominated by higher amounts of Mge in all the horizons, constituting 53.4 to 63.2 per cent of Mgt and 61.2 to 72.9 per cent of total inorganic magnesium, indicating a strongly weathered profile. The distribution of magnesium fractions throughout the profile was fairly uniform. Kambatty profile contained higher amounts of all fractions up to a depth of 90 cm except Mg^{oc} which was medium. Total magnesium was also higher at these depths decreasing abruptly at the lower layers. This type of distribution, though, indicated the presence of organic cycle and a weakly weathered sub-soil over a highly weathered top soil, needs further study. Incidentally these two lower layers contained clay, less than 40.1 per cent while the layers above has more than 52.2 per cent clay.

Surface soils of this group contained higher amounts of all the fractions of magnesium as well as Mg^t than the sub-soil. This type of distribution was the result of very active organic cycle effect in a fairly weathered soil according to Blakemore and Miller (1962).

Plinthic Paleudalfs : This sub-group was represented by Kavaratty profile. Medium Mg^m and Mgr were present

in the surface soil. Though the increase of Mg_m with depth was very negligible, Mg_r increesed snbstantially with depth indicating that the soil was well supplied with reserve magnesium and the parent rock might be of basaltic type. The variations of Mg^t and Mg^{oc} with depth was negligible. High Mg^e in the surface layer gradually decreasing down the profile indicated that the surface soil to a depth of 70 cm was well weathered and the layers below were less weathered.

A light increase in Mg_{oc} and a substantial increase in Mg^e in the top soils indicated the presence of organic cycle. Accumuation of Mg_t in the subsoil showed the movement of Mg^t down the profile by leaching. Movement alongwith clay was not probable because clay content was still higher in the top soil. The above observations indicated that the reserve potential of magnesium in the soils of this group were fairly high and there need not be much worry about deficiency of this nutrient for quite sometime.

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Table 1 The status of magnesium fractions in the surface soils of various profiles

Location	Magnesium				
	Mineral	Acid soluble	Exchangeable	Organic complexed	Total
Yedakad	M	M	H	M	M
Doddabetta	H	M	M	M	M
Melur	M	M	M	M	M
Kodanad	M	H	M	M	M
Nanjanad	M	M	H	M	M
Melkundha	M	M	L	H	M
Maragal	M	M	H	M	H
Kambatty	H	H	H	M	H
Kavaratty	M	M	H	M	M

L : Low ; M : Medium ; H : High

Table 2 Mean distribution of magnesium fractions in top and sub-soils of each of the soil taxonomical sub group

Soil sub group	No. of profile	Magnesium content (me/100 g soil)					
		Mineral	Acid soluble	Exchangeable	Organic complexed	Total	Clay content (%)
Typic Hapludalfs	2						
Top soil		2.2	1.3	2.0	2.4	7.9	50.2
Sub soil		1.6	1.4	1.9	2.3	7.5	38.8
Mean		1.9	1.4	2.0	2.4	7.7	
Ultic Hapludalfs	3						
Top soil		1.9	1.7	1.5	1.5	6.4	58.5
Sub soil		2.0	1.5	1.1	1.4	6.2	37.7
Mean		2.0	1.6	1.3	1.5	6.3	
Typic Paleudalfs	3						
Top soil		3.3	2.0	3.4	2.2	10.9	52.3
Sub soil		2.3	1.1	2.7	1.8	7.8	49.8
Mean		2.8	1.6	3.1	2.0	9.4	
Plinthic Paleudalfs	1						
Top soil		1.8	1.1	2.6	1.5	6.9	63.0
Sub soil		2.1	3.2	1.4	1.4	8.1	53.0
Mean		1.8	1.7	2.3	1.4	7.2	