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MINERAL POTENTIALITIES OF LEAF LITTER OF A FEW TREE SPECIES OF INDIAN BOTANIC GARDEN, HOWRAH

In the conservation of the bio-physico-chemical matrix of an environment, the role of mineral components is pivotal. It is usually stressed that in the moist tropical environment a large quantity of valuable mineral are looked up in the leaves and other parts of plant bodies, whereas its soil remains poor in energy material owing to the quick oxidation by high temperature and simultaneous leaching of minerals due to heavy precipitation prevalent under these environments. It is noticed in course of a study in the Indian Botanic Garden, Howrah, West Bengal that its leaf litter is cleared off the soil surface manually. An attempt has been made here to assess the mineral potentialities of a few tree leaf litter (as removed periodically) which if judiciously retrieved, may compensate for the continuous process of loss of minerals from the garden soil system. The studies may help in the individual plant conservation or arboriculture practices where leaf mineral contents can be a pointer to mineral preferences of the plants.

The garden is located on the northern flank of the river Ganga in the district of Howrah. It is situated on the gangetic alluvium of recent origin. Climatically, it falls within the moist subtropics with a mean annual temperature 24°C and mean annual rainfall varying between 135-150 cm.

One composite sample was collected for

determining the mineral status of the tree leaf litter of each of *Tectona grandis* Linn. f., *Butea monosperma* (Lamk.) Taub., *Polyalthia longifolia* (Sonner.) Thwaites, *Swietenia mahagoni* (Linn.) Jacq., *Couroupita guianensis* Aubl., *Madhuca indica* J.F. Gmel., *Ficus benghalensis* Linn. and *Dillenia indica* Linn. The samples were air dried, powdered and sieved. The estimation of the ash content was done by the ignition method. The wet digestion procedure was applied for individual mineral analysis. For the sodium and potash determination flame photometer was used. The remaining components were analysed by the standard methods¹.

The mineral compositions of the litter of different tree species are given in table-1. It is evident from the analyses that the ash content is variable, the minimum being 7.5% in *Swietenia mahagoni* to a maximum of 19.8% in *Dillenia indica* within the eight species so far analysed. It is noticeable, further, that the species of *Dillenia indica*, *Ficus benghalensis*, *Butea monosperma* and *Tectona grandis* can safely be planted along the dominant saline areas with a view to soil conservation owing to their excellent salt bearing capacities.

The organic carbon (O.C.) status of the leaf litter ranges from a minimum of 34.2% in *Ficus benghalensis* to a maximum of 41.1% in the *Polyalthia longifolia*. It is

significant to note that *Swietenia mahagoni*, *Polyalthia longifolia*, *Butea monosperma* etc., many of which have an enriched carbon content of about 39%¹ in their leaf litter, can be made to react with the soils *in situ* to help augment its emaciated carbon status.

The nitrogen is variable between a minimum of 1.96%¹ as in *Madhuca indica* to as high as 3.36%¹ in *Butea monosperma* which belongs to the family Leguminosae. The C : N ratio varies between 11.4 : 1 in *Butea monosperma* to 20.05 : 1 in *Madhuca indica*. It is pertinent to observe that the moderately high C : N ratio of the litter can enrich the soil on liberating the nutrients for the growing plants.

The phosphorus content in the leaf litter of the species vary between 0.483%¹ in *Butea monosperma* to 0.625%¹ in *Swietenia mahagoni*. Significantly, the soils of Indian Botanic Garden has satisfactory status of total phosphorus² but its availability to the

plant is jeopardised due to meagre status of the organic carbon and high values of sesquioxide in the soil. Under the circumstances, the addition of leaf litter will chemically correct the basic carbon deficiency and simultaneously release the additional phosphorus which is locked up by the soil.

The calcium status of leaf litter varies from a minimum of 2.4%¹ in *Butea monosperma* and *Dillenia indica* and a maximum of 6.0%¹ in *Ficus benghalensis*. Such a high status of calcium content of *Ficus* litter clearly indicates its affinity for calcium ions. Overall, the plant litter under investigation appears to be rich in calcium content.

The values of potash in leaf litter range from 0.283%¹ in *Butea monosperma* to 0.801%¹ in *Couroupita guianensis*. The leaf litter analysis for potash clearly indicates that the species of *Polyalthia longifolia*, *Couroupita guianensis* and *Madhuca indica* have affinities for potash.

Table 1

Mineral composition of leaf litters of I.B.G. species
(Mean values of three replications)

Species	% Ash*	% O.C.*	% N*	C/N Ratio	% P ₂ O ₅ *	% Ca ⁺⁺	% K ⁺⁺	% Na ⁺⁺
<i>Dillenia indica</i> Linn.	19.8	36.09	2.24	16.1	0.602	2.40	0.294	0.345
<i>Polyalthia longifolia</i> (Sonner.) Thw.	8.0	41.1	2.80	14.7	0.501	3.04	0.634	0.288
<i>Swietenia mahagoni</i> Jacq.	7.5	40.5	2.24	18.01	0.625	3.44	0.351	0.483
<i>Butea monosperma</i> (Lemk.) Taub.	10.5	39.5	3.36	11.4	0.483	2.40	0.283	0.288
<i>Couroupita guianensis</i> Aubl.	9.4	35.4	2.80	12.6	0.615	3.60	0.801	0.391
<i>Madhuca indica</i> Gmel.	9.0	39.3	1.96	20.05	0.491	3.28	0.614	0.449
<i>Tectona grandis</i> Linn. f.	11.5	35.1	2.24	15.7	0.562	3.20	0.302	0.506
<i>Ficus banghalensis</i> Linn.	15.4	34.2	2.24	15.2	0.578	6.00	0.293	0.368
Critical difference of constituents (C. D.)	0.424	0.659	0.296		0.015	3.18	0.148	0.006

*-Highly significant at 1% level of significance.

Table 2

Mean values of leaf litters and their nutrient losses per unit tonne.

	Ash	Org. Carb.	Nitrogen	P ₂ O ₅	Ca ⁺⁺	K ⁺	Na ⁺
Mean chemical values of leaf Litter in %	8.9	37.6	2.5	0.549	3.42	0.446	0.390
Nutrient losses in Kg./Tonne	89	376	25	5.49	34.2	4.46	3.90

The content of sodium in the leaf litter varies from a minimum of 0.288%¹ in *Butea monosperma* and *Polyalthia longifolia* to a maximum of 0.506%¹ in *Tectona grandis*.

The data presented in table 1 are analysed statistically and found to be highly significant at 1% level of significance except for the calcium which are in other species barring the litter of *Ficus benghalensis*, have insignificant variations. Respective Critical Differences (CD) for each species are calculated for further variations within the species and recorded at the base of each constituents in the table.

It is significant to observe that mineral variations of the leaf litter of different species is nothing but a clear indication of mineral selectivity of the species. On the basis of mineral contents of the litter of individual species, a mean value of each mineral has been calculated for the estimation of approximate loss of these nutrients per unit tonne of litter with a view to the fact that total losses are not possible to compute on per unit area and time separately by the litter of individual species owing to the severe anthropogenic activities throughout the year in the garden (table 2). On an average, the eco-pedon system of Indian Botanic Garden is losing nearly 89 Kg of ash, 376 Kg of carbon, 25 Kg of nitrogen (the carbonaceous substances if incorporated

in the soil can fix an additional amount of 15 Kg nitrogen through photochemical means, hence the total loss of nitrogen is 40 Kg), 5.49 Kg of phosphorus, 34.2 Kg of calcium, 4.46 Kg of potash and 3.90 Kg of sodium per unit tonne of leaf litter. Such an enormous erosion of potential minerals in the form of tree leaf litter (other sources of loss from herbage and aquatic flora are not taken into account) from the eco-pedon system which otherwise can enrich it, and can help in maintaining an ecological balance in the soil system of Indian Botanic Garden requires immediate retrieval for amending the horticultural practices of the garden in vogue.

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