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Study on nutrient release from litter of Quercus incana and Cedrus deodara in different seasons in Mussoorie himalayas (Uttarakhand, India)

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Abstract *–Organic matter is continuously added to the embryonic soil during soil formation by both plants and animals. All the organic plant debris fallen recently to the ground is called litter. It is composed of dead leaves, twigs, woods, dead roots and various plant products. It has been generally seen that in thick forest during each season, of pre and post monsoon season,there is much accumulation of thousands of tons of such litter on the soil surface. The rate of humification and humus accumulation are chiefly determined by the organisms involved in the decaying process. As the biological cycle of nutrients in an ecosystem is one of the principal processes that support organic matter production this study is conducted to assess macro nutrients returned through litter of Quercus incana(Oak) and Cedrus deodara(deodar) during pre & post monsoon seasons. The analysis showed that the concentration of macro nutrients available from leaf and twig was higher in post-monsoon season than what was in pre-monsoon season.*
Keywords*: litter humification, nutrients, organic matter, decaying*

I. Introduction

Generally, all the tissues of a plant are made up of complex organic compounds which are synthesized by the uptake of minerals from the soil. These organic compounds may return to the soil either after the death of plant or through litter fall and finally result in the formation of the humus. Further more, the return of these elements to soil govern the mineral status of soil (Daubenmire, 1974). Besides, these nutrients recycle again from organic to inorganic compounds from one trophic level to another trophic level. The main sources of litter are forests, grasslands and aquatic plants. The quantity and chemical nature of litter depends upon the type of vegetation of the forest (Bir, S.S. et.al. 1987). The inorganic constituents of litter are Calcium, Potassium, Magnesium, Iron, Manganese, Silicon, Copper, Aluminium, Phosphorous, Nitrogen etc. (Singh, 1968). Difference in the concentration of these inorganic chemicals has been recorded according to the type of forest. The availability of nutrients for plant uptake depends upon the re-absorption and re-translocation of the nutrient before leaf fall and subsequently on decomposition and mineralizaton of organic matter (Atwill, P.M. 1968). It should be noted that the study on the litter nutrients and differential patterns of nutrients in leaf fall has got importance from the point of view of nutrient cycle in a forest ecosystem and that the variations in the concentration of leaf litter nutrients are not species attribute but depend upon the combined effect of soil nutrient status, growth of the stand and tree growth formations in any forested area. (Bahuguna et.al. 1990)

II. Material and Methods

A field study was conducted for two years in Mussoorie Himalayas. The area of study is located from 77^0 east longitude to 78^0 20′ east longitude and 30^0 North latitude to 30^0 30′ north latitude with the altitude ranging from 330 to 200 m from sea level about 60% of the total area is covered with forest and 14% represent cultivated area fields. The vegetation referred concerns to three main types a) tropical b) temperate and c) alpine. The number of locations selected for litter analysis is two namely, Kolhukhet (S-1) and Kadukhal (S-2) lying in Mussoorie hills.

III. Results and Discussion

The data on litter analysis for various nutrients as total of leaves and twigs has been presented in the tables. At each sampling site almost all the plantation showed an unimodel pattern of leaf fall.

Sampling Site (S-1) – At this site, the dominant species of the tree was Q. incana (Oak). The percentage of calcium and nitrogen was almost same during pre and post monsoon season. The percentage of calcium was slightly higher than that of nitrogen (Pandey, et.al. 1981). Further, the variations in the percentage of potassium, phosphorous and magnesium were to a less extent. In general, the order for the mobality was Mg<P<K, although in the post monsoon season, the magnesium was slightly more than potassium.

Sampling Site (S-2) – At this site, the dominant species were Cedrus deodara (Deodar). Calcium and nitrogen were the dominant nutrients in both the seasons as compared to potassium, phosphorous and magnesium. In case

of Cedrus deodara, the occurrence of nutrient was in the order of N>Ca>K>Mg>P during pre and post monsoon period.

The samples of decomposing leaves and twigs collected from the study site for the analysis of nutrients were oven dried at 80^0 C, after standardisation of the technique, it was powdered in a Thomas Wiley mill. The powdered samples were weighed and ashed in a muffle furnance at 500^0 C and their HCl extract, were prepared for the estimation of nutrients. Thereafter the chemical analysis of litter at an initial stage, as well as at various stages of decomposition was done following standard method (Piper, 1944 and Allen, 1974). Magnesium was determined in an atomic absorption spectrophotometer (Pye Unican 3200). Phosphorous was determined by phosphomolybdic colorimeter method as suggested by Misra (1968). To estimate the concentration of potassium and calcium, the systronics flame photometer was used (Vogel, 1961). Total nitrogen was estimated by Kjeldahls' method (Loomis and Shull, 1937).

Table-1 Litter Analysis for Macro-nutrients Concentration at the sampling sites during Pre-monsoon season

S.No.	Sampling Sites	Dominant Species	Component	Macronutrients (%)				
				N	P	K	Ca	Mg
1	S-1 1st year	Quercus incana	Leaf & Twig	0.15	0.01	0.04	0.15	0.02
	S-1 2nd year		Leaf & Twig	0.13	0.01	0.02	0.14	0.01
2	S-2 1st year	Cedrus deodara	Leaf & Twig	1.35	0.08	0.51	1.13	0.11
	S-2 2nd year		Leaf & Twig	1.45	0.11	0.59	1.16	0.14

Table-2 Litter Analysis for Macro-nutrients Concentration at the sampling sites during Post-monsoon season

S.No.	Sampling Sites	Dominant Species	Component	Macronutrients (%)				
				N	P	K	Ca	Mg
1	S-1 1st year	Quercus incana	Leaf & Twig	0.7	0.02	0.05	0.17	0.03
	S-1 2nd year		Leaf & Twig	0.18	0.04	0.06	0.19	0.03
2	S-2 1st year	Cedrus deodara	Leaf & Twig	1.40	0.12	0.60	1.18	0.16
	S-2 2nd year		Leaf & Twig	1.48	0.13	0.62	1.17	0.17

IV. Conclusion

It has been observed that the percentage of macro-nutrients, nitrogen, phosphorous, potassium, calcium and magnesium as noted in respect of leaf and twig is found higher in concentrationduring post-monsoon season than what it was noted during pre-monsoon season in sites S-1, S-2 in first year as well as the following year.

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