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Research Paper

"Concentration of Nutrients in Woody and Non-Woody Litter Components of Different Vegetation"

Healthcare

KEYWORDS : dominant plantation, litter fall, woody and non-woody litter, nutrient concentration

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ABSTRACT

In the present study concentration of nutrients (N, P, Ca, Mg and K) was estimated in woody and non-woody litter fractions of three localities i.e. Leela Sevri (LS) dominated by Acacia senegal (As), Pushkar Valley Base (PVB) dominated by Acacia tortilis (At) and Pach-Kund (PK) dominated by Eucalyptus camaldulensis (Ec) trees. The site of study is represented by Aravalli hillocks, sand dunes, sandy plains agricultural fields and fresh water bodies. The non-woody components of litter have maximum amount of nutrients as compared to woody components. Amongst the all three non-woody litter, As contributed maximum nutrient concentration as compared to At and Ec. Total nutrient concentration showed large variation among woody and non-woody components. It was noted that species, density and age of tree determine the litter production which affects the nutrient return to the soil.

Introduction

The sand dunes have low moisture retention and storage characteristics so allow heavy leaching losses of nutrients and therefore are infertile and unproductive. Further the soil is single grained, structure less and poor in organic matter and therefore prone to wind erosion. These factors coupled with high evaporative demand of atmosphere in arid areas make plant production difficult. Thus the pattern of decomposition and nutrient release of tree litter in the top soil could provide guideline for mitigating the adverse impact of desertification and increasing nutrient use efficiency. Fowler (1988) has demonstrated negative as well as positive effects of litter on seedling growth and survival of some grasses. Lodhiyal *et al.* (1994) pointed out that the major macronutrients limiting the production of a forest crop are N, P and K. According to Chapin and Kedrowski (1983), nutrient availability is a major factor influencing the distribution of plant species. Besides other effects such as shading, light penetration through tree species on ground flora litter pattern and its chemical nature are the important factors which decide the structure of ground vegetation and floor dynamics at specific site (Jake and Michael, 2009). Once tree species are recruited their litter fall patterns put an impact on herbaceous vegetation structure and nutrient dynamics of the sand dune ecosystem (Sharma and Upadhyay 2002).

An extensive work on litter production and nutrient dynamics in forests of the world has been prepared by Bray and Gorham (1964). Reports on nutrient accumulation and transfer between vegetation and soil are available only of forest ecosystems (Foster and Morrison, 1976; Turner and Singer, 1976; Cole and Rapp, 1980) including the tropical forests (Singh and Joshi 1982, Bhat, 1990, Jena 1998, Pandit and Jena 2000). However little is known about the nutrient dynamics of man-made forestry of arid lands. In the present investigation concentration of nutrients in litter of woody and non-woody components over stabilized sand dunes of Aravalli forest were studied.

Site of study

The area of the study is located at a distance of 10 km N-W to Ajmer, a centrally situated city of Rajasthan lies between 26˚25' and 26˚29' N latitude and 74˚37' and 74˚42' E longitude. The area is represented by Aravalli hillocks, sand dunes, sandy plains agricultural fields and fresh water bodies. The region may be regarded as 'ecotone' between NW drier and SE humid climate. The sand dunes selected for present investigation i.e. Pushkar valley Base (dominated by *A.tortilis)* , Leela sewri (dominated by *A.sengal*) and Pachkund (dominated by *E. camaldudensis)* are situated in 48 sq.km area in the north-west foot hills of Nagpahar, a prominent mountain belt of central Aravallis. A major part of these sand dunes and sandy plains is stabilized (under the sand dune stabilization programmes by the Forest Department).

Methods of Study

Freshly fallen plant components of the selected tree species (i.e. *As, At* and *Ec*) in about 10x10 m area were collected from the sites of study from 10-20 trees of all available girth classes separately and taken to the laboratory, samples of different trees and of same species were pooled together. The sampling and nutrient analysis was done monthly throughout the year. The composite litter samples were separated in two major categories i.e. woody (woody twigs and small fragments of bark) and non-woody components (leaves, seeds, buds and scales). Each component of litter was oven dried at 80°c for 24 hrs and both the samples (woody and non woody) were weighed separately 4gms in 3 replicates for each tree species (i.e. *As, At* and *Ec*) and were digested for nutrient analysis.

Nitrogen (N) was estimated using micro-kjeldahl distillation unit. A 250 gm of plant material was taken and procedure as described by Misra (1968) was followed. Ash content was determined by the method described by Peach and Tracy, 1956. Ca, Mg and K contents were estimated according to the method described in Misra (1968). Percentage of transmission was read at 660 nm on systronic spectrophotometer Model106. Phosphorus concentration was estimated with the help of standard curve.

Result and Discussion

The values of nutrient concentration in litter categories (woody and non-woody) under different trees (i.e. *As, At* and *Ec*) are given in the Table-1. In the present study non-woody components of litter collected from different sites have more amounts of nutrients as compared to woody components. Under *As* (site- LS) litter fall contributed maximum nutrient concentration as compared to *At* (site- PVB) and *Ec* (site PK). Total nutrient concentration showed large variations among woody and non-woody components. It was noticed that density and age of tree determine the litter production which affects the nutrient return to the soil.

Table 1.0 Concentration (% ± 1S.e.) of nutrients in litter fall of woody and non woody components of different vegetation

S.N.	Site	Component	Ash	N	P	Ca	Mg	K
1.	Leela Sewri	Woody	10.31± 0.98	2.80±0.17	0.039±0.002	1.01±0.032	0.66±0.051	0.70±0.035
		Non woody	10.90+1.12	3.20+0.26	0.037±0.008	2.00±0.075	0.76±0.028	0.90±0.047
		Total	21.21	6.00	0.346	3.01	1.42	1.60

2.	Pushkar Valley Base	Woody Non woody Total	7.30±1.50 9.02±2.28 16.32	2.50±0.57 3.00±0.99 5.50	0.056±0.004 0.320±0.012 0.376	1.70±0.18 3.21±0.93 4.91	0.58±0.003 0.82±0.005 1.35	0.60±0.007 0.91±0.005 1.35
3.	Pachkund	Woody Non woody Total	1.53±0.83 6.12±1.20 7.65	2.00±0.50 2.30±0.19 4.30	0.009±0.001 0.237±0.012 0.246	0.41±0.06 2.00±0.25 2.41	0.75±0.05 0.66±0.08 1.42	0.90±0.10 1.00±0.09 1.90

The ash content of different tree species varies between 1.53 to10.90 percent. Non-woody component of tree litter contributed maximum ash content than woody component. Ash content in litter categories was observed to be higher in *A. senegal* than other tree components, while the lowest ash content was observed in *Ec*. The percentage of N in different litter categories showed no variation among different species. Litter categories of *As* and *At* contain maximum amount of total N (6.60 and 5.50%), while it was minimum (4.30%) in *Ec*. The P content of litter in these species was generally lower than N content. The amount of P under different tree species ranges from 0.246% to 0.376%. P content was recorded more in *At* (0.376%), while it was lowest in *Ec* (0.246%). Litter categories of all tree species contain maximum amount of ash content as compared to other nutrients. The highest and lowest values of Ca were 4.91% (in litter of *At*) and 2.41 % (in *Ec* litter). Mg content was found to be lower than Ca content in litter categories of all the three tree species. Mg content varied from 1.32% to 1.42%. Maximum and minimum concentration of Mg were observed in litter of *As* and *At* respectively. No significant differences in K content were observed among different tree species. The order of relative amounts of various elements in litter categories was:

N > Ca > K > Mg > P

Conclusion

The total nutrient concentration in different litter categories in (woody and non woody) at different sites showed large variations among different trees. Non woody components of litter contain higher nutrient concentration in all the tree species growing at different sites.

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