

Consequence of *Butea monosperma* plantation on the nutrient cycling in a semiarid grazingland, Rajasthan, India

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SUMMARY

In this study, monthly changes in concentrations of various nutrients (N, P, K, Na, Ca and Mg) and their uptake, accumulation, transfer and release in both plant components and soil were studied in grazingland under *Butea* plantation and in the open grazingland in the semi-arid region of Udaipur, Rajasthan, India. At both sites, the maximum concentration of all nutrients was recorded in the live shoot, followed by dead shoot, below ground and litter. The average nutrient accumulation in the plant parts as well as in the soil was in the order of $N > Ca > K > Na > Mg > P$. Among the sites, the nutrients concentration in plant components and the uptake from the soil were significantly higher ($P \leq 0.001$) in the *Butea* plantation site than in the open grazingland. The soil moisture content also showed significant increase under *Butea* plantation than in the open grazingland. Of the total uptake, about 85% of nutrients, were transferred to above ground plant parts and very little was transferred to below ground parts. At both sites, the nutrients return to the soil through root was lower than that of litter disappearance. The study reveals that *Butea* trees can increase the nutrient content of understorey grasses by their rapid leaf turnover and decomposition of nutrient rich litter, which can result in significant increase in soil fertility.

Key words : Nutrient dynamics, Litter disappearance, Open grazingland, Plantation, Root disappearance, Semi-arid region

Establishment of suitable tree species in the degraded grasslands is one of the ways to improve grassland productivity. However, they may have both positive as well as negative effects. Low herbaceous productivity, under tree canopies than the open grasslands have been reported by Fernando and James (2006), whereas in other instances higher grassland productivity under canopies has been observed by Kai (2000). The increase in productivity of understorey vegetation under plantation depends upon the nature of the tree species selected. The choice of species may affect understorey colonization in several ways as tree species will differ in their canopy architecture and influence the understorey light, temperature and humidity regimes; rates of leaf litter production, decomposition and litter chemistry (Sharma *et al.* 2002); and influence on soil biological activity and other aspects of soil fertility. Lodhiyal *et al.* (2000) studied

the importance of trees in creating horizontal structure and influencing the dynamics of Shisham forests in central Himalaya, India. The functioning of most forest ecosystems, particularly in regard to primary production, is generally influenced by the availability of nutrients, and this in turn depends on their distribution and rates of cycling. The concentration of nutrients within any part of the ecosystem usually depends upon a functional balance within the system. Nutrient accumulation and the transfer of nutrients between vegetation and soil have been assessed in dry tropical deciduous forests, Rajasthan, India by Nirmal Kumar *et al.* (2008) and Nirmal Kumar *et al.* (2009). However, contribution of lower layer has not been explored so far in this area. Hence, the present study deals with the effects of *Butea* plantation on nutrient dynamics and soil fertility of the grazingland in the semi-arid environment.

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Study site:

The study was conducted in Chitravas forest areas ($23^{\circ} 03' N$ latitude, $69^{\circ} 30' E$, longitude; altitude 579.4 m above the mean sea level) at the Udaipur district in the state of Rajasthan which is 85 km away from the Udaipur city (Fig.1). The climate of the study area is semi-arid. There are three distinct seasons per year; winter (November to February), summer (April to mid June), and rainy season (mid-June to mid September). The climate is tropical with maximum of $45.3^{\circ}C$ and minimum of $28.8^{\circ}C$ during summers. Winters are little cold with