Fostering Traditional Natural Regeneration Protocol & The Effects of Termite Mounds on The Germination Behavior of *Shorea Robusta* (SAL)

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Abstract: MDG goal no.7 focuses on ensuring environmental sustainability. The WSSD provided a platform to achieve sustainable development under the WEHAB (Water, Energy, Health, Agriculture and Biodiversity) initiative framework. In view of the aforeside framework, an encouraging roadmap had developed towards Tradition Regeneration and Conservation technique of Shorea robusta in forest of Chhattisgarh State, India. Shorea robusta is a climax species, which regulates its environment and forms pure stands in Chhattisgarh state but Shorea robusta forest is the forest type which is most affected by development effort and infrastructure expansion programmes. Through the regeneration of "SAL" in some areas is profuse but conservation of regeneration, however, has been a serious problem in Sal forest management. The objective of the study was to develop an initial roadmap liking WEHAB framework via development a "Traditional Natural Regeneration Conservation Protocol of Sal and assessing the effect of terminate Mounds Soil on the germination behavior of Shorea robusta seeds involving communit".

Introduction: Sal (Shorea robusta) is the one of major forestry species of the Chhattisgarh forests. This has innumerous Religious, Traditional, Medicinal, Environmental as well as Commercial benefits. Considering the importance of this tree, the Shorea robusta had declared the State tree of Chhattisgarh. This is the native species of the Indian Sub-continental ranging from Assam, West Bengal, Odisha, Jharkhand to Shivalik hills to the Vindhya & Satpura range of Central India. The tree is the major source of the hardwood in India. Its leaves are being used in making of leaf plats and for cattle feeding purpose. The rasin of the tree is also being used by commercial industries especially in Ayurveda. The Sal is a major source of income generation in rural and tribal areas. Apart from the timber and its leaves, Sal seeds were major source of oil (oil contains around 30.20%). The Sal oil can be used for manufacture food and non-food industries. The Sal oil can be used as cooking oil and substitute for cocoa butter in chocolate industry after refining process. The Sal seed and its oil are in underutilized stage because of its low price and lack of technology for its processing activities. By exploring this Sal, various physical, chemical properties of this seed and its importance can be known. These results would add to the scientific database for use to develop and design processing equipment and development operation for new products.

Recently, interest in producing multiple products from Sal forests has increased; accordingly, a silvicultural regime for managing Sal forest for multiple products is a central concern. Forest managers need a comprehensive scientific understanding of natural stand development processes and anthropogenic factors affecting Sal forest when designing silvicultural regimes for multiple-product management[1]. The planning commission of India has recommended Sal seed as potential NTFPs for enterprise development in India. The estimated availability of Sal seed in India per year is 1.5 million tons. About 20–30 million forest dwellers depend on collection of Sal seeds, leaves, and resins (Patnaik, 2015)[2].

Topographically, most of the sal forest of this area is found in hilly, undulating and plains habitats. Sal forest of this area was also under sal borer infestation (Hoplocerambyx pinecones) during 1997-98. Scattered information is available in literature on status of Shorea robusta regeneration in relation to soil pH (Gupta, 1953), accumulation of leaf litter in moist forests (Champion and Seth, 1968) damage by wild animals (Sirkar, 1954), effect of grazing closure (Chaubey and Jamaluddin, 1989), Shrubby growth and ground flora richness (Khan and Gupta, 1960). Srivastava (1963) studied phyto-sociological studies of Shorea robusta forests in U.P. with special reference to regeneration. Dabral et.al. (1980) studied micro-climatic variations in naturally regenerating Shorea robusta forest in West Dehradun. They advocated that temperature and moisture regimes of the surface soil are related with mortality of Shorea robusta seedlings. Jha and Pandey (1980) studied the comparative loss of soil moisture during decomposition of leaf litter in Poplar, Eucalyptus, Chir, Teak and Shorea robusta and suggested that moisture loss is least in Shorea robusta as compared to other species. No systematic attempts were made in India, to understand dynamism of natural regeneration of Shorea robusta and to suggest management inputs to encourage its regeneration, particularly in the state of Madhya Pradesh, India. The natural regeneration aspect received very little attention with particular reference to crop composition and community type. Ecology of natural regeneration of Shorea robusta with special reference to crop composition and community types was attempted by Khan and Gupta (1960) in Dehradun Valley[3].

Keeping this in view, present paper explore the traditional natural regeneration protocol of Sal also reveals the importance of termite soil in Sal regeneration.

Material and Method: Total 15 sites were identified for sample collection in entire Chhattisgarh under 3 Agro climatic zones under Bastar platue, Chhattisgarh Plains and Northern Hills. The Seeds were manually collected from Sal forests of 3 agro climate zones of Chhattisgarh. The progress of germination of seeds was observed & recorded weekly up to 14 days from the date of seed sown. The germination percentage and average germination value was calculated. Statistical "W" tests (Shapiro-Wilk normality test) were applied. Also, Quadrates were laid along a transect line using nested quadrate methods. Data of shoot higher and collar diameter was collected from each quadrate. Graph was plotted taking diameter on X-axis and normalized diameter percent on Y-axis. The population class analysis was derived by a regression equation based on negative exponential modal (Schmelz and Lindesy, Bisht and Sharma, 1987).

The negative exponential distribution is $Y=Y^{\circ}\ e\text{-}bx$

Termite mounds soil sample also collected from all three agro-climatice zones of the State and were tested & analyzed in soil laboratory.

Result & Discussion: In this study, we had analyzed the regeneration status of different Sal forest region of Chhattisgarh using traditional regeneration conservation approach. We observed higher percentage of germination of Sal seeds. The 15 sites in Chhattisgarh under 3 Agro climatic zones were classified under Bastar platue, Chhattisgarh Plains and Northern Hills. We observed that 1, 2,3,10 and 13 sites had reverse 'J' shaped modal of distribution (coefficient of determination (r2) ranged between 0.925 and 0.791) hence categorized as good regeneration sites. In case of Site 9, 12 and 14 the value of r2 was as high (0.832 and 0.762), hence fair regeneration group. The site 4, 5, 6 and 11 having r2 value ranges from 0.624 to 0.672, and was categorized as promising regeneration. The last two sites (8 and 7) having r2 value ranging from 0.544 to 0.571 was designated under poor regeneration group. Site 1, 2,3,10 and 13 supposed to be good area for regeneration of Sal as the population distribution in these sites strictly adheres to reverse 'J' shape curve. So this kind of pilot studies will ensure the target of Millennium Development Goals (MDGs) for sustainable development.

The termite soil is playing a significant role in seed germination due to its organic nature & other nutritional qualities. A detail comparison between termite soil & normal soil on the basis of lab results is presented below -

Parameters	Comparison		Interpretation of results
	Normal Soil	Termite Soil	
Hydrogen ion activity (pH)	6.42	7.35	Termite soil basic in nature
Salinity level	215.6µ	999.9 µ	Better salinity level in termite soil as comparison to normal soil
Available Nitrogen	89.0	183.07	More nitrogen in comparison of normal soil
Available Potassium	178.0	416.43	More potassium in comparison of normal soil
Available Phosphorus	1.28	5.83	More phosphorus in comparison of normal soil
Soil Organic Carbon %	0.13	0.65	Better carbon percentage in comparison of normal soil

Conclusion: After detailed observations in different study sites and in depth discussion at community level, it was concluded that the seeds of Sal were sown using only wood appliance and were handle via holding it by its wings carefully, not by touching the viable seed coat. Termite mounds soil was spread over the pits and moisted with water followed by putting the fallen Sal leaves over it.

On the basis of above interpretation, it can be established that termite soil is better in all nature in comparison of normal soil. It is more useful & beneficial to plants regeneration and growth instead of normal soil. It is recommended that Termite soil should be used in natural regeneration as well as artificial generation of Sal tree.

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