

## Bamboo based Agroforestry System for Maintaining Ecosystem and Sustainability in India

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Bamboo, the most fascinating and diverse group of plant known to mankind belong to the family 'grass' or sub family Bambuseae of the family Poaceae (Gramineae) (Singh et al., 2012). Bamboo grows in at least 37 million ha worldwide and covers about 1% of the global forest area (Lobovikov et al., 2007). As per FAO report 2007, there are about 1,200 species of Bamboo in 90 genera across the world. India has About 125 indigenous and 11 exotic species of bamboo from 23 genera. It is Abundantly found deciduous and semi-evergreen forest of northern and southern India. Total bamboo bearing area of the country has been estimated to be 15.0 million of the county geographical area (ISFR, 2021). Versatility group of bamboo plants linked closer with the culture of tropical Asia. It is a present of nature that has empowered people to draw a variety of benefits. For livelihood sustainability bamboo has been an important source of income for millions of rural people in India. Because of its wider essential uses, it is described as "friend of people", "green gold", "green gasoline", "poor man timber", and "the cradle to coffin timber" (Singh Ombir et al., 2008). As bamboo harvesting is a continuous process, old clumps are removed new once regenerate and process will continue. Bamboo based agroforestry system produced bamboo stock, leaf biomass as well as sustainable crop.

### What is Bamboo Based Agroforestry?

Before we go ahead towards Bamboo- based agroforestry we must understand about Agroforestry. Agroforestry is a land use system that integrates trees, crops and animals in a way that is scientifically, sound, ecologically desirable, practically feasible, and socially acceptable to the farmers (Nair et al., 1979). The Bamboo-based agroforestry is the integration of Bamboo plant with other agriculture crop along with livestock production to obtain ecological and economics benefits. It can develop in the form of homegardens, block plantation, windbreaks on the boundary of agriculture field, in poultry/dairy farm and in plain and wetland near the ponds.



(A)



(B)

Fig 1 (A-B): Male Bamboo plantation in Arboretum BUAT, Banda.

## How Bamboo based agroforestry save the ecosystem?

Firstly, as we look towards, agriculture crop specially cash crop fertilizer is required to the crop from seeding to the germination stages where as Bamboo requires no chemical to proliferate. In India crop like Cotton and some other agriculture crop depletes the nutrient from the soils, Bamboo sequester the nitrogen and the cultivation of Bamboo does not surplus the chemical to the environment. Secondly, in traditional agroforestry system once the agriculture crop mature it will clear cut harvest and at that time the nutrients are washed away by rainfall, the erosion will occur on the top layer of the soil. The bamboo-based agroforestry protects the land from harsh wind. The Bamboo stumps are Blazed to provide fertilizer and their roots persist in land after harvesting clumps check the soil erosion and assist to preserve nutrient for the next crop. Along with them their leaf-litter and fine root decomposition emphasize the soil organic matter. Due to its fine and extensive root system and fast-growing ability it will help in rehabilitation of degraded and waste. In Allahabad, India INBAR support a bamboo project which lend a hand to rise 15 meters water table with in 10 years and return a destroy brick mining area prone to frequent dust storms, to productive Agri land. Thirdly, according to INBAR report 2018, Due to world fastest growth rate, giant woody bamboo is considered effective Carbon dioxide absorber. However, 100 to 400 tonnes of carbon sequester per hectare. Showing similar amount of carbon stores to tree plantation. Whereas carbon also stored in products made with Bamboo as well as charcoal. Despite of the facts that carbon emission reduction by product is presently not contemplated an mechanism approved under the Paris Agreement For Climate Change, this outlook is especially pertinent where bamboo products are used and further in future in corporate and embrace the reduction protocols for Greenhouse Gas.

## Sustainability through Bamboo Based Agroforestry

Bamboo the most assailable NTFPs of the world -give continuous fodder for the livestock, continuous timber for the household or building purpose and continuous income in term of macro/micro scale bamboo industries and Handicraft items (Adhikari, N.2008). As we compare the bamboo from timber, bamboo is twice or at least twice as timber. Its tensile strength is tenacious than steal (source: unsustainable magazine). However, Bamboo cultivation empowered the women potential as it is light in weight and their linear splitting make it flexible due to these reasons it is easy to carry way bulk mass across various massive distance. The Self Help Group were specially promoted by GOI under Bamboo Mission to generate skill among women regarding bamboo cultivation and uses. Under sustainable development goal the Handicraft likes Basket, small furniture, flowerpot, wooden jewellery, bamboo-based kitchen material is an alternative source of income. During the leaning period it reduces the risk associated with collecting timber for fuelwood and creating new dynamic of employment for the women in India.

Today bamboo is an alternative of different materials and trends toward more eco-friendly product i.e. Bamboo toothbrush, cooling straws, food plates, flooring mats. Despite bamboo associate with jute and paper are used as bag and covering the entire India market as an excellent replacement of plastic polythene.

## Major Challenges

- Poor ability of planting material is one of the major problems while cultivation of bamboos from seeds.
- Lack of conservation awareness among the tribal and rural people.
- Deterioration of important genetic sources of economic important species due to over-exploitation.
- Lack of mechanization and skilled people in harvesting and propagation.
- Insufficient warehouse/storage/depot infrastructure after bamboo harvesting.

- Generally, bamboo-based agroforestry system lacks effective and efficient land tenure system.
- Lack of intensified research in bamboo agroforestry system.

### Conclusion

Bamboo is primarily a perennial grass with woody culms from rhizomes and the fastest growth plant on earth recorded as approximately 121cm in 24 hrs. Bamboos have the dense surface root, huge connection network of rhizomes which form a mat like structure and help to prevent the seepage of soil water and furnish a high quality of protection during sheet and gully erosion for soil conservation. It is recommended as a suitable for the ecological restoration and reclamation of degraded land and introduced for the treatment of landslides and soil liquification. In India where livestock is the major livelihood option, bamboo-based agroforestry system is a quite unique opportunity to the farmer. Globally, India is second largest producer of bamboo than China and only 4% of the bamboo products were captured in global market. Due to which in India greater benefit of Bamboo Agroforestry system. If we invest more in Bamboo agroforestry system Definitely it hitches up potential of India. Whereas more intensive research, investment and up scaling is recommended in India for Bamboo.

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