



APPLICATION OF AGROFORESTRY TECHNIQUES IN THE MANAGEMENT OF BAMBOO

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ABSTRACT

This paper highlights the potential of Bamboo tree under Agroforestry management practices of the forest industry in Nigeria. Bamboo possesses a dense network of fine roots with a capacity for abundant mycorrhizal association, high rate of Nitrogen fixation, absence of toxic substances in the litter or root residues, it has the capacity to grow on poor soils as well as rapid growth rate even under competing environment. It plays a significant role in the economy by providing livelihood for the rural poor and urban dwellers thereby supporting millions of people. Its richness and diversity both as an environmental and economic species coupled with fast growing ability makes it a profitable Agroforestry tree to be studied for cultivation under the dwindling forest estate in Nigeria.

Keywords: Agroforestry system, Bamboo, Forest ecosystem, Development.

Contribution/ Originality

This paper contributes to the existing literature on Bamboo cultivation, it aims at the important use of Agroforestry techniques in the cultivation of the species, while highlighting the value of the techniques both in ecological and environmental protection.

1. INTRODUCTION

Agroforestry has been described in several ways by several authors from different perspectives which include: the collective name for land-use systems in which woody perennials (trees, shrubs, etc.) are grown in association with herbaceous plants (crops, pasture) or livestock, in a spatial arrangement, rotation, or both. The concept behind the development of this system is both ecological and economical between the trees and other components interacting in the system. Simply defined, 'agroforestry is the production of trees and of non-tree crops or animals on the same piece of land.' The crops are grown together at the same time either in rotation, or grown on separate plots when materials from one is used to benefit another (Martin and Sherman, 1992). The application of agroforestry principles can be separated into ecological, economic and social components. The primary objective is perhaps to obtain ecological benefits and resultant environmental protection. According to Martin and Sherman (1992) every part of the land is considered suitable for useful plant production. Agroforestry systems are designed to make maximum use of any type of available land. Emphasis is placed on intercropping perennial, multiple purpose crops that are planted once and yield benefits over a long period of time with annuals either on a short or long term period. The useful gains from intercropping these crops are food both for humans and animals, industrial raw materials, shade, fuelwood production and building material. Tree components in Agroforestry systems also have important uses such as holding the soil against erosion and improving soil fertility by fixing nitrogen or bringing minerals from deep in the soil and depositing them by leaf-fall. Bamboo species suitably fits into these

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benefits. Agroforestry provides land owners in various communities in Nigeria the opportunity to develop a range of products (economic) and services (ecological) offered by bamboo.

1.1. Bamboo

Bamboo belongs to the family Poaceace and subfamily *Bambusoideae*. There are more than 1,200 species grow worldwide. About 18 million hectares of bamboo are distributed in world forest ecosystems in Asia, Africa, and America (Phillips, 1995; American Bamboo Society, 2002). Bamboo is known as the fastest growing plant species with growth ranging from 30 – 100cm per day during the growing season and can reach heights of 30m or more and diameter of about 30cm. Unlike most timber species, bamboo is a self-regenerating natural resource; new shoots that appear annually ensure future raw material after mature culms are harvested. In Nigeria, bamboo culms are harvested from existing natural forests and plantations. Some come from Agroforestry plots where they are initially used as stakes for annuals and vines. The cultivation of bamboo as a wood substitute helps to reduce the depletion of natural forests and over-exploitation of plantations. It will also ensure constant supplies of wood as structural material in building and cellulose in paper industries. Four bamboo genera have been identified in Nigeria, namely, *Bambusa* (*Bambusa vulgaris*), *Dendrocalamus*, *Guaduella* and *Oxytenanthera* (Lowe, 1989; Mensah, 1997). The properties of these bamboo species have been investigated and reported to be able to support a virile bamboo industry in locally (Ogunwusi, 2011).

1.2. Uses of Bamboo in Nigeria

The traditional use of bamboo in Nigeria for scaffolding, shade house, fencing, ladder, yam and vegetable stakes, slat chair, etc generates revenue, the quality of revenue generated is far less than 0.01% of what is achievable if it is sustainably developed and its industrial potentials harnessed. The use of bamboo culms in the production industry is under-developed in Nigeria. There is only one modern bamboo processing company in Nigeria, producing floor tiles (RMRDC, 2004). Also there is limited capacity building for the crafts men whose skill is limited to a number of simple items that cannot compete in the global market (RMRDC, 2004).





1.3. Challenges of Bamboo Cultivation in Nigeria

Leonardo (2000) reported that there is general lack of understanding of the industrial potentials of bamboo among policy makers. Bamboo is mostly treated as a weed in most communities in Nigeria and little or no attention is given to its management (RMRDC, 2004). Annual burning is common. The immediate impediment to bamboo development is the lack of interest by government agencies to use the potentials of bamboo in meeting rural subsistence needs and in reducing deforestation. Example, a number of private sector operatives and Ekiti, Ondo and Osun state governments have shown interest in bamboo plantation establishment. Efforts to interest the Forestry Research Institute of Nigeria (FRIN) in production of the seedling have proved abortive (Ogunwusi, 2012).

A number of problems and other issues facing the development and potential of bamboo industry in Nigeria and other developing countries including:

- i. Lack of information on propagation, establishment and harvesting methods
There is no systematic and accurate record of natural and plantation stands for commercial bamboo harvesting and utilization in the country. Stands of bamboos are dwindling with current land use system and quest for urbanization. Stands which are frequently found along river beds and green belt areas have been depleted making way for infrastructures and roads Ongugo *et al.* (2000).
- ii. Policies: Since bamboo classified as a minor forest product, it does not come into priority list of crops for cultivation both in the agricultural and forestry subsector of the economy.
- iii. Lack of appropriate technologies for processing bamboo: The agricultural sector which is often referred to as the poor or low income earners of the society is the major user of bamboo – for fish pen, poultry houses, crop props and others. The furniture and handicraft sector have not developed the technology to enable bamboo compete with timber and gum (plastic).

With this sustaining in Nigeria, no reform on development of bamboo will work until policies towards bamboo industry are changed and technology adequately developed (Wang, 2006).

1.4. Strategic Direct Bamboo Research and Development

- i. There is need for change in government policy with an initiative that would enable the takeoff of bamboo cultivation. The focus will be on developing the sector as market driven and people oriented. A regime of incentives, subsidy, technical and professional support with regard to planting materials, improved plantation technology, processing facilities, and support services such as training, credit, marketing, export facilitation etc. should be provided (Ogunwusi, 2012).
- ii. The bamboo industry must target a user group with the aim of supplying products that can meet consumers taste while competing favourably with wood based products and other materials.

- iii. Sustainable management and use of dedicated bamboo forests and bamboo regrowth areas for industrial purposes. Management and regeneration strategy of natural stands should focus on preferred species, keeping in view the end user requirement.

1.5. Bamboo Based Agroforestry Techniques

Agroforestry systems may be thought of as a principal part of the farm system itself, which contains many other sub-systems (alley cropping, boundary planting, earthwork, taungya, improved fallows, living fences, vegetative strips and wood lots) that together define a way of life. The principles or beliefs are based on facts that agroforestry help in mitigating problems of environmental protection improve economic position of homesteads while stabilizing the social culture of embracing communities.

1.6. Taungya

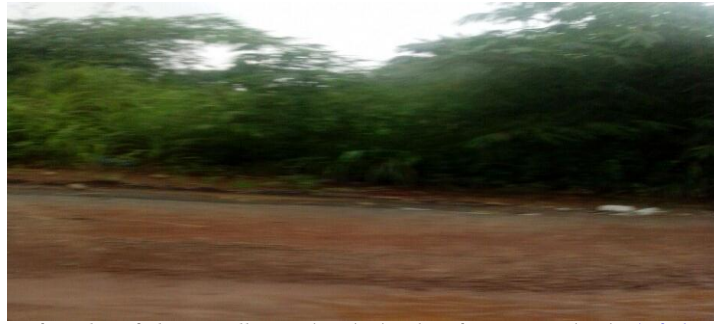
The Taungya system is like shifting cultivation, a forerunner to agroforestry. The word is reported to have originated in Myanmar (Burma) and means hill (*Taung*) cultivation (*ya*) (King, 1979). In the taungya system, annual agricultural crops are cultivated with forest species during the early years of forest plantation establishment, until the trees close canopy. Taungya is widely practiced in the past between the forestry department and local farmers in the southern parts of Nigeria where land hunger and court cases over land use are rampant. The principle underlying the system is that in all cases, temporary fertile land is used by the farmer for cultivating agricultural crops. The farmers are required to tend the forestry seedlings and, in return, retain a part or all of the agricultural produce. This agreement would last for two or three years, during which time the forestry species would grow and expand its canopy (Onweluzo, 1979). The planting scheme for bamboo should take into consideration the size and growth habit of the species and adequate distance provided for intercropping the annuals. The number of years of agreement could be reviewed from the time of planting bamboo and intercropping of cash crops or vegetables since bamboo growth rate and canopy closure is not the same with other trees.

1.7. Windbreaks

Bamboo establishments in the savanna region of the country could serve as windbreaks along the high wind areas where forestry trees are used for shelterbelt. Height, straightness, hardness, rigid culms as well as ability to resist physical constraints are the qualities that qualify bamboo to be used for hedge grow or windbreak (Hanson, 1998). The main advantages derived from this technique include food production and protection against prevailing winds.

1.8. Alley Cropping

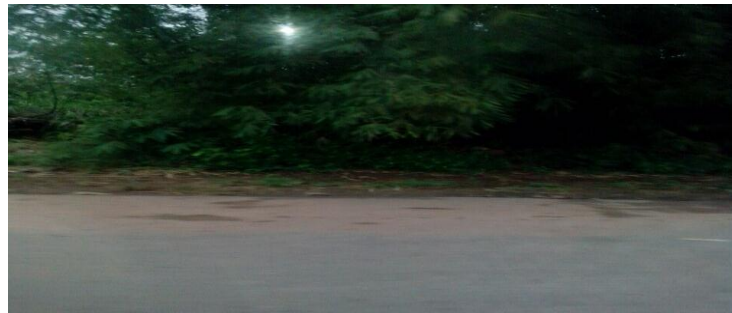
Alley cropping is an agroforestry practice where agricultural crops are grown in alleyways between widely spaced rows of woody plants (Centre for Agroforestry). Annuals such as vegetables, cereals and legumes planted in alleys between bamboos can diversify the income of farmer, improve crop production and provide protection and conservation benefits to crops. Bamboo as an alley cropping woody plant has the benefit of minimal roots at the surface. Bamboo intercropped in alleys with vegetables and other annuals would bring increased financial benefits for the farmers as well as improve the habitat for beneficial annual crop species in Nigeria. Distance provides sufficient space for intercropping.



Bamboo planted along a gully erosion site in AkwaIbom State, Nigeria (Igbokwe, 2014)

1.9. Watershed Protection

A watershed is land that drains into a particular body of water. As water moves across the landscape it picks up soil and pollutants. River banks and valleys also known as riparian zone can be planted with bamboo. These would protect the water and surrounding environment from harmful substances and also prevent the soil from being washed away by erosion.



Courtesy: Igbokwe (2014): Bamboo planted along river bank to check erosion

Benefits of bamboo along riparian zone to the environment include:

- i. Shading: this would keep the water cool. Cool water holds much oxygen for fish and other aquatic animals.
- ii. Leaves and other organic matter dropped by the roots of bamboo slows down fun-offs holds soil in place, keeping the bank from washing away and keeping sediment out of the water.
- iii. The bamboo trees also act as filters for many of the pollutants carried in water. Bamboo roots absorb water as it sinks into the soil and as the bamboo use water; they remove pollutants before releasing the water back into the air.
- iv. Bamboo along riparian zone provide habitat for wildlife and aquatic animals,
- v. It also provide a beautiful scenery and place for recreation

1.10. Boundary Planting and Life Fencing

Bamboo grown as a line of tree around a farm or human settlements creates boundary or life fence is a good idea for preventing erosion. The cuttings should be at least 18 inches long and contain 1-2 culms to create new outgrowth.

1.11. Social Protection

Bamboo craft is still limited to local handmade products. As earlier stated, there is only one modern bamboo processing company in Asaba, Delta State producing floor tiles in the whole of Nigeria (RMRDC, 2008). With the government drive to promote cottage industries, rural small scale entrepreneurs venturing into modern bamboo processing would open up the community to various social amenities and create jobs.

2. CONCLUSION

Bamboo based agroforestry is characterized with the ability to supply the needs of rural community, industries, as well as protection against erosion and other environmental hazards. The success of agroforestry techniques in managing bamboo production is associated with silvicultural and agricultural operations in continuity and under this system a disturbed site can be rejuvenated in successional stages without undue harm to the environment.

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