

A Review on Uses of Bamboo Including Ethno-Botanical Importance

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Received: 7.08.2017 | Revised: 18.09.2017 | Accepted: 20.09.2017

ABSTRACT

It has been found that bamboo is the most important Non-Wood Forest Product (NWFP) and plays an important role in daily life of rural areas. A man is born in a bamboo cradle and goes away in a bamboo coffin. In between, everything is possible with bamboo. Many traditional cultures and customs are ultimately connected with bamboo. Recently, bamboo is utilised for various purposes depending upon its properties. It is traditionally favoured for basketry and woven application. The culm is used for making handicrafts like baskets (Gaanja, Mouni, Tokri, Khanchia, Douri, Dala, Dalia), Taraju, Jhadu, food-grain containers, mats, hats, hand fan, shupe, etc. It supports a number of traditional small industries in almost every part of the world. Culms are used to make many different types of weapons like bows and arrows by the tribes. Culms of some bamboo species are also used in musical instruments like flutes etc. It has a greater scope of value addition process. Even today, bamboo continues to find new uses.

Key words: Bamboo, Uses, Traditional, Culm, Utilization

INTRODUCTION

Bamboo is a very important forest product mainly for forest dependent poor people. It is one of the fastest growing, versatile, productive, sustainable and useful plants which are widely used by poor people in rural areas of Asia, Africa and Latin America. No country in South East Asia is without indigenous bamboo flora. It is a cultural feature of South-east Asia.

Bamboo is a long tree like woody grass belonging to family Poaceae and subfamily Bambusoideae are exceptionally diverse plant and unevenly distributed in

various part of humid tropical, subtropical and temperate region of the earth where the annual rainfall ranges between 120 to 400 cm and temperature varies between 16⁰C to 38⁰C¹. It is represented by 1250 species under 75 genera in all over the world. In India, it is represented by 136 species under 20 genera. Bamboo is an environmentally friendly plant species. It is the “Green Gold” of the 21st century as it is available at the much lower price compared to wood and is as strong as strongest wood. It provides an alternate source to depleting and costly wood resources.

Cite this article: Nirala, D.P., Ambasta, N. and Kumari, P., A Review on Uses of Bamboo Including Ethno-Botanical Importance, *Int. J. Pure App. Biosci.* 5(5): 515-523 (2017). doi: <http://dx.doi.org/10.18782/2320-7051.5398>

The ethnobotanical uses of bamboo differ from region to region. It has been an integral part of Indian's cultural, social and economic tradition. Due to their strength, straightness, lightness combined with an extraordinary hardness range of size, abundance, a short period in which they attain maturity, make them suitable for a variety of uses. Bamboo has varieties of use like building material, scaffolding, handicraft, agricultural implements, musical instruments, weapons, food, fodder, fuel and solves so many environmental problems.

USES

Bamboos are fastest growing woody plants in all over the world. Bamboo can grow three times faster than eucalyptus and release 35 percent more oxygen than other forest plants. One bamboo can hold 6 m² of soil. One hectare of bamboo forest can absorb 12 t of CO₂ from the air and store 1000 t of water. Therefore, bamboo provides a great benefit to the natural environment and also solves so many environmental problems².

According to Kurz³, no plant is known in the tropical zone which could supply to man as so many technical advantages of the bamboo. The strength of the bamboo culms,

their straightness, smoothness, lightness combined with hardness and greater or less hollowness, the facility and regularity with which they can be split; the different size, various length and thickness of the joints make them suitable for numerous purpose to serve which other material would require much labour and preparation. The outline bamboo uses are (i) Paper making (ii) house construction (iii) temporary shelter either by native or traveller (iv) bamboo bridges and railings (v) living hedges (vi) bamboo for construction (vii) Furniture (viii) Chinese mason used for white washing brushes made of thin a bamboo slips (ix) fitted for yokes of cattle, axle and springs of the smaller carts. (x) bamboo loops for weeding (xi) walking sticks (xii) baskets (xiii) use as textile plants (xiv) rafts (xv) candle stick (xvi) obtaining fire (xvii) making knives (xviii) carrying poles (xix) ornaments (xx) medicinal virtues (xxi) religious purposes (xxii) educational purposes (xxiii) ornamental purposes and landscape gardening. Basically 'Turi' community along with other tribal community is involved in Bamboo crafting and the Bamboo articles made by them are listed below in Table 1.

Table 1: Traditional bamboo products commonly manufactured by bamboo craftsmen

S.No.	Items	Local name	Used for
1.	Winnowing receptacle	Supé	Winnowing of food grains
2.	Large basket	Ganja	For keeping food grains
3.	Big basket	Tokri	For keeping hen
4.	Medium basket	Tokri	For filtering rice water from cooked rice
5.	Medium basket with handle	Mouni	For keeping kitchen items
6.	Small basket	Mouni	For collection of Mahua flower and keeping kitchen items as vegetables
7.	Fencing mat	Chatai	Wall of rooms
8.	Tree guard		Protection of seedlings from cattles
9.	Hand fan	Pankha	Hand fan
10.	Ladder	Lishan/ sidhi	For climbing
11.	Fishing apparatus	Chiyari	For capturing fish
12.	Small Basket-supe	Supli Mouni	Used during marriage rituals
13.	Medium size basket	Khanchia	For collection of various crop in agriculture field
14.	Strong basket	Douri	For grain storage
15.	Piece of bamboo	Akhain	For mixing & stirring paddy
16.	Balance	Taraju	For weighing crop and vegetables
17.	Broom	Jhadu	For collection of animal dung
18.	Big strong basket	Dala	For storage of grains and other crops
19.	Small strong basket	Dalia	For storage of vegetables
20.	Small stick	Chhadi	To handle the cattle during driving Bullock cart

Bamboo is also called the wonder plant of nature, which has many uses. Bamboo have been traditionally used in building construction for times immemorial i.e. in foundation, infras, wall partitions, ceiling, doors and windows, roofs and for reinforcement of cement concrete. In addition, bamboo have specific characteristic for alleviating many environmental conditions such as soil erosion control, soil conservation, soil stabilizer, check dams, bamboo barrier in pond, river banks and slips, water conservation, land rehabilitation and carbon sequestration. There are 1500 different documented traditional uses of bamboo⁴.

Sharma⁵ reported the 26 important bamboo species which is traditionally used for edible purposes in Asian Pacific region. He also reported on uses of bamboo for sprayers, ropes, masts, sails, net floats, basket fish traps, food baskets, beds blinds, bottles, bridges, brooms, food, lanterns, umbrella handles, fans, brushes, chains, chopsticks, combs, dustpans, paper, pens, nails, pillows, tobacco and hookah pipe, anchors, fishing nets, fishing rods, flagpoles, hats. Ladles, lamps, musical instruments, mats, tubs, caulking materials, scoops, shoes, stools, tables, tallies, traps, joss sticks, walls, buildings, thatching and roofing, loading vessels, trays, bows and arrows, water and milk vessels, hedges, furniture, agriculture implements, fodder, fuels, float for timber, trellises, flues, handicrafts, sledges, toys, pipes, cooking utensils, tool handles, coffins, cart yokes, scaffolding, ladders, containers, tiles, seed drills, slats etc.

The consumption pattern of bamboos is in India, Pulp (35%), housing (20%), non residential (5%), rural uses (20%), fuels (8.5%), packing including baskets (5%), transport (1.5%), furniture (1%), other wood working industries (1%), other including ladders, staff, mats etc. (3%)⁶. Suri and Chauhan⁷ described important bamboos species and their uses: *B. bambos* (Rafters, house posts, ladders, tent poles, shafts of tongas, mat and basket making, scaffolding, chicks etc, besides pulping. Seeds and shoots are used as food. *B. balcooa* (pulping), *B.*

tulda (building material, scaffolding and roofing, mats and baskets, paper making, tender shoots as food etc.

During a survey, Singh⁸ reported more than 50 bamboo species which is used for edible purpose in large and small scale in North East Himalaya region. However, most widely used are only 15 bamboo species of which *Bambusa balcooa*, *B. pallida*, *B.tulda*, *Dendrocalamus giganteus*, *D. hamiltonii*, *D. hookeri* and *D. longispathus* are dominant species from delicacy, taste and in consumption point of view. In regards of diversity of commercial edible species of North Eastern Himalayan region as studied⁹, the maximum of 8 species have been recorded from Manipur followed by Tripura (6 species), Arunachal Pradesh and Nagaland (5 species each). There are five species, viz., *B. tulda*, *D. giganteus*, *D. hemiltonii*, *D. longispathus* and *M. baccifera* as shoot producing species in Mizoram¹⁰. Different types of preparations like bamboo kandy, bamboo shoot bhaji, chutney, pickle, fried shoots (pakoda), Kadi, pulav, keema, soup, bamboo juice and bamboo beer are made from bamboo shoots. Bamboo vinegar is also used as biofertilizer, bioinsecticide and as medicine for stomach disorders¹¹. There are uses of *Bambusa vulgaris* in the treatment of jaundice¹². The fresh shoots and fermented shoots of *Bambusa tulda* and *Dendrocalamus giganteus*, as raw material for production of steroid drugs¹³.

The total edible shoots consumption by each household in different villages of North-East states ranges from 7 to 20 kg. In a locality of 168 families, annual total consumption has been found to be 2688 kg. Manipur has the potential bamboo shoot output of 142350 tons/year and it has been estimated that the average consumption rate of bamboo shoot is about 60 kg/person/year. On an average 1979, 2188, 442, 433, 442 and 201 tons of shoots were harvested for consumption annually in Andhra Pradesh, Manipur, Meghalaya, Mizorum, Nagaland and Tripura respectively. In Japan annual per capita shoot consumption is 3 kg compared to 1.2 kg during 1950¹⁴.

Hindus carry dead body for cremation on a bamboo bier. Bamboos (mainly *Bambusa bambos* and *Bambusa nutans*) are used in construction of well ladders, lattha and their poles which is used for digging of well. Some villagers worship bamboo (*Bambusa bambos*) after marriage which is an important traditional custom in the North Chota Nagpur. In the worship, the marriage traditional caps (more) were hanged over the branches of *Bambusa bambos*¹⁵.

Bamboo leaf has a long history in food and medical application and has recently been listed by Ministry of Health, bamboo as natural plants with dual purposes as food and drug. Systematic toxicity evaluation of a triterpenoid-rich extract of bamboo shavings concluded that the extract of bamboo shavings is of low toxicity and supported its use for various foods¹⁶. Antioxidants of bamboo have been found to be safe in a safety evaluation studies that supports their use as a food additive¹⁷.

There are so many economic importance of bamboo for the rural communities in the most developing countries and also of ecological importance in preventing soil erosion¹⁸. The biological characteristics of bamboo make it a perfect tool for solving so many environmental problems, such as control soil erosion and CO₂ sequestration.

There are also so many additional uses of bamboos for many countries like bamboo houses resisted more than 7 Richter scale earthquakes whereas other concrete houses collapsed in the same areas¹⁹. An atmospheric oxygen pump, bamboo produces 35% more oxygen than deciduous trees²⁰. Juice of fermented shoots stored for about 5060 days is used for flavouring vegetables²¹. The climate change exerts a profound effect on the intensity of pest problems²². The edible part consists of tissue with region of rapid cell division, which is enveloped in a protective, non edible leaf sheaths²³. The leaves of *D. strictus* are used as fodder.

Bamboo-based agro-forestry uses:

Bamboo based agro-forestry increases the forest areas and allows for short term sustainable development for both rural and urban people as a source of income from seasonal harvest of bamboo. Under agro-forestry system having various intercrops, products are obtained even in the early stages of plantations and the income is much higher than any other system. The cultivation of soyabean (*Glycine max.*) along with *Dendrocalamus strictus* was technically feasible and economically viable²⁴. The scope for bamboo in agro-forestry in India was very wide because of the uncertain weather conditions and the increasing cost of labour involve in raising agricultural crops on marginal lands rendered the latter option less attractive²⁵. Bamboo was the most profitable of the six horticultural crops studied by them in Konkan region in India²⁶.

New generation bamboo products:

In China, the production of bamboo culms change little from 1978 to 1990, but significantly increased up during the next 20 years due to the industrial utilization of bamboo, especially from 2000. In China, bamboo industries has reached annual production value of 13.8 billion US\$ and provides employment opportunities for over 5.6 million people directly. The production of bamboo flooring and bamboo based panels in China reached 39.4 million m² 3.59 tons respectively in China. The bamboo mat panels find its value-added application fields, such a concrete forming templates and decking for trucks and containers²⁷.

From the processing of bamboo waste, bamboo powder polymer composites, bamboo pellet for energy, vinegar and charcoal are produced. In 2010 bamboo charcoals production in China reached 0.14 million tons/yr. The value of bamboo charcoal is further added in secondary processing units for bamboo charcoal fibre and cloth, charcoal for adsorption and purification materials, in handicrafts and even for improving sleeping materials. Similarly from vinegar in the secondary processing units, vinegar for

bathing, for horticulture and agriculture purposes are produced. Attempts are being made to manufacture bamboo carbon based lithium battery and conductive polymers. High value-added bamboo products viz., bamboo decorative veneers are also produced. Advanced bamboo engineered materials are significantly different from the existing various bamboo composites to replace glass fibre re-inforced particles for application in wind blade and yacht. Bamboo scrimbers, a novel structural composite, has been developed for producing strand, panel, floorings, structural components in houses, top-grade furniture and for outdoor applications. Bamboo structural lumbers are produced for using as the loading component for construction purposes like roofs, poles etc.²⁷.

Productivity, litterfall seasonality and nutrient cycling of bamboo plant

There are two major pathways are recognized in the forest ecosystem; (i) Biological (closed) cycle and (ii) Geochemical (open) cycle. The biological cycle may involve a cyclic circulation of nutrients between the forest soil and the biotic communities and may include the process of mineral uptake (or) absorption, retention (in the annual accumulation of biomass) and restitution or losses through leaf litter, organic debris, washing by rain etc.²⁸. Nutrient cycling is a good indicator of continuity and stability of any living system. On a generalized way, nutrient cycling for plantation bamboo may be worked out from the data on biomass, productivity, nutrient content, litter production and nutrient in litter etc. using the expression²⁹.

$$\text{Nutrient uptake} = \text{Nutrient retained} + \text{Nutrient returned.}$$

For the growth and production of commercial bamboo species, it is particularly important to know the sources of energy and nutrients that sustain the rapid accumulation of biomass in young culms. Only 26% of total non-structural carbohydrates in *phyllostachys pubescens* were located in rhizomes whereas culms contained 44%³⁰. Both Uchimura³¹ and Li et al.,³² measured decrease in carbohydrate concentration in rhizomes during new culm and rhizome growth in the same species. Bamboo grown under poorer soil conditions accumulates less total biomass but relatively more biomass is accumulates to below ground plant parts³³. Biomass can also vary within individual species, even when it is cultivated at the same site^{34&35}. For *D. strictus*, Joshi et al.,³⁶ recorded total above ground biomass of 9 t/ha four years after clear felling. Oli³⁷ prepared biomass tables for *B. tulda* grown in Nepal and developed a regression model useful in estimating bamboo biomass of managed natural stands or plantations under similar climatic condition.

Bamboo litter biomass contributes significantly to soil organic matter and supplies bamboos with nutrients in natural

stands and cultivated plants. Bamboo leaf litter occurs over whole year but has two annual peaks- in spring (April-May) and late autumn (November)³⁸. The annual quantity of litter was greatly affected by both the biological properties of bamboo and the environmental condition. However, recorded *D. strictus* litter fall of 2.7 t/ha/yr from standing biomass of 35 t/ha with annual nutrient return of 28, 1.3, and 12 kg/ha/yr N, P and K³⁹. In bamboos stand, 89% of total uptake of nitrogen was found to be retained while 11% was return to soil.

Employment generation

Bamboo has a tremendous capacity to provide employment and income to large number of people especially suited to women to allow flexible working hours nearby their house. Indian bamboo sector generates 48-60 million work days (WDs) for harvest annually and 60-72 million WDs for loading, unloading, handling etc. for six million tones of bamboo, annually. It has been estimated 10 to 25 work days for unskilled per hectare for soil working and maintenance of clumps including thinning operation⁴⁰. One hectare of bamboo plantation with 500 clumps generates 3.9 mandays of employment for unskilled labour and 47.3

mandays for supervisor annually over a period of 30 years⁴¹. Craft sector can generate about 150 WDs per tonne and two tones of bamboo is enough to employ one person for one year in this sector⁴².

There are about 43.2 million mandays of employment is generated annually by bamboo sector in India⁴³. Demand of bamboo is estimated to 26.6 million tons/year, whereas supply is of 13.7 million tons/year⁴⁴. Agroforestry is a dynamic, ecologically based natural resources management system that, thought the integration of trees in farms and in the agriculture landscape, diversifies and sustains production for increased social, economic, and environmental benefits for land users at all levels⁴⁵.

About 2.5 billion people in the world depend economically on bamboo and international trade in bamboo amounts to about US\$2.5 million⁴⁶. About 300 companies are engaged around the world in production of various bamboo based products⁴⁷. Recent trial at IFP with some silvicultural measures have shown enhanced yield of edible bamboo shoot and duration of shoot production period in some native and introduced bamboo species under Chota Nagpur climatic condition⁴⁸. More than 100 bamboo species are used commercially and have potential to provide excellent means of income generation in primary and secondary processing with little capital investment⁴⁹. They are important for biomass production and play an increasing role in local and world economies⁵⁰.

CONCLUSIONS

A man is born in a bamboo cradle and goes away in a bamboo coffin. In between, everything is possible with bamboo. Many traditional cultures and customs are ultimately connected with bamboo. Bamboos are socially, economically and environmentally an ideal material for commercial application and offers development opportunity for poor people communities. There are four major roles of bamboos (I) Shelter security through the provision of safe, secure, and durable housing. (ii) Livelihood security through the

generation of employment in planting, construction, craft and manufacture of value-added products. (iii) Ecological security- It solves so many environmental problems such as control soil erosion, conserve water etc. (iv) Food security- It provides food and fodder. Young culm of some bamboo species like *D. strictus* (bon bans) *B. balcooa*, *B. tulda*, *B. bambos*, etc. are used for the edible purpose. It has a greater scope of value addition process. Even today, bamboo continues to find new uses.

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