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BAMBOO: USE AND POTENTIAL

After going through the previous lesson, you must have developed an understanding about the different bamboo species and various parts of the bamboo plant. As you know now that bamboo is a woody grass, it can be the perfect alternative for hardwood. It is light weight, strong, durable and flexible. These qualities are suitable enough to make composites, furniture, decors, flooring, roofing, cloths, paper and even a complete building from bamboo. About 2.5 billion people in the world depend economically on bamboo (INBAR, 1999), and international trade in bamboo amounts to about US\$2.5 million (INBAR, 2005). Though India has the largest area under bamboo, which is estimated to be around 13.96 million hectares. It has low yield of around 0.4 tonnes per ha (Internationally it is as high as 50 tonnes per ha.). It is very low in comparison to other countries like China, Malaysia, Costa Rica etc. The annual turnover of the bamboo sector in India is estimated to be around Rs. 2400 crores. Still, this is a largely unorganized sector and bamboo has always been considered from the craft point of view and if otherwise for pulp making only. In this lesson, you will learn the various uses of bamboo in different fields. You will find that they have their innumerable uses as food, shelter, clothing, decorative articles, flooring etc. They can even be a source of renewable energy and also help in sustainable development. You will also come to know about the various initiatives taken by the Govt. in India to encourage bamboo cultivation on a commercial scale.



OBJECTIVES

After reading this lesson, you will be able to:

- list the use of bamboo in various fields;
- demonstrate use of bamboo in housing construction, flooring etc.;



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- extract charcoal, oil and gas from bamboo;
- estimate the importance of bamboo in sustainable development;
- explain the potential for bamboo industry in India;
- analyze the public initiatives for bamboo industry.

2.1 USES AND APPLICATIONS OF THE BAMBOO PLANT

Bamboo is an important resource in the India with over 1500 recorded uses. It is a fast growing, widespread, renewable, low-or-no cost, environment-friendly resource. It has potential to provide livelihood in the years to come, in both rural and urban areas. Apart from its traditional uses, bamboo has various new applications as an alternative to wood and other more expensive materials like steel, iron etc. It is widely used in construction, either in its natural form or as a reconstituted material, laminated boards and panels composite of bamboo and plastic.

Let us see some of the uses of bamboo that we see in our surroundings. They can be used:

- as a composite and wood substitute
- as fabric for making clothes
- as food for people and animals
- as fuel
- as a wind break and fence
- as soil binder
- for building normal and air-conditioned houses, schools, hospitals, etc.
- for making furniture
- for medicinal purposes
- for scaffolding
- for making paper
- for making handicraft items
- to make accessories and utility items.
- to make durable utensils



2.2 ENGINEERED BAMBOO

Bamboo can be processed into modern products (engineered bamboo) that may successfully compete with wood products in price and performance. Use of bamboo in making composite panels and boards greatly improves quality of the culms and allows the production of homogeneous products.

Bamboo composites come under Green Materials category. The constructions based on bamboo material provide excellent alternate of wood, cement concrete and other high cost material.

2.3 BAMBOO HOUSING

There are three main types of bamboo housing:

1. **Traditional houses** (Fig. 2.1): They use bamboo culms as a primary building material. According to reports, over one billion people live in traditional bamboo houses.



Fig. 2.1: Traditional bamboo house

2. **Traditional (bahareque) houses** (Fig. 2.2): In these houses a bamboo frame is plastered with cement or clay.



Fig. 2.2: Traditional bamboo bahareque house



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3. **Modern prefabricated houses** made of laminated boards, veneers and panels. (Fig. 2.3): These buildings are usually cheaper than wooden houses. They are light, strong and earthquake resistant as compared to brick or cement constructions. They are environment friendly too. Bamboo based materials are widely available and can be cultivated at a low cost. Bamboo based structures are low on maintenance, fire resistant, and have thermal protection and most importantly suitable for constructions in earthquake prone zone. They are important due to ease of construction and cost-effectiveness of bamboo. They also play an important role in disaster mitigation and post-disaster rehabilitation.



Fig. 2.3a: Modern bamboo composite house



Fig. 2.3b: Modern bamboo composite house

2.4 BAMBOO PANELS/ BOARDS AND TIMBER

Bamboo panel/board consists of multiple layers of bamboo, available in many variations with respect to size, thickness, configuration, style and color (Fig. 2.4).

Bamboo: Use and Potential

At present more than 20 different types of panels are produced these are Bamboo Mat board, Scrimber (processed board from low quality or old bamboo). The process and the product are called Scrimber. Veneer panel, bamboo jute composite board, flattened board, Bamboo timber etc. For example, Bamboo Mat Panel is made by hot pressing of hand woven bamboo mats. Mat boards are durable, stable and resistant to pest attack, fire etc. They can be used as wall panels, ceilings, assembled structures and household utensils etc.



Fig. 2.4: Bamboo panel

2.5 BAMBOO FLOORING

It is a quality product that can be commonly used and has a large global market. It has certain advantages over wooden floors due to its smoothness, brightness, stability, high resistance, insulation qualities and flexibility (Fig. 2.5).



Fig. 2.5: Bamboo flooring



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More and more furniture, flooring, and even homes are being built with bamboo. It is becoming a popular wood alternate. The smooth floors hold up well in kitchens and other rooms.

2.6 BAMBOO FURNITURE

Traditional bamboo furniture uses natural round or split bamboo (Fig. 2.6a). A new type of 'pack-flat,' 'knockdown' furniture uses glue-laminated bamboo panels (Fig. 2.6b). Unlike the traditional design, this furniture may be shipped in compact flat packs, to be assembled on the spot. The furniture, bound attractively with rattan or leather, gives any room a modern look.



Fig. 2.6a



Fig. 2.6b

2.7 BAMBOO CRAFTS AND WOVEN MATS

They are traditional products in India, China, Malaysia, the Philippines and Thailand. The technique has been known for several thousand years. There are nearly 20 categories of woven bamboo products in Asia, including fruit baskets, trays, bottles, jars, boxes, cases, bowls, fans, screens, curtains, cushions, lampshades and lanterns (Fig. 2.7). Several bamboo-producing countries, such as China and India, use bamboo in pulp, paper and more recently cloth. Bamboo paper has practically the same quality as paper made from wood.



Fig. 2.7: A few articles of bamboo



2.8 BAMBOO FIBRE

Bamboo clothes are a fabulous trend right now as bamboo fibers being used in fabrics and clothing (Fig. 2.8). Bedding made of bamboo fibers is as soft as or softer than most cotton beddings. They have the look of silk without being expensive. It is becoming a mainstream trend to have bamboo fabric products or clothing, populating many major chain retail stores.



Fig. 2.8: Bamboo clothes

2.9 BAMBOO CHARCOAL, OIL AND GAS

Through a process called pyrolysis, bamboo can be converted into three valuable products: bamboo charcoal, oil and gas. Bamboo can be used in machines called gasifiers as a source of fuel. They are also used in thermal applications, replacing furnace and diesel oils. Gasification of bamboo (waste and low quality bamboo) can produce energy and a range of valuable byproducts. This can be used to produce clean and renewable electricity and thermal energy.

Gasification is a thermo-chemical conversion, carried out through process of oxidation and reduction with limited air supply (Fig. 2.9). It generates a combustible gas called producer gas and active charcoal as a by-product. The producer gas obtained can be used either for thermal application or for mechanical/electrical power generation. It provides smokeless combustion and is thus an environment friendly operation. Whole process has lower operating cost than other methods. A 100 KW gasifier would require only about 1000 tonnes of bamboo



Fig. 2.9: Bamboo based gasifier



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per annum. Gasification process does not depend on quality, species, and maturity of bamboo hence the waste bamboo can also be used as fuel for the gasifiers.

Bamboo waste generated during the production of different products can be used in charcoal and briquette production (Fig. 2.10a). Bamboo Waste Charcoal is produced by heating bamboo with a controlled supply of air (Fig. 2.10b). Carbonization in a brick kiln produces uniform quality charcoal with a good yield and with minimum investment. This not only serves the heating needs of people but also reduce burden in the ecosystem by reducing cutting of trees. Bamboo charcoal has much higher calorific value (7000Kcal/ kg) than wood. Bamboo charcoal could be used as solid fuels by hotels, *dhobis* (washer-men) and for cooking in rural areas. It can further value added by pulverizing (for use in Agarbatti making) and briquette forming (for heating). Bamboo vinegar is a byproduct of charcoal which can be prepared by condensing the gases coming out of bamboo charcoal.



Fig. 2.10a: Brick kiln

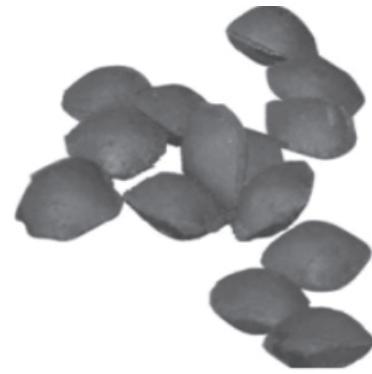


Fig. 2.10b: Bamboo charcoal

Bamboo can also be used in the manufacture of charcoal, which is superior to charcoal from other sources in terms of calorific value. Bamboo charcoal is traditionally used as a substitute for wood charcoal or mineral coal. It can serve as a fuel, absorbent and conductor.

Bamboo extracts also contain valuable elements and can be used in pharmaceuticals, creams and beverages. Activated bamboo charcoal can be used for cleaning the environment, absorbing excess moisture, producing medicines, water filtration, cosmetics, fuel etc.

2.9 BAMBOO SHOOTS

Bamboo shoot is a young culm harvested shortly after it appears above the ground (Fig. 2.11). Bamboo shoots have high nutritional value and low fat, and are a good source of fiber, vitamins, cellulose and amino acids. About 200 species of bamboo



can provide edible and palatable (tasty) bamboo shoots. Fresh bamboo shoots are delicious and healthy, with high fiber content. Bamboo vegetables can be found in high end grocery stores and restaurants worldwide (Fig. 2.12). After cooking, the shoots still remain crisp, because cooking does not destroy their texture. Cooked bamboo shoots can be stored in containers and shipped worldwide.



Fig. 2.11: Bamboo shoot

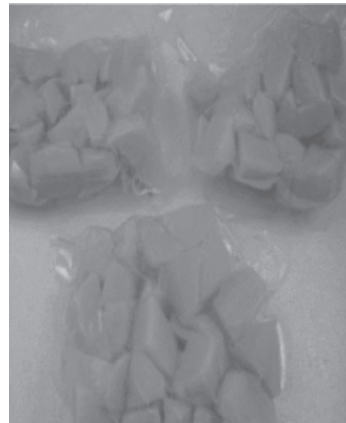


Fig. 2.12: Processed shoots

Cooking with bamboo is nothing new in Asia. But introduction of new food process technologies has led to the shift from home scale processing to industrial scale. The bamboo shoots are processed using these technologies which help not only in increasing shelf life, improving the product quality and sales, providing employment but also increase the marketability of product under hygienic conditions (Fig. 2.13). These finished and processed bamboo shoots are finding higher demand in the market due to their taste and health benefits.



Fig. 2.13: Tinned proc. bamboo shoot

**INTEXT QUESTION 2.1**

1. Fill in the blanks
 - (a) comes under Green Material category.
 - (b) Bamboo shoots have fiber content which is good for digestion.
 - (c) has largest area under bamboo cultivation in the world.
 - (d) The yield of bamboo in India is as compared to China, Malaysia etc.
2. State whether true or false
 - (a) Bamboo is more expensive and prone to fire than wood.
 - (b) Bamboo houses are safer to be built in earthquake prone areas.
 - (c) Bamboo vinegar is a byproduct of bamboo charcoal.
 - (d) Bamboo charcoal has a lower calorific value than the wood.

2.10 BAMBOO FOR SUSTAINABLE DEVELOPMENT

The importance of Bamboo industry for sustainable development is evident from the fact that it is the best source for the restoration of forests and landscapes. It is to be noted that around 47 percent of the world's potential forest area has been



Fig. 2.14: Plantation of bamboo in degraded land



cleared or degraded to make way for crops, cattle, cities, and roads. As a native species across tropical, sub-tropical, and some temperate areas, bamboo could contribute significantly to restoring degraded landscapes. By planting bamboo in parts of landscapes, degraded lands could be restored to some productive use (Fig. 2.14).

Bamboo forest ecosystem has a higher potential in fixing Carbon from the atmosphere relative to other forest species (Fig. 2.15). It is one of the prominent ecosystems which plays an important role in the carbon cycle and carbon balance on the earth in fixing the CO₂ from the atmosphere through the process of photosynthesis and release it through respiration and decomposition process. Bamboo sequesters CO₂ and generates up to 35% more oxygen than an equivalent stand of trees. They are also fast growing and have high production and rapid maturation from shoot to culm.

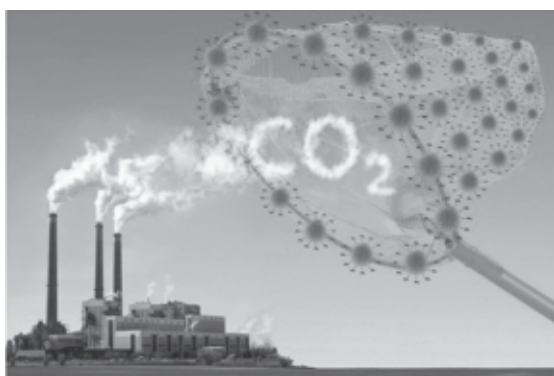


Fig. 2.15: Bamboo is best carbon sequester

2.11 THE POTENTIAL FOR THE BAMBOO INDUSTRY IN INDIA

“The world bamboo market is currently worth US\$ 8 billion/year, of which China’s share is US\$ 5.5 billion. Traditional markets cover handicrafts, blinds, bamboo shoots, chopsticks and traditional bamboo furniture, which explain 95 per cent of the market to date. New market products include modern/laminated furniture, flooring and panels cover the remainder five percent of the bamboo sector.”

The bamboo and rattan industry of India is worth Rs. 28,005 Crores. During 2015-16 and 2016-17 the export of bamboo and bamboo products was Rs. 0.11 Crores and Rs. 0.32 Crores respectively while the import was Rs 148.63 Crores and Rs 213.65 Crores. Hence, despite the growing stock both within and outside forests, India is a net importer of bamboo. It means that there are greater opportunities to harness the market potential by increasing its production and ensuring establishment of a proper value chain system. In most of the hilly states of the country, bamboo



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is used as building /construction material, besides, having a potential niche market in other countries as well with various traditional and an ever-increasing range of modern uses/applications in industries like construction, furniture, textile, food, energy production, herbal medicine etc. This is especially important from the potential of bamboo-based livelihoods and employment for rejuvenating the rural economy and doubling of farmers' income (NBM 2019).

2.12 PUBLIC INITIATIVES FOR BAMBOO INDUSTRY

Keeping in view the vast untapped potential of the bamboo sector government of India realized an urgent need to widen the dimension of bamboo sector and give due attention to the unorganized market and provide for high level technology application for manufacture of value added products in the industrial and artisanal sector. National Mission on Bamboo Technology and Trade Development formulated an Action Plan to upgrade the bamboo economy by according bamboo development a strategic role in rural development, poverty alleviation and bamboo-based handicrafts and industrial development. This is to be achieved under an integrated programme of expansion of plantation, of bamboo species on selective basis, with a view to reaching the markets and utilization centers, scientific management with the involvement of expert committees, Self Help Groups (SHGs), and assisting the industry to access and apply modern technology for producing globally competitive new generation bamboo products.

National Bamboo Mission (NBM)

With a view to using the potential of bamboo crop, Department of Agriculture and Cooperation (DAC), Ministry of Agriculture and Farmers Welfare implements a 100% Centrally Sponsored Scheme called National Mission on Sustainable Agriculture (NMSA) under the umbrella scheme Krishonnati Yojana of which National Bamboo Mission (NBM) is being implemented as a sub scheme.

The Mission plans to promote the holistic growth of bamboo sector by adopting area-based, regionally differentiated strategy and to increase the area under bamboo cultivation and marketing. Under the Mission, steps have been taken to increase the availability of quality planting material by supporting the setting up of new nurseries and strengthening of existing ones. To address forward integration, the Mission is taking steps to strengthen marketing of bamboo products, especially those of handicraft items.

Objectives

- (i) To increase the area under bamboo plantation in non-forest Government and private lands to supplement farm income and contribute towards resilience to



climate change as well as improve availability of quality raw material requirement of industries. The bamboo plantations will be promoted predominantly in farmers' fields, homesteads, community lands, arable wastelands, and along irrigation canals, water bodies etc.

- (ii) To improve post-harvest management through establishment of innovative primary processing units near the source of production, primary treatment and seasoning plants, preservation technologies and market infrastructure.
- (iii) To promote product development keeping in view market demand, by assisting R and D, entrepreneurship and business models at micro, small and medium levels and feed bigger industry.
- (iv) To rejuvenate the underdeveloped bamboo industry in India.
- (v) To promote skill development, capacity building, awareness generation for development of bamboo sector from production to market demand.
- (vi) To realign efforts to reduce dependency on import of bamboo and bamboo products by way of improved productivity and suitability of domestic raw material for industry, to increase income of the primary producers.

Coverage

The Mission will focus on development of bamboo in limited States where it has social, commercial and economical advantage, particularly in the North Eastern region and 13 other States including Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Tamil Nadu, Telangana and Uttarakhand,.

The Mission is expected to establish about 4000 treatment/ product development units and bring more than 100000 ha area under bamboo plantation during the period 2018-19 and 2019-20.

National Mission on Bamboo Application (NMBA), now North East Centre for Technology Application and Reach (NECTAR).

National Mission on Bamboo Applications (NMBA), a Technology Mission was established by the Department of Science and Technology during the 10th five year plan period. NMBA has now joined North East Centre for Technology Application and Reach (NECTAR) an autonomous organization under Department of Science and Technology, Govt. of India.

The primary objective of the mission was to support the up gradation and enlargement of the bamboo sector with special emphasis on value added products and applications. It supported the efforts of the government towards better



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economic opportunity especially in areas and amongst people who are relatively disadvantaged.

The Mission was multi-disciplinary in its approach with focus on value addition and commercialization, developing, testing and disseminating technologies, creating knowledge and technology network in action.

The core application and thrust areas of the NMBA include wood substitutes and composite, structural Applications, machinery and process technologies; Agro Processing; Industrial Products and Bamboo for energy.

The NMBA has played an important role in skills training to almost 2,50,000 persons in primary processing and related activity who were integrated with the industry/ economy for supply of mats. It has set up more than 42 lakh sq.ft. of public utility structures with just socio-economic objectives in many states and union territories and also contributed towards rehabilitation construction after the tsunami in Andaman and Nicobar islands in the year 2004 and the 2005 Uri earthquake disaster in J and K and in Sikkim in the year 2011.

For additional information on these initiatives you can visit the following websites:

www.inbar.int

www.nbm.nic.in

www.nectar.org.in

www.ipirti.gov.in

<https://skillindia.nsdcindia.org>



INTEXT QUESTION 2.2

1. Fill in the blanks

- (a) Bamboo ecosystem has a potential to fix carbon from atmosphere as compared to other forest trees.
- (b) By planting on degraded land they can be restored for use.
- (c) Commercial consumption of bamboo in the world are expected to double by the year
- (d) is established by Ministry of Agriculture and Farmers Welfare to harness bamboo crop.



WHAT YOU HAVE LEARNT



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Let us summarize the salient points we have learnt through this lesson:

- Bamboo is an alternative for wood and can be used in variety of ways.
- It is fast growing, renewable, low or no cost and environment friendly resource.
- Bamboo can be processed to form engineered bamboo to be used in construction and other works.
- Bamboo building are cheaper than wooden houses.
- They are earthquake resistant and can be used in earthquake prone zones.
- Bamboo flooring and furniture has high acceptance and demand in the market.
- Bamboo also has uses for crafts, woven items like lampshades, mats, bags etc. as well as paper.
- Bamboo is also used to produce oil, gas and charcoal to meet energy requirement.
- The by-products of gasification can be used for vinegar, pharmaceuticals, creams and beverage production.
- Bamboo shoots have high fiber, vitamins, cellulose and amino acids.
- Bamboos are important in sustainable development.
- They can restore degraded lands to be used for productive purposes.
- There is high potential for bamboo industry in India. It can generate livelihood for millions of people.
- There are many public initiatives by the government to encourage bamboo industry in India.
- Ministry of Agriculture and Farmers Welfare has important National Bamboo Mission (NBM) to harness the potential of bamboo crop and its application.
- National Mission on Bamboo Application (NMBA), now North East Centre for Technology Application and Reach (NECTAR) has been established by Department of Science and Technology, Govt. of India to support the up gradation and enlargement of the bamboo sector.



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**TERMINAL EXERCISE**

1. What are the different types of bamboo houses that can be constructed?
2. Describe gasification. How are charcoal, oil and gas produced from bamboo and what are their uses?
3. Discuss the advantages of bamboo over wood or other construction material in building houses and other structures.
4. Can bamboo shoots also be used? Discuss.
5. Discuss the role of bamboo in sustainable development.
6. Do you think there is potential for bamboo industry in India? Why if yes or no?
7. What are the different initiatives that are taken by the government for bamboo industry?
8. Emphasize the role of NBM and NMBA in supporting bamboo sector in India.

**ANSWERS TO INTEXT QUESTIONS****2.1**

1. (a) Bamboo composite (b) High
(c) India (d) Low
2. (a) False (b) True
(c) True (d) False

2.2

1. (a) High (b) Bamboo
(c) 2020 (d) National Bamboo Mission (NBM)

Key Learning Outcomes

- Bamboo has many uses – commercial, household, industrial uses of bamboo etc.
- Public initiatives to support development of bamboo