Introduction

Bamboo, the poor man's timber, is one of the most important forestry species with wide distribution throughout India. Bamboo has made a major contribution in sustaining the rural economy in most of the states of the country. Bamboo has been an important source of income for millions of rural people for sustaining their livelihood. The major quantity of bamboo is utilized as raw material for paper and pulp industries, handicrafts, housing, rural and agricultural applications and also in packing industry etc. India has the largest area and the second largest reserve of bamboo in the world today. A very large standing resource is found mostly in moist and deciduous forests in all the states except Jammu & Kashmir. Of India's total forest area of 67.7 million ha, bamboo (both natural and planted) occupies around 11.4 million ha. This represents 16.7 per cent of the total forest area of the country and 3.4 per cent of the total geographical area (329 million ha) of India (PSI, 2003). Despite having large resources, India contributes only 4 per cent share of global market. This is mainly attributed to the low productivity of around 0.4 tonnes per hectare, which is much lower compared to other countries such as China, Japan and Malaysia, which contribute about 90 per cent to the world's bamboo market.

Bamboo is a versatile group of plants, which are closely linked with the culture of tropical Asia. This gift of nature has enabled man to draw a variety of benefits. Besides being a convenient source of cellulose for paper manufacture and rayon, it supports a number of traditional cottage industries in India. The origin of bamboo craft is traced from the beginning of the civilization when man started cultivation of food crops thousands of years ago. Bamboo is emerging as a major source of raw material for several industries, viz. bamboo mat boards, bamboo mat veneer composites, bamboo mat corrugated sheets etc. These developments have created a new interest in bamboo across the world.

Since the beginning of civilization bamboo has played an important part in daily lives of people in India. Bamboo craft is one of the oldest cottage industries primarily due to versatility, strength, lightness, easy workability of bamboo with simple hand tools. Bamboo has been put to use for various applications ranging from construction to household utilities and have more than 1,000 documented uses including an important use in paper and pulp manufacturing (Anon., 2008). Due to plethora of essential uses, it has been aptly described as “poor man's timber”, “friend of people”, “the cradle to coffin timber” and “green gasoline”. Bamboo grows fast
and matures early. The output of bamboo plantation is great and the use of bamboo stem is wide. Once successfully planted, bamboo plants keep on rhizoming, shooting and maturing every year. The annual selective cutting and sustainable utilization can be implemented without damaging ecological environment.

**Bamboo for Development**

One of the core strengths which is still virgin and if exploited could bring wonders, especially for the upliftment of socio-economic conditions of the rural poor is bamboo. Bamboo, the plant of fascination, with its many remarkable properties, including strength, lightness and flexibility, as well as nutritional and environmental value, has more than 1,500 documented applications, ranging from medicine to poison, and from toys to aircraft. It is without doubt one of the most important agricultural plants worldwide. It is a fast growing natural resource with unsurpassed rate of biomass generation. Over 1,200 different species of bamboo with annual crop production of approximately 10 million tonnes, or about 8 million km of bamboo, enough to belt the earth 200 times are identified worldwide (Anon., 2008). The main bamboo stands are found in China and India. Unlike timber, bamboo is self-regenerating natural resources with new shoots that sprout annually that ensure production after individual culms. In Asia, Africa and South America, it is a basic raw material with numerous traditional uses and is used as an ornamental material. It is used for ecological purposes such as soil stabilization, erosion prevention on hill slopes and verges; and, very importantly as forestry plant.

There has been a growing awareness in recent years about bamboo being an important component of development and an affective means to improve the livelihoods of rural poor people. It is a natural vehicle for development because rural people generally have adequate access to it and it can be easily grown and harvested. In many parts of the tropical world the rural poor are completely dependent on bamboo for their shelter and for day-to-day utilities. Over 600 million people generate income from bamboo; over a billion people in the world live in bamboo houses. Women and children in Asia, Africa, who live below subsistence levels, harvest a great part of the bamboo that is used. The annual trade in bamboo and related products is estimated at US$ 15 billion. In the last decade, increased knowledge about bamboo has given rise to many new industries and products. Increased research on bamboo has had a tremendous economic impact. Many export markets have been opened and the development of innovative products is a continuous process. The utility of bamboo has expanded to include its transformation into various structural composite panels. Bamboo promotes ecological security and contributes to rural development, environmental benefits and disaster avoidance, and improves socio-economic condition. In Europe, it is being used as an ornamental plant for over a period of 150 years. Currently, over 300 different species of temperate bamboo are grown throughout Europe. Recently, it has also been recognized as a potential agro-forestry plant in Europe. There are significant developments within Europe in propagation techniques, biotechnology, and wood technology that are relevant for enhancing the value and utility of bamboo globally (Anon., 2008).
On the ecological front, bamboo absorbs more water than many plants, thereby helping maintain soil stability. It absorbs from the air 12 metric tonnes of harmful carbon dioxide per hectare, which is twice that of a similar size forest, and produces 35-46.2 per cent more beneficial oxygen than most plants. Hence, it is the best plant to counter urban and industrial pollution.

**Bamboo Applications**

The 13.47 million tonnes of bamboo harvested annually gets utilized industrially in paper mills, as scaffolding in fencing, for internal consumption in bamboo-growing households, handicrafts and miscellaneous items like incense-sticks, ladders, ice-cream sticks, agricultural implements, etc. However, again, no reliable estimates of quantities are available for any of these items. Experts in paper industry have indicated that 25% of the raw material requirement of the industry is currently met through bamboo and the quantity of wet bamboo required for this purpose is 2.5 million tonnes annually. The primary survey has indicated that, 8-10% of the total harvest, is consumed by individual households internally, which translates to 1.35 million tonnes approximately. The handicraft sector uses 2.55 million tonnes of bamboo per year which is also used for making incense-sticks, ice-cream sticks, chopsticks, agricultural props in fields, implements and tools, ladders, lathis, walking-sticks, fishing rods, boat masts, bows and arrows, flag poles, paddles, kites, fire crackers, etc. About 1,000,000 million incense-sticks weighing one million tonnes are produced annually. Each incense-stick consists of one-third quantity of bamboo stick, jigat and charcoal by weight. To produce 1 kg of bamboo incense-sticks, 2 kg of bamboo is needed. Thus, 0.67 million tonnes of bamboo is consumed by incense-stick industry. The value of the ladder industry is in the range of Rs. 58 crores, which is equivalent to 0.29 million tonnes of bamboo. The total value of 3.4 million tonnes of bamboo used for scaffolding is Rs. 340 crores annually. Biers used for the dead consume 0.08 million tonnes of bamboo. So 11.77 million tonnes are used as mentioned above and the balance of 1.7 million tonnes could be possibly accounted towards the illegal trade to neighboring countries like Bangladesh, Nepal and Myanmar (Anon., 2008).

There are vast bamboo resources available for commercial exploitation. The varieties that grow in our country lend themselves to most commercial applications. Almost Rs. 5,000 crores worth of raw bamboo is available in the North-eastern region alone (54% of 90 million tonnes). Even a two-fold value addition can create an industry worth Rs. 10,000 crores in about five years.

Some modern applications of Bamboo are:
- **Food processing industry**
- **Wood substitution**
- **Structural applications in infrastructure**
- **Handicrafts**
- **Agarbatti industry**
- **Construction**
- **Pulp and Paper**
- **New generation building material**
- **Furniture and household items**
- **Food and nutrition**
- **Health and pharmaceutical industry**
- **Alternative energy.**

The wide variety of products that are now being made or could be made from
bamboo determines that the subject of bamboo marketing must be narrowed down into segments. Furthermore, ‘marketing’ in the sense of selling, must be actively pursued all along the distribution system.

Discussion

Bamboo today is a major non-wood forest product and wood substitute and is also important from socio-economic and cultural points of view. Its usage as healthy vegetable (the bamboo shoot) has also been growing over the years. Quickly changing its image from the “poor man’s tree” to a high-tech industrial raw material and wood substitute, bamboo is globally recognized now as an increasingly important economic asset in poverty eradication and economic & environmental development. Bamboo has always played an important economic and cultural role across Asia and its usage is growing rapidly in Latin America and Africa as well. In India farm bamboo adds substantially to farmers’ income. Young shoots of bamboo have been in high esteem for edible delicacy. Bamboo shoots are exported to Japan, USA, Germany, Saudi Arabia and Denmark by China and Taiwan. In India, a range of fresh and fermented products is prepared for domestic consumption. The National Forest Policy, 1988 has provision to enhance livelihood of the people living in and around forests through forests, of which bamboo is one of the options. However, being a forest produce, the movement of bamboo is regulated through transit rules framed under the Indian Forest Act, 1927 and other State Forest Acts. Research and development needs further studies on cultivation methodology, sustainable utilization and marketing. In addition, it is necessary to grow bamboo on degraded and marginal land.

Because of its versatile applications, bamboo is also called ‘green gold’ and has the potential to provide economic security to the rural population. And it is the high time to make serious efforts to harness the full potential of bamboo. The challenges and works to be done in developing the domestic bamboo economy from production to consumption can be summarized as:

Challenges

- The major hurdle in cultivation of bamboo from seeds has been the poor availability of planting material. Most of economically important bamboo species bear seeds only 2 to 3 times in a century and seed viability is only for a short period.
- Existing use of rhizome as planting material is not only insufficient and costly but in most of the clump forming bamboos, is leading to relocation rather than development of the resource.
- Over-exploitation of the existing forests threatened the very existence of important genetic resources of economically important species.
- Low awareness of conservation practice is gradually leading to the decrease in production and supply of bamboo.
- Lack of mechanization in harvesting making it a cumbersome and inefficient practices leads to losses.
- Lack of appropriate storage and warehousing infrastructure. After harvest bamboo is required to be transported safely and stored properly
in warehouses near the villages, which is lacking at present.

The way forward

- Major policy shift towards farm-based supplies from forest-based bamboo resources, so industry should get bamboo on constant basis and of good quality. Good and improved practices should be imbedded into the cultivation and harvesting of the natural resources.

- Commercialization of bamboo as an enterprise at farmer's level. Bamboo should be put into the industrial pedestal with appropriate tie-up arrangements with bamboo based industries viz. paper, handicrafts and the new emerging areas of eco-friendly products e.g. housing, tiles, flooring, bamboo shoots etc.

- Boost research and development activities for genetic improvement in bamboo, development of efficient methods for mass production of superior quality planting stock and conservation of genetic resources. Since a limited number of species produced most of the products, basic research should be directed towards the other potentially useful species.

- Increasing availability of planting material to the farmers through development of improved storage facility for bamboo seeds, vegetative propagules and establishment of a network of suppliers of plant material.

- Selection of high yielding clones coupled with suitable agro techniques for raising bamboo plantation for higher productivity. For example Singh (2008) has drawn scientific guidelines for selecting plus clumps of bamboos which includes - survey of potential areas, selection criteria, number awarded for different traits e.g. internode length, height, girth, straightness, number of clumps/clump and disease resistance of the clumps. The maximum and minimum scores of these characters are decided on the basis of the phenotypic average value of base population of the species. The total score while evaluating the candidate plus clump is fixed to 100. The candidate clump, if attains the pre decided score and more would be declared as Plus clump. After that, the rhizomes/culms will be taken from the selected plus clumps for establishment of germ-plasm bank and further multiplication using various proliferation techniques for supplying improved planting stock in plantation activities.

- Installation of a grading system for classifying bamboo according to its age, height and thickness to ensure better price and to provide incentives to grow and supply bamboo of the required maturity, quality and species.

- Development of processing machinery, suitable for Indian bamboo species producing quality product at a competitive price.

- Proper linkage between private growers, cottage industry/ artisans and marketing agencies need to be established by envisaging a holistic developmental plan for the bamboo industry.
SUMMARY

The bamboo sector to serve as an eco-friendly source of goods & services and livelihood to millions of people in India including the challenges and efforts to be undertaken in this direction has been discussed in detail in this paper.

Key words: Bamboos, Sustainable Livelihood, India.

भारत में दीर्घकालिक टिकाऊ आजीविका उपलब्धता में बांस
अम्बी रिंह
सारांश
भारत के करोड़ों लोगों को परिस्थिति-मित्र वस्तुएं और सेवाएं तथा आजीविका उपलब्ध कराने का साधन बनाने के लिए बांस सेक्टर को किन चुनौतियों का सामना और किन प्रश्नों को इस दिशा में करना पड़ेगा, उनका विवेश किस्मतपूर्ण इस अभियान में किया गया है।

References


