

Bamboo – Conservation, Cultivation and Utilization

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Bamboo Distribution: India has one of the richest bamboo resources in the World, second only to China. The annual bamboo production in the country is estimated at 3.23 million tons. According to Forest Survey of India (FSI), in India bamboo grows in 8.96 million hectares of forest area, which constitutes about 12.8% of total forest area of the country. Of this, nearly 28% occur in the North Eastern States, followed by 20.3% in Madhya Pradesh, 9.90% in Maharashtra, 8.7% in Orissa, 7.4% in Andhra Pradesh, 5.5% in Karnataka and the balance is spread over in other states.

Among the major economic forest products, Bamboo occupies the prime slot. In Andhra Pradesh Bamboo occurs over an area of 9,882 sq. km with a potential yield of 70,000 metric tons annually. Bamboo is a versatile plantation species and its afforestation is ecologically sound and economically viable. It is also adopted by farmers as agro forestry species, planted along field bunds and in concentrated blocks. It has great demand both in domestic and industrial sectors. Besides meeting the basic necessities of life i.e. food, shelter and clothing, it is also used in making baskets, fencing mats (thatties), toys, house hold articles and raw material in paper and pulpwood industries. Thus it provides livelihood to millions of people. Bamboo is everything to some and something to all.

Species Wise Composition: Two important species of Bamboo occurring in the State of Andhra Pradesh are: *Dendrocalamus strictus* (Sadanam or solid bamboo) and *Bambusa bambos* (Mullem or hollow bamboo). Besides the above species, *Dendrocalamus hamiltonii* (locally called as Jadi Veduru) is present in small patches in East Godavari, West Godavari, Khammam and Visakhapatnam districts. No other species of Bamboo is reported in the state. Spread of Bamboo on private lands or homestead gardens is sporadic as it is not a widely preferred species by farmers.

Silviculture of Bamboo: The Silviculture system adopted is “**culm selection system**”, combined with cleaning and tending operations. Clump is the unit of management. Mature culms will be extracted by selection method depending upon the total number of mature culms and the productive capacity of the clumps. The main objective is to ensure maximum production without impairing the vigor of the clump and to protect bamboo to ensure sustained growth and productivity.

Felling Rules: The following felling rules are prescribed for working bamboo areas:

- No felling of bamboos is carried out during the monsoon period i.e. from 1st July to 30th September as this is the period of formation of new culms and the area is closed for grazing to avoid damage of fresh shoot and rhizomes by cattle.
- No clump is considered mature for exploitation unless it contains more than eight mature (more than one season old) culms.
- In a mature clump the following types of culms are retained-
 - a) All current season culms i.e. less than one year old culms
 - b) From the rest, equal in the number to the current season culms or eight whichever is more
 - c) The remaining culms are considered available for exploitation.

- The oldest culms and deteriorating culms, if any, that cannot stand for another cycle should be cut first. Young culms of 1 and 2 seasons old should be retained. If no new culms are produced. 50% of the old culms are to be retained.
- Culms must be cut clear with a sharp instrument at a height of 15 -30 cms. above the ground level and just above the septum of the nodes so as to avoid forming a receptacle to collect water.
- Cutting should be made on one side of the clump opposite to that where the largest number of one-year-old culms are found. Because new culms are usually produced from that part of the clump where the rhizomes are most vigorous, this part of the clump needs to be protected.
- In case of flowering clumps exploitation is deferred till the seeding is completed.
- All dead, dry, top broken (more than 1/3 of the normal length damaged), twisted, bent, malformed culms are felled without exception.
- Congestion in clumps can be removed by cutting out such useless portions of the clump viz the central raised portion or the down hill portion with no chance of extension of new growth and by leaving more culms on the side of new growth on the uphill side etc. The congested clump should be thinned heavily to allow light and air to pass through. Crooked culms should be cut.
- After felling, debris and slash should be removed to prevent rotting or fire damage.
- The following acts are strictly prohibited.
 - a) Digging of rhizomes,
 - b) Cutting of tops of bamboos for fodder,
 - c) Use of tender bamboos for bundling
- All climbers infesting the bamboo clumps are to be removed.

Conservation and Management Practices of Bamboo: Working of forests including bamboo forests is governed by Working Plans. These are mandatory documents and need approval of the Government of India in terms of Forest Conservation Act 1980. Bamboo bearing forests of a given forest division is constituted as a Bamboo working circle. Invariably this Working Circle overlaps with other Working Circles in that occurrence of Bamboo is gregarious as well as scattered and may overlap areas that require treatment other than managing bamboo alone. Areas of such working circles are then organized into series depending on geographic contiguity of area in question. Each series is then organized into coupes. Number of coupes within a series is equal to the felling cycle of bamboo. Since felling cycle in the Working Plans of Andhra Pradesh is 3 years, each bamboo series will have three coupes. Thus these coupes are worked once in three years. Constitution and demarcation of coupes is done duly ensuring equiproductivity of the coupes. In case of VSSs organizing areas into coupes is done depending on abundance of occurrence of bamboo in the respective VSS. If bamboo occurs copiously in a given VSS it may be divided into three coupes in which case 1/3rd of the VSS area is worked every year to yield bamboo every year and alternatively if occurrence is sporadic, entire VSS may be worked along with nearest coup once in three years. These details are included in the microplans of the respective VSSs. Felling or extraction of bamboo is done following silvicultural principles and felling rules detailed above.

Cultivation practices: Bamboo flowers once in around 40 years. As such cultivation from Seed origin has to be planned carefully. Following is an account of nursery and planting practices:

Nursery Practices: Since flowering and seeding in *Dendrocalamus strictus* take a very long time and the seed viability is often less than six months, it is imperative to establish rhizome banks to ensure the continuous supply of planting stock. Following are the essential steps to establish the rhizome bank.

Procurement of Initial Multiplication Stock: To raise the initial multiplication stock, the fresh and viable seeds of bamboo are germinated in germination chamber or sown directly in nursery beds. After germination the seedlings at the stage of 3-5 leaves should be transferred to polybags (size-24 x 18 cm) filled with growing medium (soil: sand: FYM in the ratio of 1:1:1). The transplanted seedlings should be kept in shade for about 7 days and then shifted to direct sun light. Maintain the seedlings by regular watering weeding etc till the time they attain 4-6 culms (tillers). This generally takes about 4-6 month. At this stage the seedlings are ready for multiplication. Alternately, wild young rhizomes of bamboo in the forest, whenever available may be collected from good bamboo stands and used in place of seedlings. To have assured and accelerated growth such rhizomes should be maintained for two seasons and when they attain the size of a small 'onion' they should be planted.

Another method used for multiplication of bamboo seedlings is called 'Tiller separation'. This is a form of clump division. Like many other grasses, bamboo has an inherent proliferating capacity and offset planting capability of reproducing it self. This capacity of the bamboos had been used in developing a method for multiplication of nursery stock, by seedling separation and planting. When the seedlings are at 4-6 culms stage, these are ready to be used for multiplication. Soil from the root system is washed off with water. The rhizomes are carefully separated with the help of a sharp secateur, in such a way that each separated unit has a shoot, rhizome and roots. A seedling at 4-5 culms stage can usually be made into about 3-4 such units or propagules. These separated units (propagules) are then transplanted in polybags filled with soil mixture as described earlier. The plants are kept in shade for 7-10 days and watered regularly. Thereafter the plants are shifted to the nursery under full sunlight. After about six months the plants may be used for field planting or the stock can be further multiplied, and the process can be repeated at least twice every year for a number of years. The method is not only very simple, but also ensure high success rates. An additional advantage of this method is that the propagules remain small in size due to repeated rhizome separation, thereby making them easy to handle and transport.

Planting: Successful bamboo planting and growth are regulated by three important factors:

- loose and well aerated soil for rapid development of the rhizome
- adequate growing space for rhizome during its life and
- enough moisture in the soil, particularly during the growing season from July to October.

Heavy soils with poor drainage should be avoided.

Cultivation Practices: A deep ploughing (about 20 to 30 cm) with tractor or country plough, to loosen soil, improve aeration and for moisture conservation is advisable. As bamboos live over 30 years, with clump size increasing with age, sufficient space for development of individual clumps should be allotted. For *Dendrocalamus strictus* a 5m x 4m (500 nos. per ha) or 5m x 5m (400 nos./ ha) would be good espacement. 30 cum pits are dug, and the soil allowed to weather for one month before refilling the pits with good top-soil. If the area is ploughed, planting can be done by scooping the earth. Seedlings with two seasons growth with rhizomes of the size of a small 'onion' are planted

with the ball of earth intact. If irrigation facilities are available, naked seedlings 9 to 12 months old can also be used. 30 to 40 cm tall seedlings should be planted with the ball of earth, 4 to 6 cm below the general ground level. Planting is best done in the early part of the rainy season, but after the soil has become sufficiently moist. A saucer of 50 cm radius with a central mound 15 cm high and 15 cm radius may be formed around each seedling.

Post planting care: The planting lines should be weeded clean at suitable intervals, two or three times a year to a width of one metre around the plants. The bamboo rhizome needs loose, well aerated soil for good growth for production of new culms. Where inter-cropping is done, the soil around the bamboo seedlings may be worked up to a depth of about 15 cm and a radius of one metre once at the end of rains and a second time in December – January, to loosen the soil and conserve moisture. Where inter-cropping is not practiced, ploughing should be done once or twice at the end of the rainy season. Irrigation helps good growth. These operations are to be repeated every year to facilitate good rhizome development and growth.

Cleaning: As the clump expands all round, one would notice congestion also at the center. This will hinder girth development. So thin culms are removed, providing more space to a lesser number to grow better. This cleaning operation may be from 4th year onwards, and will also be repeated as a part of harvesting activity when due for harvest from the following year or two years later.

Protection: Tender bamboo is relished by cattle and protection from cattle is essential.

Planting Bamboo as Under Crop: In certain degraded natural forests devoid of bamboo and in plantations of teak, bamboo can be introduced as an undercrop. Here care should be taken to ensure that young seedlings receive adequate light for their establishment. For this reason planting can be done in temporary gaps that arise on account of silvicultural thinnings in such forests and plantations.

Harvesting and Marketing Bamboos: Harvesting and marketing bamboos in VSS & non VSS areas and non forest lands: Working season commences from 1st October every year and continues up to end of June. The annual coupe is divided into convenient sectors depending upon the accessibility and harvesting takes place in one direction. All dead, dry and crooked culms, lops and tops and also high cuts are extracted and converted into 1.5 - 2.0 M long billets and are made into bundles of 20 pieces each and are stacked at plantation/forest site and are called *industrial cuts*. Mature green bamboo is cut and converted into 6-8 Mt. lengths and are stacked separately. Large work force is deployed for bamboo harvesting. It normally takes three weeks before the harvested green bamboo is transported, as and when ready, to nearest sale depots. Based on the size and diameter at the base the bamboo is segregated and formed into convenient lots (sufficient for a lorry load). Bamboo is classified as super class, special class, first class, second class and third class, as described below:

Category	Specification (bottom girth in cms)
Super class	18 cms and above
Special class	15 to 18 cms
1 st class	12 to 15 cms
2 nd class	9 to 12 cms
3 rd class	below 9 cms

From the commercial point of view, the bamboo harvested is categorized into the following classes depending upon the diameter of the culm: Bamboos which is not straight and have bends are lotted together. These lots made by quality class are put to public auction once or twice a month at pre announced date and time. Sadanam (*D. strictus*) and Mullam (*B. bambos*) is stored and auctioned separately. It normally takes a minimum six weeks after cutting before it is auctioned. The successful purchasers will effect payment and transport the material as convenient to them. The industrial cuts are sold at forest/plantation sites on tender basis or at prefixed rates. The paper industries normally buy and transport the material directly to mill site. While the green bamboo is sold by numbers, the industrial cuts are sold by weight. Both, the green bamboo and the industrial cuts attract the provision of transit rules (under the A P Forest Act, 1967) and therefore require a valid permit for transportation.

Present Utilization of Bamboo: Bamboo is an important source of livelihood for the rural folk especially the Scheduled tribes, Scheduled castes and other poor traditional bamboo artisans. It is extensively used in construction of rural housing as posts, walls, roofing, fencing etc., and is often referred to as *poor man's timber*. The uses range from basket making, weaving mats to traditional implements, furniture, ply-bamboo panels, flooring and construction materials, medicines, food etc., Strength, straightness, lightness, fast rate of growth and ease in propagation makes bamboo an excellent wood substitute. Bamboo forms an excellent raw material for pulp in paper industries. In the past it used to form almost 40% of the total raw material requirement of Paper Industry in Andhra Pradesh. However with the change of technology and limited availability, hardwoods largely replaced bamboo.

Emerging Uses of Bamboo: The systems of management and working of Bamboo forests, the administrative and institutional structure and even market structure have been tuned in line with the existing utilization pattern of Bamboo. But experience elsewhere especially in China and in some of the North Eastern states have opened new vistas in utilization of Bamboo. Its fast growth, strong and versatile mechanical properties of its poles, widespread nature of its distribution and the ease with which it can be propagated have opened new avenues and hopes. Seen in the backdrop of depletion of timber resources feasibility of using bamboo as a timber substitute is altogether a new chapter in utilization of Bamboo. These are classified as the ones that are strip or slat based, mat based, stick and splint based and the ones that use all waste and byproducts. The examples of stick based applications are incense sticks or agarbatthi sticks, match splints, fire crackers (for rockets and replacement of metallic wire and rod in sparklers) and handicrafts of various types. Examples of mat based applications are roofing, partitioning, furniture, packaging etc., applications, bamboo mat board, bamboo mat corrugated sheets, bamboo mat as veneer / core in plywood and particle board manufacturing. Applications of strip based utilities are converting bamboo poles into strips to make bamboo wood (an alternate to quality hard woods) and bamboo laminates for pallets and other modular / Completely Knocked Down (CKD) furniture and other structural applications. Dead and non saleable bamboo, bamboo leaf / branches / lops & tops and harvesting and waste generated during conversion can be used for making charcoal and briquetted coal and for power generation through gasification / incineration

There is a definite value addition in manufacturing these utilities including furniture from bamboo wood. While the expected value addition in converting bamboo pole into a flooring tile is 8 times (a pole of Rs. 10/- can be converted into a flooring tile worth Rs.80/-), converting bamboo laminate into furniture will have at least 4 to 5 times thereon. Converting bamboo wood / laminates / sections into furniture, has already been demonstrated by National Institute of Design (NID), through imported laminates. The prepared furniture was well appreciated by trading and user community. These designs are available for commercialization and there is no dearth of expertise for developing new designs.