
THE NEW GREEN GOLD OF THE POOR FARMERS BAMBOO CULTIVATION FOR A SUSTAINED LIVELIHOOD

Article Particulars

Received: 16.8.2017

Accepted: 30.8.2017

Published: 30.9.2017



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Abstract

Bamboo, often referred to as the wonder wood has attracted the attention of people in different walks of life including farmers, researchers, policy makers because of its versatile use, income generating potentiality, and environmental friendliness. India is home for a number of species of bamboo and it grows across the country. Though farmers face hardship and struggle to find a consistent source of income, the potentiality of bamboo to provide a sustainable livelihood is still underutilized. One of the reasons for farmers to take up bamboo farming is because they lack sufficient data to estimate its economic viability. This paper is an attempt to examine the economic viability of bamboo farming and an attempt to estimate the cost and income generating capacity of bamboo cultivation.

Keywords: *Bamboo; geographical distribution of bamboo; bamboo cultivation; environmental importance of bamboo.*

Introduction

In the past couple of decades, Bamboo has received increasing attention for its economic and environmental values, its close association with culture, knowledge and wide use for housing, forestry and agro forests. It is one of the fastest growing woody plant on earth which can reach up to 30 CM in diameters and 40 meters in height within a short span of 120 days. The relative abundance of its availability, wide presence across the globe, the cheap price, its capability of meeting different human needs which include using its shoot for food has helped it to be widely used by the common man and has helped it to earn the reputation of "poor man's timber".

Though the farmers have been adopting various measures and resorting to the method of intensive farming, multi-cropping, organic farming, and various other

modern techniques to overcome the hurdles, the success of the methods are short lived and they continue to fall in debt and financial crisis. India, with its diverse geographic and climate conditions, is blessed with many natural resources. Bamboo with its diversity and versatility of uses and benefits can enhance the quality of our lives especially that of the rural population whose earning and living conditions depend on natural resources to a large extent. We have failed in effectively utilising its potential which would otherwise have become a boon to the farmers. Bamboo occupies a prominent place among the under-utilized natural resource.

Geographical Distribution of Bamboo

Bamboo is a woody grass and belongs to the family of Poaceae (Gramineae) and the sub-family Bambusoideae. (Mera and Xu) cultivated as flowering perennial crop and is known for its rapid growth and variety of uses (Bamboo Information Network). There are about 1600 bamboo species in 75 genera have been identified across the world so far. It is also estimated that about 40 million hectares of the earth are covered with bamboo (Abdullah, Hamzah and Samdin). Though its geographical distribution generally depends on climate condition, it is found between 46°N and 47°S latitude. It is capable of adapting to any climatic condition and so grows usually at a temperature range of 8.8 to 36°C. But it is also found that some species can even grow in the cold climate with a temperature of -20°C or even less and grows at an altitude of more than 4000 meters in the Himalayas and in parts of China. (Mera and Xu). Asia claims over 80 % of the bamboo forest and has more than 590 species followed by Australia and Pacific Island. (Ana) America also has about 590 bamboo species whereas in Africa there are just three species of Bamboo are found. Many Asian countries like India, China, Myanmar, Thailand, Vietnam and Indonesia are rich in bamboo resources. (Tran)

Because of its versatile use from time immemorial, the low price and ease of accessibility to the common man, bamboo is known as poor man's timber or "the wood of the poor" in India. It is also known as "friend of people" in China and in Vietnam "the brother" indicating how it is closely linked to the daily life of the people in different part of the world. Bamboo is found across the globe and is used for construction and for making farming tools in Asia, Africa and South America. India is blessed with different varieties of bamboos and many of these are used for food also. The country has about 22 genera and 130 species of bamboo and holds the second position, next to China, in the possession of bamboo in the world. With an estimated global market of \$ 60 billion the share of India is estimated to be around \$ 5 billion (CNN). Bamboo is considered as one of the important tools for poverty eradication and to enhance the livelihood of the poor.

Bamboo Use: A Brief History

Studies carried out on different civilizations suggest the use of Bamboo as one of the common resources for various purposes. Excavations carried out in The Valdivia and Machalilla culture which existed during 3500 BC in Milagro province of Guayas, (Ecuador) has shown several pieces of bamboo mixed with clay. The ceramic vessels used in the Jama Coaque culture during 500 BC contains narrow bamboo boards secured with fibre straw. Stothert () in her research on the Las Vegas Culture dated back to more than a10,000 years in Santa Elena Peninsula in Ecuador suggest the use of tools and equipment from wood, Bamboo and reed. The finding of a circular trench made of bamboo in Quebrada Chica, in the central coast of Peru also confirm to the fact that bamboo was utilised in ancient culture in different parts of the world thousands of years ago (Takahashi).

A close examination of the Asian culture and ethnic groups reveals that every part of the bamboo plant is put to use. The different use of bamboo range from construction of simple housing, support to the building, use in different construction activities, manufacture of different furniture and equipment, production of musical instruments and in paper production. (Organic Information Service) The versatile use of Bamboo has made it capable of meeting four major global challenges:

1. **Shelter Security:** Bamboo, one of the strong but cheap building and construction material is capable of providing shelter to millions of homeless across the globe.
2. **Livelihood Security:** Bamboo is a versatile and income generating crop. The different stages of cultivation, harvesting, processing, construction, craft and manufacturing provide employment to millions of people. the ever increasing demand for bamboo products ensures livelihood and employment opportunities.
3. **Ecological security:** Bamboo is an environmentally friendly product and a timber substitute. It is an efficient carbon sink, an alternative to non-biodegradable and plastics products. The capacity of Bamboo to generate oxygen, enhance soil fertility and prevent soil erosion make it one of the most eco-friendly material.
4. **Food security.** Bamboo shoots are edible and are used by many as food. In many Asian countries such as China, Japan, Korea, Thailand, Philippines, Taiwan, Indonesia, Nepal and India bamboo shoots were used as food from time immemorial. (Organic Information Service) There are different methods of preparation. It is a source of vitamins, minerals, folate and pantothenic acid and so on. Further, the bamboo cultivation increases the fertility of the soil, increasing the yield of other crops. (Government of Kerala)

Bamboo Cultivation

Most farmers, who are accustomed to traditional cultivation, may be reluctant to shift to the new crops like Bamboo. Many cannot even think of bamboo cultivation as they have seen it only as a forest product and have never even thought of it as a cultivable item. Many farmers are unaware of the fact that bamboo with considerably

shorter gestation period can be an inducement for the farmers to take up Bamboo cultivation. The harvesting can be done from the third year onwards and a continued and sustained harvesting can be undertaken for another 50 to 70 years (depending on the species under cultivation). Other common plantation crops like teak, rubber, coconut etc have longer gestation period and shorter cropping duration. The initial investments, as well as the annual maintenance, are also high for these crops.

Table 1 Assumptions Made for Working out Cost of Cultivation of Bamboo under Indian Condition

Spacing (Meters)	4.03
No. of Plants/ acre	1000
Mortality Replacement (%)	10
Manure required (Kg per plant per year)	5
Fertiliser required (Kg per plant per year)	7.2
Cost of Manure(Rs / Kg)	5
Cost of Fertilizer (Rs / Kg)**	15
Irrigation Cost/acre (Rs.)	5000
Drip system Cost/acre (Rs.)	30000
No. of Irrigations days/year	210
Plantlet price (Rs. / Seedling)	30
Labour wages (Rs. / manday)	500
No. of harvestable plants/acre (%)	90
Average Weight of each culm (Kg)	8
Sale price per tonne (Rs.)	6000

An estimate of Expenditure and expected income of bamboo cultivation is given in the table below. The estimates are made for normal climatic and geographical condition. Variation in the expenditure can happen depending on the actual situation. The estimates are prepared based a set of assumptions as given in the table (Table No 1). These estimates are more or less fixed for some variables like cultivation area, manure requirements and so on. Only factors like wage rate, price of the input as well as output can vary from time to time. Table no 2 gives the expected output from bamboo cultivation.

Table 2 Expected Yield from Bamboo from 5th Year onwards

Year	III	IV	V	VI	VII	VIII	IX Onwards
No. of culms per clump	5.5	6	6	6	6	6	6
No. of culm per acre	5500	6000	6000	6000	6000	6000	6000
Wt. in Kgs / Culm	6	6	8	8	8	8	8
Yield in tonne	33	36	48	48	48	48	48

Table 3 Cost of cultivation per acre (In Rupees)

S.No	Items	I year	II year	III year	IV year	V year	Total
1	Ploughing (1st year - 3 times & II nd year - 1 time)	3,000	1000	-	-	-	4,000
2	Ploughing for Weed Removal		2000				2,000
3	Planting Material + Transport@ Rs.40	8,000	-	-	-	-	8,000
4	Mortality Replacement in II year	-	800	-	-	-	800
5	Manures	10000	10000	10000	10000	10000	50,000
6	Fertilizers	10,800	16,200	21,600	21,600	21,600	91,800
7	Plant Protection	2000	2000	2000	2000	2000	10,000
8	Irrigation	5,000	5,000	5,000	5,000	5,000	25,000
9	Drip system	25,000	-	-	-	-	25,000
10	Fencing @ Rs.20 /RM for 160 RM	3200	-	-	-	-	3,200
	Sub total	67,000	37,000	38,600	38,600	38,600	219,800

Table no 1 to 4 show the expected cost and income from bamboo cultivation per acre. The figures are based on the averages if cultivation is undertaken in an area of 10 hectares under a normal condition with drip irrigation. Usually, bamboo harvesting can be done from the 3rd year onwards and can continue beyond 15 years depending on the species. But here the estimates are prepared for a 15 year period and assume that the harvesting will begin in the third year.

Table 4 Mandays and Their Cost

S.No	Item	No. of Man days	I year	II Year	III year	IV year	V year	Item total
1	Land Preparation	2	1000					1000
2	Digging & Refilling of pits	25	12,500					12500
3	Planting & Staking	4	2000					2000
4	Plant Protection / year	1	500	500	500	500	500	2500
5	Weeding	20	10000	10000	10000	-	-	30000
6	Soil working, Pruning from II year and Others	30	-	7500	10000	15000	15000	47500
7	Soil working & others							
8	Harvesting during III year onwards	36	-	-	10000	15000	18,000	18000
	Sub total		26,000	18,000	30500	30500	33,500	138500
	Total		93,000	55,000	69,100	69,100	72,100	343,300
	Contingencies @ 5%		4,650	2750	3455	2705	3605	17165
	Grand total		97,650	57,750	72,055	56,805	75,705	360465

Compare to other forest products like wood, the vegetative cycle of bamboo is much short. The bamboo can grow up into grove in 3 to 5 years and can sustain harvest for many years. Since the grows are self-renewing, there is no need to undertake re-cultivation or replanting. Thus bamboo has a better chance of generating higher income.

The table shows that bamboo cultivation is highly economical in nature and yield consistent output thereby ensuring sustained income to the farmers. Since the plant has self regenerating capacity, they continue to yield output for a long duration of time if the harvesting is carried out properly. The loss of crop due to heavy rain and drought are very limited as they can sustain even the extreme climatic condition. They also can act as a safeguard against land slide, soil erosion and other environmental damages thereby ensuring protection against natural calamities.

Experts in the bamboo growing field are of the opinion that any size of the plantation, be it just one hector or a large area of more than a thousand hectors, can be profitable. The entire process including the area and the selection of the species of bamboo must be governed by few considerations like (i) the type of market we intent to sell our product—ie the targeted market. (ii) The end use of the product: ie, whether the farmer aims to sell just bamboo polls or whether on intent to add value to the product before taking it to the market plays a crucial role. This also determines the size of cultivation. For example, if the market is energy or biomass industry, a large-scale cultivation is necessary but if it is for handicraft or furniture a small to medium scale cultivation is advisable. (iii) geographical and infrastructure considerations. The farm location, transportation facilities, the availability of labour force and such factors also need to be studied well before cultivation. (Stephen, Stephen. 2012. 'Minimum Acreage for a Profitable Bamboo Plantation'..)

Role of Bamboo in Environmental Conservation

Bamboo is considered as one of the most environmental friendly plant which can positively contribute to reduce the effect of environmental degradation. Various features the plant possess helps in rebuilding the environment which is highly degraded by rapid industrialization and other human activity. Bamboo is also good for fighting the effect of global warming and climate change. In many counties it is used for ecological purposes and to fight against environmental degradation, soil stabilization and to prevent soil erosion.

Soil Conservation

Research has shown that area with bamboo cultivation has less soil erosion and promotes soil conservation. Studies have shown that the sediment yield is reduced to 1.4 t/ha in a high rainfall year which is about 10 to 20 % less than an untreated watershed (Kurothe and Nambiar). Bamboo with its huge canopy and dense branches and leaves intercept the precipitation. This changes the raindrop's descending direction and thus lessens their descending speed. This helps in reducing the splash erosion of soil (Chaomao, Weiyi and Yan). The comparative analysis of the soil quality also has shown that farm with bamboo plantation has higher nitrogen, phosphorous and potash content indicating a better soil health. (Pande, Kurothe and Ra).

Table 5 Estimated Details of Expenditure and Return in Cultivation of Bamboo under Irrigated Condition with Adequate Fertilizer

S. No	Particulars	Units	II yr	III yr	IV yr	V yr	VI yr	VII yr	VIII yr	IX yr	X yr	XI yr	XII yr	XIII yr	XIV yr	XV yr
1	No. of Culms/ Clump	Nos.,	-	5.5	6	6	6	6	6	6	6	6	6	6	6	6
2	No. culms acre	Nos.,	-	5500	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000
3	Weight of the Culm	Tons	-	6	6	8	8	8	8	8	8	8	8	8	8	8
4	Yield per acre	Kgs	-	33	36	48	48	48	48	48	48	48	48	48	48	48
5	Total Income	Rupees	0	198000	216000	288000	288000	288000	288000	288000	288000	288000	288000	288000	288000	288000
6	Total Expenditure	Rupees	57,750	72,555	72,555	75,705	75,705	75,705	75,705	75,705	75,705	75,705	75,705	75,705	75,705	75,705
7	Net Income	Rupees	-57,750	125,445	143445	212,295	212,295	212,295	212,295	212,295	212,295	212,295	212,295	212,295	212,295	212,295
Total Income for 15 yrs / Acre in Rupees : 3582000																
Total Expenditure for 15 yrs / Acre in Rupees : 1133265																
Net Income for 15 yrs / Acre in Rupees : 2448735																

Source: Table 1 to 5: items in the tables are based on the report Economics of Bamboo cultivation, Grow More Bio-Tech Limited, Mysore, Karnataka. Figures are compiled by the author

The soil erosion caused by the deforestation and other activities including farming is one of the greatest challenges across the world. Bamboo cultivation offers an easy solution to this. The net-like root system of the bamboo is capable of creating an effective mechanism for watershed protection. the extensive rhizome system of bamboo lies primarily in the top layers of soil which can prevent soil erosion and land slip in fragile areas like river bank, deforested areas, places prone to earthquakes or mud slip (Bystriakova, Kapos and Stapleton). Studies were done in Kenya and South-East Asia confirms to the soil protection ability of the bamboo (The Organic Farmer). In many parts of Japan and in the Hakone Yama Mountains of Japan bamboo planting has been successfully prevented soil loss. (Ben-zhi, Mao-yi and Jin-Zhong) Since proper harvesting of bamboo does not kill the plant, the protection offered by it continue even after harvesting (Environmental Bamboo Foundation).

Water Absorption

The rhizome root structure of the bamboo helps in preserving water resources. The networking of bamboo roots in addition to holding the soil together, absorb rainwater and reduce soil erosion. Studies have shown that bamboo has a higher capacity to preventing soil erosion and water absorption compared to coniferous forests (Chaomao, Weiyi and Yan).

Further, bamboo is also capable of retaining rainwater to the extent of 80 to 100%. This will help in vegetation as well as ground water recharge. The present day world bamboo cultivation can be of great help in solving the acute water crisis problem.

Carbon Absorption

Various international conventions including the Stockholm Conference on Environment in June 1972, the Earth Summit in Rio de Janeiro in June 1992 and many conventions in the recent years have called for a reduction in the emission of carbon dioxide and to promote ways to increase carbon absorption. Bamboo is known for its carbon absorption potential. It is estimated that most species of bamboo can absorb as much as 10 to 20 tonnes of atmospheric carbon dioxide per hectare. Scientific studies in Mexico has shown that *Guadua Angustifolia* (a bamboo species) has the capacity of carbon dioxide absorption to an average level of 21.41 tonnes per hectare (Schroder, Environmental Impact of *Guadua* Bamboo).

In spite of the advantages associated with bamboo, it is doubtful whether India has paid enough attention to promote the effective use of this resource. The bamboo sector has been undervalued as a potential sector and we lack adequate knowledge on the resource status both at the grass root level and at the national level. It is estimated that the country uses only one-tenth of its bamboo producing potential. Out of the 130 species available across the country, only 10 are being commercially exploited (Pande, Kurothe and Ra).

Prevent Pollution

Bamboo also helps in reducing pollution and in purifying the air. Research has shown that the crop area of about 1 mu can absorb 125 kg of SO₂ every month, 60 t of dust every year and 67 kg of CO₂ every day. In other words, the bamboo stand area of about 3x10⁴hm² will absorb 3.86x10⁷t waste air every year (Schroder).

Conclusion

Bamboo is not just a grass. It has the potentiality to provide substantial income to farmers for a number of years. It has potential to keep the environment safe and clean. The ability of the bamboo to prevent soil erosion and to enhance the quality of soil is commendable. In this era of climate change, bamboo is a "wonder plant" with its immense ability and potentiality. It is the resource which can promote sustainable farming, protect the environment and provide income to the farmers. Hence there is a need for better intervention from the policy makers to promote bamboo cultivation across the country.

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