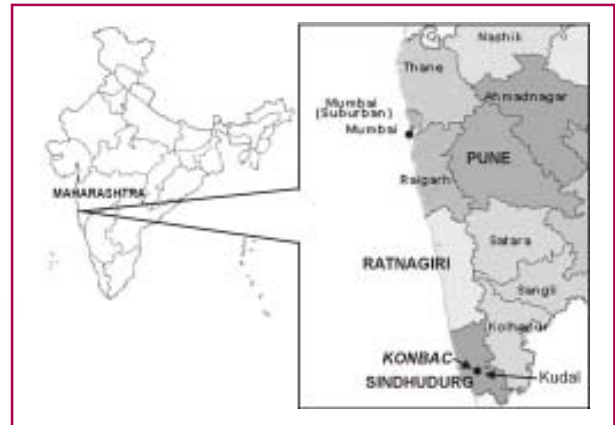

Bamboo Nursery

Oxytenanthera stocksii – Culm Cutting Method

Location	Kudal, Sindhudurg district, Maharashtra, India
Suitability	Self-help groups, Communities, Entrepreneurs
Benefits	Cash income generation – Resource generation – Gender-neutral
Level	Micro enterprise
Capacity	142,600 plants per year
Keywords	Bamboo – Nursery – <i>Oxytenanthera stocksii</i> – Culm cutting



Introduction

In most bamboo-growing regions of the world, bamboo forms a means of livelihood for a large number of people. Many rural areas, such as Kudal of Maharashtra, India, have a long-standing tradition of bamboo crafts and other products. Kudal has dedicated bamboo craftsmen who produce a wide variety of goods for household and ceremonial purposes. In recent times, several social programs have served to revitalize bamboo craft sector. As applications grow, the need for assured raw material supply also increases.

Natural regeneration of bamboo resource through sexual reproduction is often not a viable proposition for bamboo, as the flowering cycles of most species are very long. In order to ensure sustainable supplies of the raw material, therefore, natural regeneration needs to be supported through vegetative methods such as seedling multiplication, rhizome cutting, culm cutting, layering, etc. The technology described here details the raising of a nursery from culm cuttings of *Oxytenanthera stocksii*, a medium bamboo that is widely used by craftsmen.

The Konkan Bamboo and Cane Development Centre (KONBAC) – a not-for-profit company set up by the Centre for Indian Bamboo Resource and Technology (CIBART) under the Action Research Program of the International Network for Bamboo and Rattan (INBAR) – works closely with the local communities. It uses bamboo and rattan as the means for developing livelihood and income generation opportunities for the local communities. It also provides capacity building and skills upgrading for members of the communities.

The Nursery

The nursery described here was established by the Social Forestry Department of Maharashtra. It spreads over 10 acres and has a capacity to produce 142,600 plants. It has adopted the culm cutting method for raising plantlets of *O. stocksii*.

The Process

The process involves burying nodal sections of the bamboo in shallow trenches, along with suitable fertilizers and growth enhancers.

Beneficiaries

The key beneficiaries of the enterprise are self-help groups, communities and micro-scale entrepreneurs. Secondary beneficiaries would be in the plantation and social forestry sectors.

Key Financial Data

Cost price per plantlet	: INR 9.87
Sale price per plantlet	: INR 20.00
NPV of the enterprise	: INR 7,597,903.00
IRR	: 320%
Benefit-cost ratio	: 2.2

Although the nursery is on government land, for calculations land cost was taken at actual value.

For the enterprise, market rate of INR 20 per seedling is taken as the sale price, although the Social Forestry Department sells the seedlings at a subsidized price. In the first year, only 75% of the

Exchange rate: US\$1 = INR 46



Node of *Oxytenanthera stocksii*

production is sold and 25% is kept in stock for re-planting. At the end of 5th year, this also will be sold.

Tax at 7.2% is taken into account for the purpose of profit calculations. Net profit over five years is INR 6,867,943, giving an average annual profit of about INR 1,373,590.

Key Benefits

- Supply of good planting material of a commercially important bamboo species
- Cash income generation
- Poverty alleviation
- Opportunity for women and aged people to contribute to income generation
- Flexible working hours

Key Requirements

- Availability of planting material (1-2 year old bamboo culms)
- A yield of minimum 142,000 marketable plantlets from second year onwards
- Each plantlet commanding a minimum price of INR 20
- Land at the enterprise's disposal free of cost
- Water source for irrigation during non-rainy seasons

The Environment

Located in the north-centre of Peninsular India, with a command of the Arabian Sea through its port of Mumbai, Maharashtra spreads across an area of 308,000 sq. km, with 6 revenue divisions, 35 districts and 353 sub-districts (Tehsil). The dominant physical trait of the state is its plateau character: it is a plateau of plateaux, with its western upturned rims rising to form the Sahyadri Range and its slopes gently descending towards the east and southeast. The major rivers and their master tributaries have carved the plateaux into alternating broad-river valleys and intervening higher level interfluves.

The Sahyadri Range is the physical backbone of Maharashtra. Rising on an average to an elevation of 1,000 m, it falls in steep cliffs, to the Konkan on the west. Eastwards, the hill country falls in steps through a transitional area to the plateau level. The series of crowning plateaux on the crest forms a distinctive feature of the Sahyadri Range.

Little is left today of the forests that once constituted the legendary Maha Kantara (Great Forest). Forests now comprise only 17% of the state area, covering the eastern region and the Sahyadri Range, while open scrub jungle dots the plateaux. Water is the most precious natural resource of the state, greatly in the demand, and most unevenly distributed. A large number of villages lack drinking water, especially during the summer months, even in the wet Konkan. Barely 11% (3,812,000 ha) of the net sown area (17, 579,000 ha) is irrigated.

The state has a population of 96.88 million (2001 Census), 57.5% of them living in rural areas, with a density is 319 people per sq. km. Overall literacy is 76.9% and the sex ratio 922 females per 1,000 males.

The Konkan, lying between the Arabian Sea and the Sahyadri Range is narrow coastal lowland, barely 60 km wide and 600 km long. Though mostly below 200 m, it is far from being a plain country. Highly dissected and broken, the Konkan alternates between narrow, steep-sided valleys and low laterite plateaux.

Sindhudurg is a major district in the Konkan region, with a largely rural population (about 93% of the population living in villages) and an agrarian economy. Carved out of the erstwhile Ratnagiri district, it is the second district in the country to achieve 100 per cent literacy. It has a land area of 5,222 sq. km and a forested area of around 910 sq. km, which has fairly dense patches of bamboos such as *Oxytenanthera stocksii*, *O. monostigma*, *Bambusa bambos* and *Dendrocalamus strictus*. The bamboo most in demand is *Oxytenanthera stocksii*.

Kudal is one of the eight sub-districts in Sindhudurg. The traditional artisans – mainly the Burud



Cutting nodal sections from the culm

community – in Kudal are well versed in primary processing of bamboo poles and producing woven and interlaced articles. The average monthly income of a family depending solely on bamboo for their livelihood is INR 800-1,000. Almost all of the bamboo artisans are women.

Bamboo Nursery Enterprise

The nursery is established on 10 acres of land and has a capacity to produce 142,600 plants. The bamboo propagated in the nursery is *Oxytenanthera stocksii*, a species high in demand among artisanal communities. It is a medium-sized bamboo with culms up to 9 m tall and 2.5-4 cm in diameter. The internodes 15-30 cm long and the nodes are not prominent. The propagation method adopted is culm cutting method.

Eighty percent of both fixed and working capitals are covered through loans with annual interest rate of 12%. Working capital is for one year, as raising the plant would take 10 months and another two months are taken for effecting sale.

Inputs

- Green culms of *O. stocksii*
- Polythene planting bags (polybags)
- Pesticide
- Root hormone
- Fertilizers
- Pickaxes
- Hacksaws
- Spades
- Sprinklers

Process Details

1. A suitable site is selected and the soil is flattened for bed preparation.
2. Weeding is carried out, and the soil loosened and stones removed.
3. Propagation beds of size 4 ft × 40 ft are prepared to 4 inches thickness.
4. On each bed, 12 furrows are made at equal distance. This is to be completed a month before



Planting nodal sections in furrow

the rainy season so that between the 4th and 20th day of the rainy season, the bamboo can be planted.

5. *O. stocksii* culms (2 years old) are harvested and brought to the nursery. Ten culms would yield 150 culm cuttings needed per propagation bed.
6. Each culm is cross-cut on either side of nodes, about 5-10 cm away from the nodes, to get cuttings with nodes in the middle.
7. These cuttings are dipped in a mixture of pesticide (against borer) and root hormone for 15 minutes.
8. The cuttings are placed in the in the furrows and covered with soil.
9. A mixture of fertilizers BHC and single super phosphate is applied on the bed.
10. After 40-50 days when sprouting occurs, urea and NPK fertilizers are applied and the process repeated after 100 days.
11. Maintenance and weeding are carried out once in two months.
12. The plantlets sprouted have to be watered every fortnight during non-rainy season.
13. A compost mixture is prepared with 2 parts of soil, 1 part of sand and 1 part of compost/manure.
14. Planting bags (polybags) are filled with the compost mixture, at about 5 kg per bag.
15. The saplings are transplanted into these bags.



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BAMBOO NURSERY : ON-FARM MODEL

A. PARAMETERS

Local currency unit:	INR (US\$1 = INR 46)
Interest rate	12% per year
- working capital (with project)	12% per year
- fixed capital (with project)	12% per year
Loan period (months)	12 months
- working capital	60 months
- fixed capital (with project)	60 months

B. FIXED CAPITAL

Item	Unit	With project										
		Y1		Y2		Y3		Y4		Y5		
		Quantity	Rate	Quantity	Rate	Quantity	Rate	Quantity	Rate	Quantity	Rate	
Land	Acre	10	80000	800000	0	0	0	0	0	0	0	0
Shed for storage	500 sq. ft.	-	-	25000								
Tools & Equipment (Pickaxe, space, saw, sprinklers)	INR	1	5000	5000	0	1	5000	5000	0	0	0	0
Total				830000	0	5000	5000	0	0	0	0	0

Notes:

1. All figures in INR.
2. Average operating life of tools and equipment is 2½ years.

Item	Unit	With project														
		Y1			Y2			Y3			Y4			Y5		
		Quantity	Rate	Total	Quantity	Rate	Total	Quantity	Rate	Total	Quantity	Rate	Total	Quantity	Rate	Total
C. OPERATING COSTS																
(1) VARIABLE																
Raw Materials																
- Planting material	Per sapling INR 1.391	142600	1.391	198357	142600	1.391	198357	142600	1.391	198357	142600	1.391	198357	142600	1.391	198357
- Pesticide & hormone	Per sapling INR 0.870	142600	0.870	124062	142600	0.870	124062	142600	0.870	124062	142600	0.870	124062	142600	0.870	124062
- Planting bags	Per sapling INR 1.565	142600	1.565	223169	142600	1.565	223169	142600	1.565	223169	142600	1.565	223169	142600	1.565	223169
- Manure/compost	Per sapling INR 1.739	142600	1.739	247981	142600	1.739	247981	142600	1.739	247981	142600	1.739	247981	142600	1.739	247981
Labour																
- Unskilled	Workday per sapling 0.04785	6283	70	477639	6283	70	477639	6283	70	477639	6283	70	477639	6283	70	477639
Other viable exp.	5% of material & labour costs			63560			63560			63560			63560			63560
Marketing exp.	10% of sale price			213900			285200			285200			285200			356500
Sub-otal				1350311			1421611			1421611			1421611			1492911
(2) FIXED																
Miscellaneous exp.	INR 400 per month	12	400	4800	12	400	4800	12	400	4800	12	400	4800	12	400	4800
Fencing exp.	Lumpsum INR 6000 per year			6000			6000			6000			6000			6000
Water	INR 750 per month	12	750	9000	12	750	9000	12	750	9000	12	750	9000	12	750	9000
Supervisor salary	INR 2500 per month	12	2500	30000	12	2500	30000	12	2500	30000	12	2500	30000	12	2500	30000
Sub-total				56800			56800			56800			56800			56800
TOTAL				1400111			1471411			1471411			1471411			1542711
Depreciation	INR 7000 per year			7000			7000			7000			7000			7000
D. REVENUE																
Sale of sapling	142600 (75% in Year1)	106950	20	2139000	142600	20	2852000	142600	20	2852000	142600	20	2852000	178250	20	3565000
Total				2381400			2381400			2381400			2381400			2381400

E. CASH FLOW PROJECTIONS

Item	Y1	Y2	Y3	Y4	Y5
INFLOW					
Sale revenues	2139000	2852000	2852000	2852000	3565000
Enterprise contribution					
- Fixed capital (20%)	166000	0	5000	0	0
- Working capital (20% of 12 months operating cost)	280022	0	0	0	0
Loan					
- Fixed capital (80%)	664000	0	0	0	0
- Working capital (80% of 12 months operating cost)	1120089	0	0	0	0
Realization value of investment	-	-	-	-	2200111
Total inflow	2585022	2852000	2857000	2852000	5765111
OUTFLOW					
Fixed capital	166000	0	5000	0	0
Operating costs	1400111	1471411	1471411	1471411	1471411
Total outflow	1566111	1471411	1476411	1471411	1471411
Cash Flow before debt service	1018911	1380589	1380589	1380589	4222400
DEBT SERVICE					
Loan Repayment					
- Fixed capital	132800.00	132800.00	132800.00	132800.00	132800.00
- Working capital	224017.84	224017.84	224017.84	224017.84	224017.84
Interest on loan					
- Fixed capital	79680.00	63744.00	47808.00	31872.00	15936.00
- Working capital	134410.70	107528.56	80646.42	53764.28	26882.14
Total debt service	570908.54	528090.40	485272.26	442454.12	399635.98
Cash flow after debt service	448002	852498	895316	938134	3822764

E. CASH FLOW PROJECTIONS

Item	Y1	Y2	Y3	Y4	Y5
F. FINANCIAL ANALYSIS					
Return on total capital employed					
- Income from sales	2139000	2852000	2852000	2852000	5765111
- Cash outflow	2137020	1999502	1961684	1913866	1942347
- Net cash flow	-278042	852498	890316	938134	3822764
Internal rate of return – IRR (%)	320				
Discounted cash inflow	13942840				
Discounted cash outflow	6344938				
Net present value – NPV	7597903				
Benefit/Cost ratio	2.2				
Contribution (Sales - variable cost)	788689	1430389	1430389	1430389	2072089
Profit after tax	731889	1373589	1373589	1373589	2015289
Present value ratio – PVR	37	50	50	50	36
Break even point (in value)	154047	113251	113251	113251	158033
Break even point (in unit)	7702	5663	5663	5663	7902