Bamboo Cultivation - Potential and Prospects
Sangeeta Prasad Mehra & L. K. Mehra

1. Introduction:

1.1 The world market for bamboo has been valued at Rs. 50000 crore (US$ 10 billion) in 2001 and is expected to grow to Rs. 100,000 crore (US$ 20 billion) by 2015. India, China and Myanmar together have about 198 lakh ha of bamboo reserves - 80 percent of the world’s bamboo forests. Of this, India’s share is about 45 percent. However, its share in global market is only 4.5 percent. On the other hand, China alone has captured 50 per cent of the World market, exporting as much as 20 million tonnes of varied products a year. India, almost 20 years behind China in commercial production, produces only 3.5 million tonnes of bamboo a year.

1.2 The Govt. of India, has lately come to regard bamboo as an easily manageable export item that provides high yields, has multiple uses and has the potential to provide employment for millions. In this backdrop, the Planning Commission, Govt. of India, has accorded special status to bamboo and launched ‘National Mission on Bamboo Technology and Trade Development’. The target is to capture 27 % of the world bamboo market by the year 2015.

1.3 In tune with the Government policy, NABARD has developed a ‘Bamboo Development Policy’ to give focussed thrust to develop the sector with an integrated approach. The major objective is to commercialize Bamboo at farmers level. The policy envisages comprehensive development of bamboo resources as a marketable commodity and a linkage of bamboo farmers with bamboo artisans.

1.4 In the context of the above, it is high time we put bamboo into 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. corrugated sheets, bamboo tiles, bamboo flooring, bamboo fabric, etc. There is huge untapped potential in the wastelands under purview of Farm forestry/Agro-forestry in the country. However, the progress under the sector is hampered with lack of information, supply chain management, lack of institutional credit and restrictive rules. There is a need to integrate the efforts at various levels for evolving workable strategies to promote the sector, which would not only be instrumental in addressing environmental concerns but also economic and livelihood security to millions of people in the country.

2. Potential for Bamboo Cultivation:

2.1 Availability of Land:

As per the National Remote Sensing Agency, about 20% of the geographical area of the country, i.e. about 638.5 lakh ha. are classified as wastelands. Covering 10% of this land under bamboo cultivation can achieve the suggested target of 60 lakh ha under the National Bamboo Mission.

2.2 Availability of Technology:

The ‘National Mission on Bamboo Application (NMBA)’, established under the TIFAC (Technology Information, Forecasting and Assessment Council), Department of Science and Technology, New Delhi has been supporting bamboo sector through technological upgradation, development of indigenous capacities/enterprise and linkages with markets. The agency presently is working with about 60 partners, mainly Research institutions, Enterprises and Govt. agencies, across the country for technological intervention and demonstration of bamboo as a business venture, both at cultivation and utilization level. Venture capital support is available through the agency, for interested entrepreneurs to establish hi-tech bamboo industry in the country.

2.3 Availability of Market:

According to the Planning Commission, the annual market potential for value added bamboo products in India is Rs.4,463 crore as against the current market size of Rs. 2043 crore. This is projected to touch Rs.26,000 crore by 2015.

The current size of bamboo use in Agarbatti industries itself has been estimated at Rs. 135 crore and bamboo utilized in ice-cream industries, kites, crackers, lathies and fishing rods has been estimated to the tune of 10 lakh tonnes annually.
The Indian bamboo shoots industry is expected to grow at the rate of 25% per annum and capture a market worth Rs. 300 crore by 2015 from the current level of Rs. 4.8 crore. A large potential

Table 1: Bamboo – Projected Demand and Supply

- Country’s bamboo economy is expected to grow by over 15% to touch Rs. 26,000 crore by 2015.
- Bamboo can replace the projected import of timber to the tune of Rs.30,000 crore in the next 20 years i.e. 2025.
- The market size for bamboo plywood is expected to grow to Rs. 500 crore in 2015 from Rs. 200 crore in 2001.
- It has been estimated that the total market size of bamboo flooring materials will rise to Rs. 1,950 crore by 2015 from the current Rs. 200 crore.
- The demand for bamboo pulp is expected to grow to Rs. 2,088 crore by 2015 from Rs. 100 crore in 2001.
- The demand for bamboo furniture is expected to grow to Rs. 3,265 crore in 2015 from Rs. 380 crore in 2001.
- By 2015 bamboo scaffolding requirement will rise to Rs. 861 crore and for housing purposes the demand will be Rs. 1,163 crore.
- The demand for bamboo in road construction will rise to Rs. 274 crore and for bamboo grids the demand will be Rs. 100 crore by 2015.
- The demands for miscellaneous industry viz. ice cream sticks, fire crackers, bamboo lathis and ladders will rise to Rs. 600 crore by 2015.

Export market exists for shoots in Japan, Hong Kong, Singapore and Thailand. The Projected demand and supply of Bamboo as envisaged by the Planning Commission is given in Table 1.

2.4 Credit Potential:

The Bamboo Mission envisages expanding the area under Bamboo plantation by 20 lakh ha. during the X Five Year Plan (10 lakh ha in forest area and 10 lakh in areas outside forest) and overall 60 lakh ha by XI Five Year Plan. This calls for a massive requirement of quality planting material viz. 100 crore during the X plan period and another 200 crore during IX plan period. This itself requires an investment to the tune of about Rs. 500 crore. A part of the requirement is expected to be met through credit.

Further, the financial requirement during the Xth plan for Bamboo Mission is estimated at Rs. 2608 crore under various components, wherein, Rs. 2000 crore has been earmarked for plantation in 20 lakh ha. of area. Considering the cost of plantation as 20,000/ha, the financial gap under the sector is to the tune of 2000 crore, which needs to be supported through credit by way of building private public partnership for investment.

The financing institutions can play a significant role in greening India under the behest of bamboo cultivation. Various financing models are available to cater to the need of different clientele, viz.

- Finance for Nurseries – Centralized/ Decentralized/ Tissue Culture Unit etc.
- Captive Bamboo plantation by SFDC and User Industries
- Contract farming
- Area Development Project
- Joint Forest Management (JFM) – under (RIDF)
- Forest regeneration/ development- under (RIDF)
- Financing to Village Forest Committees (VFCs)/ Self Help Groups – under micro-credit programme.
- Cluster Development for Artisans and Craftpersons

Financing for nursery and plantation of bamboo are covered under ‘Direct Finance to Agriculture’ under Priority Sector Lending.

3. NABARD Initiatives in Bamboo Sector:

3.1 NABARD, as an apex bank for development of agriculture and rural sector, has identified bamboo sector as “Thrust Area” and has taken distinct policy initiatives for creating an enabling environment for promoting this sector under farm and non-farm sector. NABARD’s Bamboo Development Policy aims at mainstreaming bamboo farming, processing and marketing. Interventions are taken under four broad areas viz. Policy; Promotional and Financial; Capacity Building and Networking and Coordination. A ‘Bamboo Cell’ has been created at NABARD’s Head Office, Mumbai with Nodal Officers in all the Regional Office for a concerted effort.

3.2 A perspective plan for financing bamboo plantations by banks in 3 lakh ha potential states,
with an investment outlay of Rs. 1,000 crore during Tenth Plan period was formulated. Bankable Model Projects for Bamboo have been prepared to suite different areas/ cliental. An Area Development Project for Bamboo cultivation in Barak valley of Assam has been developed which envisages covering 2500 ha of area under bamboo cultivation over a period of three years. RIDF assistance has been provided to APFDC for raising bamboo in degraded forest.

4. Techno - Economic Parameters of Bamboo Financing:

4.1 Nursery:
Bamboo can be raised through seeds, rhizomes, culm cuttings as also through tissue culture techniques. Nursery could be centralized or decentralized. While Centralized nurseries are expected to be developed by Forest Department. Forest Development Corporation and Entrepreneurs, decentralized nurseries are expected to be taken up by VFCs, SHGs or farmers to cater the local requirement of bamboo seedlings. The Cost of for raising a decentralized nursery (1000 plants) is about Rs. 25,000. Detail break up of the unit cost and economics is given in Annexure I.

4.2. Bamboo Plantations:
Bamboo can be raised profitably on wastelands to yield recurring income for 20-30 years. The techno- economic parameters of raising bamboo is given as under:

a. Site and Composition : Bamboo is non-exacting, hardy and drought-resistant in nature and posses a wide range of soil/climatic adaptability and grow on marginal and degraded land, elevated ground, along field bunds and river banks from coastal regions to mountain slopes (upto 4000m above mean sea level) under moist to semi-arid conditions. Bamboo however, cannot withstand saline soils, alkaline soils and waterlogged areas. Bamboo can be raised as block plantations in degraded slopes, watershed areas, and cultivable wastes or under joint Forest Management programmes. It also combine well with grasses, pulses, oilseeds, soyabean and shade crops like ginger turmeric, cinnamon, etc. and can be raised under various agro-forestry systems.

b. Planting Technique: Monsoon is the best time for planting of the nursery-raised plants in the field. About 1 year old plants may be planted for better survival. The commercial spacing recommended to obtain good crop varies from 5 m x 4 m to 6 m x 6 m. Plants are planted in pits of 45 cm x 45 cm x 45 cm size.

Organic manure mixtures along with fertilizers containing NPK should be applied in the planting pit at the time of planting. Weeding and protective irrigation are essential in the first two years of plantation for stabilization of the plant. The plantation needs to be protected from fire and biotic pressures for initial 3-4 years, thus fencing or digging cattle-proof trench around the plantations is advisable.

c. Management: Proper management practice is the key to the success of bamboo plantations as the yield realized from the bamboo plantations is directly dependent on the soil nutrition and cultural operations. 'An eight year bamboo clump can have about 90 culms, of which 70-80 culm are destroyed, if left unmanaged.' Bamboo is a heavy feeder and even a rich soil becomes depleted after a few years. On an average, Bamboo plantations removes about 2300 kg of nutrients per ha in a period of 6 years. Therefore, soil supplements in the form of organic manures and fertilizers must be added to the clumps every year. A little bit of soil working around the clumps enhances production of new culms and is a must management practice. From 4th year onwards, the dead/dying culm from the clump must be removed to avoid congestion. Pruning of excessive thorns is necessary to maintain a hygienic conditions of the clump and must be carried out every year from 3rd-4th year onwards. Insect and diseases, if any, need to managed, though bamboos have comparatively few problems of insects or pests.

d. Harvesting: Well-managed commercial bamboo plantation matures within 4-5 years and can be harvested every year. Selection fellings must be practiced, and should be done in summer months. For harvesting, the mature culms should be cut at a height between first and second node above the ground level. Harvesting should be done in a horse shoe-fashion (instead of peripheral cuttings) to avoid congestion of the clump and give space for the newly emerging clumps and thus give a better yield. As a good management practice, a few mature culms should be left well distributed in the clump to provide support to the current year's culms. All immature culms (less than 4 years old) must be left to mature.

The cost for raising *Dendrocalamus strictus* on wastelands, under rain-fed condition is Rs. 23,600 per ha. (capitalized for 6 years). The detail break up of unit cost is given in Annexure II.
5. Limitations and Required Interventions:

Despite the available potential under the Bamboo sector viz. availability of land, availability of technology, availability of credit, as also, Government thrust, the sector has not gained the desired momentum in the country. The main limiting factors in the promotion of the sector are:

a. Lack of awareness: Bamboo has been traditionally raised, to a limited extend, in village commons and homestead gardens. However, it still remains a forest species in respect of industrial use and commercial plantations. There is a need for changing the ‘forestry mindset’ to the ‘farming mind set’ and creating awareness on the commercial viability and profitability of the species. In this regard, extensive awareness and capacity building programme are required at all level viz. farmers, extension workers, banks, user industries, etc. The Research & Development (R&D) under the sector needs to be complimented with awareness creation, demonstration and extension support for a multiplier effect. SHGs, VFCs, Farmers clubs, etc. could be used as vehicle for such extension programme.

b. Harvesting and Transport restrictions: It is evident, to meet the domestic and International demand of bamboo, the ‘raw material’ has to necessarily come from the private sources. The Indian Forest Act, 1927, defines bamboo as a “forest produce”, and the species attracts the felling and transit restrictions under most of the States Forest Rules. Procedures for taking permits are, more often than not, cumbersome, time consuming and harassing. These legal restrictions, detract farmers/entrepreneurs from raising bamboo on their private wastelands on commercial basis and is one of the most crucial issues in promotion of bamboo sector in the country. The probable option lies in exemption of Bamboo from the restrictive harvesting and transit rules, as in case of many other agro forestry species or at least simplifications of these rules.

c. Land Ceiling Act: The Land Ceiling Act is one of the deterrent factors for entrepreneurs interested in taking large-scale industrial plantations of the species. Plantation crops such as tea, coffee, cardamom and rubber have been relaxed from the purview of Land Ceiling Act. Similar relaxation needs to be extended for the bamboo sector.

d. Policy for leasing revenue wastelands for forest plantations: A large portion of available wastelands, which could be profitably used for raising bamboo, are under the control of the Revenue Department. Such lands are neither being developed by the Department nor leased away to the interest entrepreneurs for development. There is therefore desirable that the State Govts. evolve suitable policies for leasing of the revenue wastelands to the farmers/SHGs/entrepreneurs for raising forest plantations for industrial use. Andhra Pradesh, Tamilnadu and, Chattisgarh have come up with such policy. Other States may also follow to encourage the public private partnership for greening the wastelands.

e. Need for Organized Supply Chain Management: Though a vast market exists for the bamboo sector, there is a need for an organized market with assured minimum price regime to encourage the small farmers to take up bamboo plantations on their private wastelands. Contract farming by user industries needs to be encouraged. There is also a need for promoting ‘Bamboo Governance’ and encouraging the bamboo products at the Govt. Offices, Corporates and Public-sector undertakings to pave the way for large scale demand, supply, production of bamboo-based utility items and regeneration of bamboo by strengthening the supply chain.

f. Need for rationalization of taxation and price fixation: In some States, viz. Karnataka, bamboo raised under private sector is subject to tax by the forest department, as also by the APMC. This needs to be rationalized. Similarly, the price fixation mechanism by the Forest Department must be rationalized to ensure suitable remuneration to growers viz. a viz. the industries.

g. Need for incentives for raising bamboo plantations: Cultivation of Bamboo under the farm sector is a new activity and may be given fillip through extending capital/interest subsidy to the farmers/entrepreneurs for raising bamboo plantations.

6. Conclusion:

From a ‘poor mans timber’, bamboo is fast emerging as a ‘Green Gold’. Markets are growing and offer new opportunities for promotion of bamboo as alternative to wood as also other products. This is a golden opportunity for the farmers, entrepreneurs, industries, Banks, as also govt. agencies to tap the potential under the sector for economic, ecological and social gains. However, policy and operational bottlenecks, viz. restrictive harvesting and transit rules, land ceiling act, double taxation of bamboo, non-remunerative price regime, lack of organized market, lack of awareness among entrepreneur and banks, etc. needs to be addressed to give the desired momentum to the sector.
# Unit Cost of Decentralised Bamboo Nursery of 1000 Sq. Mt. (10000 seedlings)

**Techno-economic parameters**

<table>
<thead>
<tr>
<th>Spacing : 6m x 6m</th>
<th>Avg. wage rate Rs. 50 per Man Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of plants per ha : 278</td>
<td>Interest on term loan 12%</td>
</tr>
<tr>
<td>Mortality replacement : 10%</td>
<td>margin 10% of the unit cost</td>
</tr>
<tr>
<td>No. of harvestable plants per ha : 90%</td>
<td>Species: Dendrocalamus strictus.</td>
</tr>
</tbody>
</table>

## S. No. | Particulars of Works | Unit | Cost (Rs.) |
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td><strong>Capital Cost</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Land preparation/ Sitr development</td>
<td>2 MD</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>Fencing (Bamboo/ live hedge)</td>
<td>LS</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>Repair and maintainance of irrigation source</td>
<td>LS</td>
<td>500</td>
</tr>
<tr>
<td>4</td>
<td>Tools and Implements</td>
<td>LS</td>
<td>800</td>
</tr>
<tr>
<td>5</td>
<td>Water Tank - 1</td>
<td>LS</td>
<td>2000</td>
</tr>
<tr>
<td>6</td>
<td>Layout and preparation of poly beds (24 beds of 10x 1 m size)</td>
<td>10 MD</td>
<td>500</td>
</tr>
<tr>
<td>7</td>
<td>Shading Net of 80% shade with installation or thatching by grass</td>
<td>LS</td>
<td>4000</td>
</tr>
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<td>8</td>
<td>Sub total</td>
<td></td>
<td>8400</td>
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<tr>
<td></td>
<td>Contingencies (5% of sub total)</td>
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<td>420</td>
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<tr>
<td><strong>Total Capital Cost (A)</strong></td>
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<td></td>
<td><strong>8820</strong></td>
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<tr>
<td><strong>B</strong></td>
<td><strong>Recurring cost</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Land rent (1000 Sq. mt)</td>
<td>@ Rs. 1000/year</td>
<td>1000</td>
</tr>
<tr>
<td>2</td>
<td>Preparation of seed beds (2 beds) of 10m x imt</td>
<td>2 MD</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>Seeds</td>
<td>LS</td>
<td>1000</td>
</tr>
<tr>
<td>4</td>
<td>Polybags (6x9 of 100 gauge) 200 PB/ Kg Pot mixture - sand manure, earth (2 kg/bag)</td>
<td>20 MT @ 120/T and 10 MD</td>
<td>2900</td>
</tr>
<tr>
<td>5</td>
<td>OM including Loading , unloading</td>
<td>100 kg</td>
<td>1000</td>
</tr>
<tr>
<td>6</td>
<td>fertiliser, 10 gms/ polybags (in two doses)</td>
<td>LS</td>
<td>200</td>
</tr>
<tr>
<td>7</td>
<td>Plant protection chemicals</td>
<td>1 MD</td>
<td>50</td>
</tr>
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<td>8</td>
<td>Sowing on seed beds</td>
<td>5 MD</td>
<td>250</td>
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<tr>
<td>9</td>
<td>Weeding and Hoeing</td>
<td>2 MD</td>
<td>100</td>
</tr>
<tr>
<td>10</td>
<td>Picking up from germi beds</td>
<td>50 MD @200 PB/MD</td>
<td>2500</td>
</tr>
<tr>
<td>11</td>
<td>Filling Polybags</td>
<td>10 MD</td>
<td>500</td>
</tr>
<tr>
<td>12</td>
<td>Irrigation (labour cost)</td>
<td>2 MD</td>
<td>100</td>
</tr>
<tr>
<td>13</td>
<td>Application of fertiliser</td>
<td>2 MD</td>
<td>100</td>
</tr>
<tr>
<td>14</td>
<td>Application of pesticides/ insecticides</td>
<td>2 MD</td>
<td>100</td>
</tr>
<tr>
<td>15</td>
<td>Maintainace of path and channels</td>
<td>2 MD</td>
<td>100</td>
</tr>
<tr>
<td>16</td>
<td>Maintainace of pumpset</td>
<td>LS</td>
<td>2500</td>
</tr>
<tr>
<td>17</td>
<td>Sub total</td>
<td></td>
<td>14800</td>
</tr>
<tr>
<td></td>
<td>Sub total</td>
<td></td>
<td><strong>16280</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Total recurring Cost (B)</strong></td>
<td></td>
<td><strong>25100</strong></td>
</tr>
<tr>
<td><strong>Total (A + B)</strong></td>
<td></td>
<td></td>
<td><strong>25100</strong></td>
</tr>
<tr>
<td>Margin @ 10%</td>
<td></td>
<td>2510</td>
<td></td>
</tr>
<tr>
<td>Bank Loan</td>
<td></td>
<td>22590</td>
<td></td>
</tr>
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</table>

### Income

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sale price per seedling/ Poly bag</td>
<td>3</td>
</tr>
<tr>
<td>Installed capacity of nursery</td>
<td>10000</td>
</tr>
<tr>
<td>Capacity utilization</td>
<td></td>
</tr>
<tr>
<td>IYr.</td>
<td>60%</td>
</tr>
<tr>
<td>II Yr. onwards</td>
<td>85%</td>
</tr>
</tbody>
</table>
# Annexure II

## Unit Cost of bamboos (Dendrocalamus strictus) in Wastelands (One ha model)

### Techno-economic parameters

- Spacing : 6m x 6m
- No. of plants per ha : 278
- Mortality replacement : 10%
- No. of harvestable plants per ha : 90%
- Avg. wage rate Rs. 50 per Man Day
- Interest on term loan 12%
- margin 10% of the unit cost
- Species Dendrocalamus strictus.

### Cost Table

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Particulars of Works</th>
<th>Unit</th>
<th>Cost (Rs.) per year</th>
<th>Total (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Site preparation, alignment and staking</td>
<td>LS</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Digging of pits (45 cm x 45cm x 45cm) and refilling</td>
<td>@ Rs. 4/pit</td>
<td>1112</td>
<td>112</td>
</tr>
<tr>
<td>3</td>
<td>Cost of Plants including transport and replacement plants (278/28))</td>
<td>Rs. 3.00 / plant</td>
<td>834</td>
<td>84</td>
</tr>
<tr>
<td>4</td>
<td>Planting &amp; Replanting expenses @60 plants per MD</td>
<td>6MD/1MD</td>
<td>300</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>Cost of Insecticide</td>
<td>LS</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Cost of FYM @ 5kg / pit/year</td>
<td>Rs. 0.3/kg</td>
<td>417</td>
<td>417</td>
</tr>
<tr>
<td>7</td>
<td>Cost of Fertilizer @ 0.1kg / plant/year</td>
<td>Rs. 8 / kg</td>
<td>222</td>
<td>222</td>
</tr>
<tr>
<td>8</td>
<td>Weeding in first two years</td>
<td>10MD/8 MD</td>
<td>500</td>
<td>400</td>
</tr>
<tr>
<td>9</td>
<td>Soil Working (per year)</td>
<td>10MD/yr</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>10</td>
<td>Pruning from IV year onwards</td>
<td>10 MD</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>11</td>
<td>Plant Protection</td>
<td>LS</td>
<td>250</td>
<td>2500</td>
</tr>
<tr>
<td>12</td>
<td>Irrigation cost - 3 per annum for 2 years @ Rs. 750/- per irrigation</td>
<td></td>
<td>2250</td>
<td>2250</td>
</tr>
<tr>
<td>13</td>
<td>Fencing @ Rs. 6/- RM / cattle proof trench</td>
<td>LS</td>
<td>2500</td>
<td>2500</td>
</tr>
</tbody>
</table>

**Sub Total**: 22376

**Contingency @ 5%**: 1118.8

**Grand Total (Unit cost taking first 6 yrs of expenditure)**: 23495

**round off**: 23600

**Unit cost per ha. with a spacing of 6m x 6m**: 23600

**Margin @10%**: 2360

**Bank loan @ 90%**: 21240

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**Recurring Expenditure**: 3700/- towards the maintainance (pruning, soil working, fertilization) and harvesting cost.

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The Thirteenth Business Development Meet of Plantation and Horticulture Discipline of NABARD was held at Tocklai Experimental Station, Jorhat, Assam during 20 - 21 November, 2006. The meet was inaugurated by Dr K.G.Karmakar, MD, NABARD. He stressed on the need to achieve financial inclusion by involving all agencies and the people. He also stated that horticulture and plantation / tree based farming models are best suited for the North Eastern Region and we need to nurture good NGOs to take this mission forward.

Dr. M.Hazarika, Director, Tocklai Experimental Station, in his address, stated that the future of the Indian tea industry lies in the production of value added teas, development of diversified products from tea and in reducing production cost. Dr P.G.Rao, Director, Regional Research Laboratory(RRL), Jorhat also addressed the participants and highlighted the thrust areas of research being undertaken by RRL, Jorhat. Presentations were made by Dr.S.S.Bagel, Vice Chancellor, Assam Agricultural university, Jorhat on New Vistas of Agricultural Research in India with an accent on Commercial Production and Processing of Horticultural Crops of North Eastern States and by Dr.Jayanta Madhab, Advisor to Chief Minister f Assam, on the Prospects & Problems of Horticulture Development in the North East. The business session of the meet discussed the state wise developments and the policy and operational issues. The important issues identified at the national level are indicated below:

- Non-availability of adequate quantity of quality planting materials.
- Inadequate extension services from the State Governments including farmers training on modern technologies, post harvest handling, etc.
- Absence of adequate marketing infrastructure.
- Price fluctuation in horticulture products.
- Inadequate post harvest management facilities including processing infrastructure.
- Grossly inadequate manpower at bank branch level, particularly technical to take care of horticultural projects.
- Banks’ apathy towards financing horticultural activities.
- Lack of entrepreneurship acceptable to the banks in most states.
- Inadequate coordination amongst different agencies such as those concerned with horticulture development with institutional credit facilities.
- Insurance coverage.
- Non availability of updated land records to facilitate mortgaging.
- Small fragmented land holding.
- Stronghold of middlemen in marketing the horticultural products.
- Poor connectivity from farms to road heads to markets.

A field visit was undertaken to a tea estate and a tea factory run by Tata Tea. The diversification programme within the tea estate into floriculture and allied agricultural activities, initiated by Tata Tea gave the participants a first hand insight on the enterprising ability of the Company in their effort to revive the tea industry.
WATER RESOURCES DEVELOPMENT AND MANAGEMENT DISCIPLINE

The Business Development Meet of Officers of Water Resources Development and Management Discipline was held at Water Technology Centre (WTC), Coimbatore from 7 - 9 August 2006. The objective of the meet was to take stock of the changing scenario, make plans for the future and to draft a plan of action for 2006-07. The Meet was attended by 36 officers from various Regional Officers and HO of NABARD. The Meet was inaugurated by Shri K.V. Ragavulu, CGM, Tamil Nadu RO. In his inaugural address Shri Ragavulu flagged issues like pricing of water, efficiency of power and irrigation for discussion. He also touched upon the Vaidhyanathan Committee and the X Finance Commission. Dr. M.V. Rangaswami, Director, Water Technology Centre, Tamil Nadu Agricultural University (TNAU), in his address, emphasised on the sustainability aspects of water resources management projects. He highlighted the urgent need for water resources management through the use of micro irrigation system. He feared that Tamil Nadu may soon become another desert as the water table had gone down in many parts of the state. Shri John Kurien, CGM, TSD gave a brief presentation on the overview of activities of WRD&M/MI discipline. He also released the national status paper prepared on Minor Irrigation during the occasion. This was followed by presentations by resource persons from Central Ground Water Board, Ministry of Agriculture, GoI, faculties from Water Technology Centre, TNAU, Jain Irrigation Limited and senior officers in the Irrigation sector. Shri John Kurien guided the deliberations of the Meet and spoke in detail on the Vision for Future for the Water Resources Development and Management Discipline Officers. Some of the important national level issues that emerged during the meet are:

- Exploring the possibility of supporting micro level studies in overexploited areas by the State Government under R&D Fund of NABARD.
- Ensuring exploration of recharging ground water in project areas, extraction of water only from deeper aquifers by incorporating the same as a part of our terms and conditions for projects sanctioned under RIDF.
- Examining the technical details of efficient and low cost foreign made pump sets since the same are not eligible for NABARD refinance due to lack of BIS certification.
- Revisiting the existing NABARD circulars on eligible investments in critical areas and areas where ground water is over exploited. Categorisation of blocks as per GEC-1997 to be notified to all SLBCs for compliance.
- Emphasis on issues like ground water legislation, participatory irrigation management, revival of failed wells compensation scheme and conjunctive use of water specially in canal command areas.
- Promotion of micro irrigation activity for sustainable utilisation of water resources especially in critical and over exploited ground water areas and other water scarce areas. There is a need for standardisation of low cost micro irrigation systems and their wide scale availability.
- Ground water governance is the need of the hour. Some states like Govt. of Andhra Pradesh has enacted APWALTA 2002 & 2004 to promote water conservation, regulate exploitation and use of ground and surface water.
- Formation of WUAs should be made mandatory and they may be involved right from the planning stage and overhead and maintenance should be entrusted to them.
- The security deposit / power connection charges and recurring charges should be rationalised in order to enable small / marginal farmers to be able to use power supply. This is in view of the non-availability of power (both in terms of quantity and quality) which is acting as a major deterrent for operation of agricultural pump sets.
- Impact assessment studies of MI investments and correction action are required in some states.
- The existing MIS needs a relook to capture the flow of institutional finance under different investments of MI discipline.
INFORMATION TECHNOLOGY IN DAIRY INDUSTRY

NABARD has supported a research Project for using information Technology in Dairy Sector.

The project has two major parts viz.,

A. Herd Health: The first major part is to collect data on health of animals, examine the clinical data as revealed from blood and dung samples collected, apart from individual animal data and work out the average for each village (treating each village as a herd). The findings in each village is compared with accepted norms and the problems existing in each village is identified and solutions suggested. This has brought out revealing results. For example, in a village the Haemoglobin and Red Blood Corpuscles counts are low indicating iron deficiency. This result was further confirmed from examination of faecal samples, which showed presence of worms which suck blood and reduce iron level in blood of animals. Suitable remedies have been suggested.

Similarly, the study has brought out that, average calving interval differs by more than 90 days between villages indicating that, in some villages breeding management needs to be improved. In some area, soil analysis reveals, calcium is adequate and there is no need for calcium supplement in feed of animals. This type of analysis can help to prevent poor performance and mineral mixtures having required ingredients only are used, which saves cost.

B. Performance Recording: The second major part is about the performance recording of dairy animals. In our country, the most important factor affecting the efficiency of animal improvement is, lack of records. The project has employed suitable hardware, which can be used by village level workers for recording the performance of dairy animals. The software developed, can be used by milk unions, private dairy units and even Government cattle farms.

Development of Software

Project envisages recording the data of all animals from villages by field level para-veterinarians by a handheld PC (simputer), which are transferred to PC at the milk union for analysis, identification of problems and suggesting remedial measures.

The software "Herdman" used for analysing the data from the village centres, provides the following report:


Collection of Data and Follow-up

An action list generated on the animals tells the village level worker, which are the animals to be examined for heat or pregnancy, which animals are expected to calve etc. An alarm list is also generated which gives him a list of animals which are having delayed heat, fertility problems, low milk yield etc.

This is an excellent tool in the hands of para-vets and veterinarians, who supervise the village level workers, as they can easily identify and treat the animals before they actually become sick. In dairy farming, if a heat is missed (animal not inseminated), 21 days milk production is lost. For the first time in our country, some effort has been made to record the observations for future use.

Data Management

The data is available at three levels.

(1) At the farm level, the owner has approximate figures. Animals can have a chip embedded in the body which can store all information.

(2) At the livestock centre in the village level which maintains data on all animals. The plan is to put-up touch screen so that, farmers will have access to information on own animals. This
PC also will get results of analysis done at milk union level which will help farmers to understand the local problems and use the remedies suggested. For example, iron deficiency and reason for this like worm infestation. Classifying data breed-wise and unit-wise, generates average results which can be compared with accepted norms and level of performance at the unit or village level can be zeroed on.

(3) At milk union level which maintains all data on all animals covered by it. Our project supports maintenance of data at this level only. However, the milk unions is interested in maintaining data at village level, so that, feedback to farmers is easy.

From the project, dairy farmers are benefitted through reduction of infection in animals and feeding cost and increase in milk production.

ON FARM RESEARCH ON PULSES - MAJOR FINDINGS

NABARD has sanctioned the above R&D project to Tamil Nadu Rice Research Institute, Adathavai, Thanjavur District, Tamil Nadu which has been completed successfully.

The existing viable technologies adopted by the pulse growing farmers and constraints in adopting the improved technologies in the Cauvery command area of Thanjavur and Nagapattinam districts were identified through a comprehensive survey conducted among the selected farmers, followed by on-farm experiments conducted during 2000-2003. There is significant improvement in adoption of the technology by the selected farmers when compared to pre-project survey. Major findings that emerged from the studies are follows:

1. Pulses are grown in rice-fallow utilising the residual moisture and the moisture obtained from dew. The seed is broadcasted in the standing rice field, 5 to 10 days before the harvest of rice when the soil moisture is optimum, i.e., seed should get embedded in wet waxy layer. Black gram and green gram are the two main pulses grown.

2. In black gram, high yielding varieties like ADT1, ADT2, ADT3, ADT4 and in green gram ADT2 and ADT3 are found to be suitable for rice-fallow situation.

3. To realize higher yields from rice fallow, the correct time of sowing is very important. The crop will give higher yield when sown during 15 January to 15 February.

4. Optimum plant population is the basis for higher yield. Optimum seed rate of 30 kg/ha is recommended. The gaps are to be filled with pre-sprouted seeds to maintain optimum population.

5. To prevent the spread of seed borne diseases, pre-seed treatment with fungicide/ bio-control agent is to be resorted. For this seed treatment with Trichoderma viride @ 4 gm/kg of seeds or Pseudomonas @ 10 gm/kg or Carbendazim @ 2 gm/kg must be done to prevent root rot disease. For leaf crinkle disease, spraying with Dimethonate @ 500 ml/ha is recommended.

6. To control leaf beetles and pod borer, Neem Seed Kernel extract @ 5% or Neem Oil @ 3% can be sprayed.

7. Foliar spraying of 2% ADP + 40 PPM NAA on 25 and 40 Days gives higher grain yield in rice-fallow black gram (ADT3) with increase in number of pod on plant and in number of seeds per pod. The average yield of sample farmers was 639 kg/ha with minimum of 375 kg/ha and maximum of 1250 kg/ha.

8. For new Cauvery Delta area where irrigation facility is available, black gram variety ADT5 is highly suitable through suitable foliar spray of nutrient mix.
INCENTIVISING FARMERS FOR ORGANIC FARMING

B.K. Samal and H.N. Bhuyan

Organic farming is a production system of crops that avoids the use of synthetic and chemical inputs like fertilisers, pesticides, growth regulators and livestock feed additives. Application of genetically modified organisms and irradiation of food stuffs are prohibited under organic farming system. It is a system approach utilising natural cycles and biological interactions for crop production and protection. This method of farming produce food for healthy consumption and at the same time protect the soil and environment. India as a leading agriculture producer and with a tradition of organic farming has unique opportunities to capture growing organic markets both in fresh and processed forms, in the domestic and export market. However, desired growth is not there due to lack of awareness and constraints faced by farmers for going organic. Under the circumstances, NABARD management Committee in one of its decisions advised TSD to examine if incentivisation is required for encouraging farmers to go in for organic farming and to identify areas of incentivisation if required.

In an attempt to examine the issue of incentivising farmers to go for organic farming, TSD, HO has conducted one field study in Yavatmal, Amaravati and Pune some selected districts of Maharashtra and interacted with some leading firms that has gone for organic.

Major Observations

1. With organic farming the yield gets stabilised after the end of the conversion period (2 to 3 years). The differences in yields and economics of organic and conventional systems are only marginal and organic systems offer comparable productivity.

2. Inadequacy of input material availability is noticeable. Compost/vermi compost is produced in the villages mostly for own use; no commercial unit is there in any of the villages covered. Some farmers who do not have sufficient or any cattle, prefer to stay inorganic.

3. Physical quality of grain/product improves under organic system of production. Rice grains remain unbroken after pounding and weight more with less volume indicating higher density. Rice recovery ratio is higher (100 : 70) against the inorganic (100 : 60).

4. Organic farming improves soil qualities from physical chemical and biological point of view.

5. The National Project on Organic Farming initiated by Government of India has limited components. Different subsidy schemes related to organic farming have been floated/implemented by Government of India and Government of Maharashtra.

6. Major cost components for organic production are inputs like compost/vermi compost, certification, transportation, storage, cleaning, sorting, packing and marketing, which makes organic cultivation higher than conventional farming.

7. India has 20 crores potential customers for organic products to be tapped. There is increasing demand for organic food items in Mumbai market with an annual demand growth of about 40%. The growth in other Indian cities is also very fast.

8. Total annual market for organic product is around $13 billion. In developed countries, the organic food trade represents about 2% of the total food trade. Indian export markets in European countries including U.K., USA and Japan are expanding.

9. The retail prices of organic items are significantly higher than the regular ones.

10. Agencies like Eco-farm, Maharashtra Organic Farmers' Federation, etc. facilitate group training to farmers, provide guidance, purchase organic farm products and facilitate marketing.

11. Major constraints faced by the organic farmers are:
   i. Shortage of input materials including cow dung.
ii. Certification - cost and complicated procedure.

iii. Capacity building.

iv. Market linkage.

v. State support.

12. For realising premium price, two important requirements are:

i. Facilities for testing and certifying the produce as organic at local level.

ii. Adequate and appropriate market infrastructure exclusively for organic products, so as to prevent mixing up with conventional products and to enable fetching premium prices providing safeguard to the farmers’ interest.

Recommendations

1. Banks may give priority to projects related to organic farming.

2. There is a need to develop separate scale of finance for crops grown under organic system and enhanced refinance support.

3. Farmers may be incentivised for rearing more cattle to have more cowdung/compost and also for establishing bigger vermi compost units.

4. Capital subsidy scheme on organic farming may be extended for production of biopesticides and compost from other bio-resources.

5. Production subsidy may be provided for popularising organic inputs at affordable retail prices as done for chemical fertilisers.

6. Creation of infrastructure for testing and certifying at local level.

7. Cost of certification being costly, may be incentivised.

8. Service providers such as NGOs may be incentivised for providing training, technologies, exploring marketing, etc.

Hi-tech market infrastructure - The TN initiative

The Tamil Nadu Government is reported to be planning to create terminal markets for agriculture produce with necessary infrastructure in three places, to eliminate post-harvest loss and ensure remunerative prices to farmers. These markets will have facilities such as collection centres, pre-cooling equipment, sorting and treatment facilities, and electronic auction. They will be established in Chennai, Coimbatore and Madurai, declared the State Finance Minister, Mr. K. Anbazhagan recently. Presenting the 2006-07 budget, he said these markets will provide good export opportunities besides enhancing marketing prospects for agricultural produce. He said cold storage facilities will be created for onion in Palladam in Coimbatore district, for mangoes in Krishnagiri district, and for grapes at Odaipatti in Theni district to enable export of these produce. The Government will also take action to produce ethanol in all sugar mills for blending it with petrol. Farmers will be encouraged to cultivate sweet sorghum and sugar beet as these can also be used for producing ethanol.
Thanks to the initiative of our Assam Regional Office, we have formed a nucleus of contract broiler farming in Assam. It all started at a workshop held in Guwahathi. With the great demand for poultry meat, the potential for the activity in Northeast is very high. VHPL accepted our request to establish a centre for broiler farming. RO acted as a catalyst and coordinated the entire plan by liaising with State Government, local people etc. In spite of many teething troubles, persistence paid off in the end. The present position is:

- With the cooperation of Venkateswara Hatcheries in Kolkotta, persons in 4 districts of Assam were trained on broiler farming.
- **65 units under contract farming has been established** with the help of local authorities. (6 units by Bodo women. (Kokrajhar and Chirang districts)
- Average size of farm is 2000 birds
- **Bodoland Livestock Farming and Marketing Society (BLFM)** is providing help for cheap shed construction (Bodo Tribal Council has announced assistance to farmers for poultry farming).
- Another **100 new groups are being formed** and they will take up broiler farming after training.

### NATIONAL FISHERIES DEVELOPMENT BOARD

With the objective of achieving full potentials of Indian fisheries, Government of India has constituted "National Fisheries Development Board (NFDB)" under the Ministry of Agriculture with a budget of Rs. 2,100 Crores during 2006-2012. The board consists of Governing Body and Executive Committee, where chairman of NABARD is a member of the Governing Body and Managing Director of NABARD is the member of Executive Committee. The Headquarter of the NFDB is at Hyderabad.

The objectives of NFDB are as follows:

1. To bring major activities relating to fisheries and aquaculture for focused attention and professional management.
2. To coordinate activities pertaining to fisheries undertaken by different Ministries/Departments in the central government and also coordinate with the State/Union Territory Governments.
3. To improve production, processing, storage, transport and marketing of the products of capture and culture fisheries.
4. To achieve sustainable management and conservation of natural aquatic resources including the fish stocks
5. To apply modern tool of research and development including biotechnology for optimizing production and productivity from fisheries
6. To provide modern infrastructure mechanisms for fisheries and ensure their effective management and optimum utilization.
7. To generate substantial employment
8. To train and empower women in the fisheries sector
9. To enhance contribute of fish towards food and nutritional security.