

**Summary report**

**ON**

**MARKET SURVEY ON TISSUE CULTURED PLANTS**

**PREPARED BY**

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**FOR**

**DEPARTMENT OF BIOTECHNOLOGY**

**AND**

**SMALL FARMERS' AGRI-BUSINESS CONSORTIUM**

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## POTENTIAL OF TISSUE CULTURED PLANTS IN DOMESTIC MARKET

### 1. INTRODUCTION

Realizing the potential of plant tissue culture technology in revolutionizing the commercial agriculture sector by enabling mass propagation of elite, high yielding and disease free plants throughout the year, the Department of Biotechnology (DBT) has identified it as a priority area and initiated a number of programmes aimed at development and commercialization of the technology in an integrated manner. A number of research and development projects in various research institutes and universities have been supported for perfecting protocols of important plant species namely forest trees, horticulture crops and plantation crops (list of technologies which have been perfected for large scale propagation is given below).

#### List of technologies which have been perfected for large scale propagation

Plant category	Plants
Fruits	Banana, grapes, pineapple, strawberry, sapota
Cash crops	Sugarcane, potato
Spices	Turmeric, ginger, vanilla, large cardamom, small cardamom
Medicinal plants	Aloevera, geranium, stevia, patchouli, neem
Ornamentals	Gerbera, carnation, anthurium, lily, syngonium, cymbidium
Trees	Teak, white teak, bamboo, eucalyptus, populus

Two tissue culture pilot plant facilities were also set up for large scale production of elite planting material with the main objective of demonstrating the field performance of tissue cultured plants. Each pilot plant has production capacity of 1 million plantlet per annum. Hardening units have also been established in different agro-climatic regions. The pilot plant have produced more than 5 million tissue cultured plantlets. These pilot plants have now been converted to micropropagation technology parks (MTPs) to provide an effective platform for transfer of proven technologies to

entrepreneurs. The MTPs have optimized a large number of technologies and also transferred them to industry.

In addition, based on the needs of the industry, National facilities for virus diagnosis and quality control of tissue cultured plants (TCPs) have been set up at many institutions in the country.

These measures have contributed immensely in promoting the tissue culture industry. There are 46 established commercial tissue culture units. Their production capacity ranges between 1 million to 5 million and above plants per annum with an aggregate production capacity of 180 million plantlets per year. Most of these tissue culture units are located in Maharashtra, Andhra Pradesh, Karnataka and Kerala. These companies have been so far largely concentrating on exploiting the international markets and are facing a number of constraints such as short shelf life, stringent quality requirements and uncertainty of rejection of consignments.

Considering the high rate of consumption of conventionally propagated plants in the domestic market and the potential of replacement of at least a part of this requirement by TCPs for improving overall productivity and for strengthening the industry, the Department of Biotechnology (DBT) and the Small Farmers' Agri-Business Consortium (SFAC) commissioned a market survey to the Biotech Consortium India Limited (BCIL) in 2002. The study aimed at selecting commercially important tissue cultured plants (TCPs), current domestic demand and projections, major consumer segments and recommendations for improving the demand and strengthening the tissue culture industry. The survey was carried out by collecting information from all the target segments by way of structured questionnaires as well through personal visits. The data so obtained was validated in consultation with key experts from the industry and the government.

## **2. STATUS OF DOMESTIC MARKET**

The highlights of the market survey on TCPs conducted in the year 2003 are as follows:

### **2.1 MAJOR CONSUMERS**

The major consumers of tissue culture plants (TCPs) are the State Agriculture Department, Agri Export Zones (AEZs), sugar industry and private farmers. The paper industry, medicinal plant industry and State Forest Departments are using TCPs in a limited scale.

Under the annual Area Expansion Programme (AEP), State Agriculture Departments identify priority plants as well as the additional area to be brought under cultivation of each plant. Presently, most of the State Agriculture Departments are meeting their area expansion requirements using conventionally propagated plants except for banana for which the requirements are largely met through TCPs. However, with increase in awareness about the benefits of use of TCPs a few states have identified other plants for propagating using tissue culture technology.

Under the auspices of the Ministry of Commerce and Industry, AEZs have been set up for promoting export of agriculture products from India. AEZs are being implemented by the state level nodal agencies primarily the State Agro Industries Corporations with active involvement of all the existing stakeholders responsible for production and processing of the identified product including the farmers and the private industries. Priority plants identified by AEZs are those plants that are suitable for large-scale cultivation in the region and have a high export demand. Keeping in view the requirement of high quality planting material for export purposes, the AEZs are expected to change over to use of TCPs for sourcing large part of their planting material requirements.

The Spices Board, Cochin, has also brought large area under cultivation of TCPs particularly for small cardamom, vanilla and large cardamom through involvement of progressive farmers and is an active consumer of TCPs.

Among the 140 sugar factories spread across the country, there is an increasing awareness about the benefits of the TCPs over conventional plants. Although, at present only 6-7% of these are using TCPs, a larger number of factories are expected to shift over to TCPs in the next 3-5 years.

In addition, a number of progressive farmers and nurseries in the states of Andhra Pradesh, Maharashtra, West Bengal, Karnataka, Tamil Nadu etc., are the major consumers of TCPs particularly for flowers, banana, sugarcane and medicinal plants

## 2.2 PRIORITY PLANTS FOR TISSUE CULTURE

The plants prioritized for tissue culture propagation by the above consumer segments are banana, grapes, pineapple, strawberry, sugarcane, potato, turmeric, ginger, large and small cardamom, vanilla, aloevera, geranium, stevia, patchouli, gerbera, carnations, anthuriums, syngonium, lily and for few tree species namely teak, white teak, bamboo, eucalyptus and populus. The lists of plants prioritized by the various consumer segments are at Table 1 to 4

**Table 1: Priority plants of State Agriculture Departments**

<b>Plant category</b>	<b>Priority plants</b>
Horticulture	Banana, Papaya, Strawberry, Grapes, Apple, Sapota, Mandarin Orange, Passion fruit, Cherry, Walnut, Almond, Pecan nut, Pineapple, Fig
Spices	Vanilla, Ginger, Turmeric, Pepper, large Cardamom
Medicinal and Aromatic Plants	Aloe, Patchouli, Gloriosa, Senna, Aswagandha, Nightshade ( <i>S. khasianum</i> ), Phyllanthus ( <i>P niruri</i> ), Dioscorea, Neem, Geranium
Ornamental plants	Orchids, gerbera, Anthurium, chrysanthemum, Rose, Dendrobium,

**Table 2: Priority plants of Agri Export Zones**

<b>Location of AEZ</b>	<b>Priority plants</b>
West Bengal	Pineapple Var. Giant Queen
	Potato
Orissa	Turmeric, Ginger
Sikkim	Orchids, Ginger, Turmeric
Assam	Ginger
Tripura	Pineapple
Andhra Pradesh	Grapes
Kerala	Banana
Tamil Nadu	Roses
Karnataka	Flowers
Punjab	Potato
U.P. (Agra)	Potato
Uttaranchal	Flowers, Medicinal Plants
Maharashtra	Grapes

**Table 3: Priority plants of State Forest Departments**

<b>States</b>	<b>Priority plants</b>
Tamil Nadu	Sandal wood, Bambusa species, Ailanthus, Melocanna species, Sapindus species
Mizoram	Bamboo
Kerala	Teak, Eucalyptus, Bamboo, Albizzia, Cane
Uttaranchal	Poplar, Eucalyptus, Teak, Sissoo
Madhya Pradesh	Amla, Gmelina species
West Bengal	Eucalyptus, Teak, Nypa, Gmelina species, Dalbergia species, Pterocarpus, Xylocarpus species, Machilus species, Calamus sp.
Tripura	Teak, Bamboo, Gmelina, Thyrostachys

**Table 4: Priority of plant based industries/ associations /export promotion boards**

<b>Industry</b>	<b>Priority plants</b>
Paper industry	Eucalyptus, Subabul, Acacia, Casuarina, Bamboo
Medicinal Plant Industry	Aloe, patchouli, Safed musali, Taxus, Digitalis

The requirements of TCPs for the above consumer segments are primarily met by the commercial tissue culture units and to a small extent by the Micropropagation Technology Parks (MTPs).

The Department of Biotechnology has set up two MTPs at The Energy Research Institute (TERI), New Delhi and National Chemical Laboratory (NCL), Pune with the main objective of promoting commercialization of plant tissue culture. They are also supplying TCPs in the domestic market in a limited way.

### **2.3 CURRENT MARKET AND FUTURE PROJECTIONS**

The consumption of TCPs in 2002-03 and the future projections are given at Table 5 and 6.

**Table 5: Current domestic consumption of TCPs****(Volume in thousand nos., Value in Rs. lakhs)**

Crop	Year 2002-03	
	Volume	Value
Banana	18000	1620
Sugarcane	13500	540
<b>Spices</b>	<b>2500</b>	<b>175</b>
Ginger	300	22
Turmeric	520	36
Large Cardamom	1000	70
Small Cardamom	150	10
Vanilla	530	37
<b>Medicinal Plants</b>	<b>1550</b>	<b>78</b>
Aloe	420	21
Safed Musali	500	20
Stevia	630	37
<b>Ornamental</b>	<b>5995</b>	<b>899</b>
Gerbera	1975	296
Carnation	2710	406
Anthurium	860	129
Orchids	450	68
<b>Trees</b>	<b>2150</b>	<b>538</b>
<b>Total</b>	<b>43695</b>	<b>3849</b>

**Table 6: Market projections for TCPs****(Volume in thousand nos., Value in Rs. Lakhs)**

Crop	Year									
	2003-04		2004-05		2005-06		2006-07		2007-08	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value	Volume	Value
Banana	21613	1945	27537	2478	35808	3223	47470	4272	64060	5765
Pineapple	4618	693	5080	762	5588	838	6147	922	6761	1014
Grapes	926	232	975	244	1026	257	1080	270	1137	284
Sugarcane	14791	592	16271	651	18709	748	22449	898	28055	1122
Potato	6		10		22		43		83	
Turmeric	634	44	698	49	767	54	844	59	929	65
Vanilla	1000	70	1245	87	1123	79	1123	79	1123	79
Large Cardamom	2000	140	2000	140	2000	140	2000	140	2000	140
Small Cardamom	200	18	300	27	400	36	500	45	600	54
Ginger	401	28	441	31	484	34	533	37	586	41
Medicinal and aromatic plants	2100	105	11510	576	11741	587	11995	600	12275	614
Ornamentals	20290	3044	18120	2718	18944	2842	19973	2996	21172	3176
Trees	3000	750	3380	845	3824	956	4342	1086	4951	1238
<b>Total</b>	<b>71579</b>	<b>7660</b>	<b>87567</b>	<b>8607</b>	<b>100436</b>	<b>9793</b>	<b>118499</b>	<b>11404</b>	<b>143731</b>	<b>13592</b>



The consumption of plants for 2002-03 has been approximately 44 million plants with banana constituting 41% share followed by sugarcane at 31% and ornamentals at 14%, spices at 6% and medicinal plants at 4%. For the year 2003-04 the demand for TCPs is projected at 72 million. The growth in demand for tissue culture banana is expected to increase at a high rate of 25 to 30%. The demand for sugarcane for 2003-04 is expected to increase by 10% as per the past trends, however in the subsequent years this demand is anticipated to grow at a higher average rate of 20% due to introduction of ethanol blended petrol.

The demand for tissue culture plants for tuber crops e.g., potatoes, turmeric and ginger is increasing due to increased awareness. However, due to high cost the TCPs are being further multiplied conventionally to get a breeder seed ratio of at least 1:100.

The setting up of AEZs is expected to have a significant impact on the overall requirement for ornamentals, medicinal plants and spices. The demand for tissue culture ornamentals is expected to increase from 6 million in 2002-03 to 20 million in 2003-04 and would persist in the subsequent years. Similarly for medicinal plants the demand is expected to increase significantly from 2 million in 2002-03 to 12 million in 2004-05 and for spices from 2.5 million in 2002-03 to 4 million in 2004-05.

New horticultural crops expected to gain a foothold in the domestic market are the grapes and pineapple. Due to large crop rotation period of these plants, the demand is expected to be low at about 1 million and 5 million respectively.

The overall market for TCPs is expected to grow by at least 20 to 25% from 72 million in 2003-04 to 144 million over the next five years as compared to the average growth rate of 10 to 12% annually during the last two to three years.

## **2.4 DEMAND SUPPLY GAP**

The aggregate production capacity of the established commercial tissue culture

units is estimated at 150 million plants per annum. The small units may account for additional 20 million. Assuming that only 50% of this capacity is being used for addressing the domestic demand, the existing capacity would be able to cater to the demand for the year 2003-04. However the existing production capacity even at 100% capacity utilization would not be able to meet the requirements of TCPs for 2004-05 onwards. New tissue culture units would therefore need to be set up with due attention to the suitability of the location having adequate demand supply gap. The distribution of the tissue culture units vis-à-vis demand is at Table 7.

**Table 7: Distribution of TC units vis-à-vis the demand**

<b>Region</b>	<b>Demand (In thousand nos.)</b>	<b>No of Units</b>
North	10108	5
East	8162	3
West	11129	16
South	39182	21

The table indicates a need for setting up additional units in the northern and eastern regions to cater to the increasing demand for tissue cultured medicinal and horticulture plants.

The demand projections are highly conservative. Considering the vast potential that TCPs offer for supplementing and replacing the conventionally propagated plants for improving agricultural productivity, the potential demand is expected to be significantly higher than the projected figures. This potential can be tapped by creating large-scale awareness about the benefits of TCPs and reduction of the cost of production.

### **3. GOVERNMENT SCHEMES AND INCENTIVES**

Various Central and State Government departments have framed financial

schemes and announced incentives for assistance tissue culture industry which are summarized below:

**a. Ministry of Agriculture**

The Department of Agriculture and Cooperation under the Ministry of Agriculture, Government of India has the following programmes and schemes for promotion of horticulture.

- (i) There is a provision for assistance of upto Rs. 21 lakhs and Rs. 10 lakh for setting up tissue culture units in public and private sector respectively subject to a maximum of 20% of the project cost.
- (ii) Under the Integrated Development of Fruits scheme assistance is given for purchase of planting material under the area expansion programme for the following crops: -
  - a) Rs. 7,000/hectare for plants of guava, Amla, Date Palm, Plum Peach, Bes, Fig and citrus.
  - b) Rs.10,000/hectare for plants of mango, almond, pomegrante, apple, nuts, apricot, olive, papaya, litchi and sapota.
  - c) Rs. 30,000/hectare for plants for Bananas and pineapples.
  - d) Rs. 70,000/hectare for plants of grapes and strawberry.

In addition, 50% subsidy is given to the farmers for purchase of tissue culture banana by the Andhra Pradesh State Agriculture Department under the Macro Management Scheme

## **b. Agricultural and Processed food products Export Development Authority (APEDA)**

APEDA under the Ministry of Commerce and Industry has taken the following initiatives for promoting tissue culture in the country.

- (i) A state-of-the-art airfreight transshipment centre has been set up for temperature sensitive perishables at Delhi, Mumbai and Bangalore airports.
- (ii) Airfreight subsidy is given for TCPs along with other live plants / bulb in category of perishable horticulture produce for export. The rate of subsidy to West Asia and CIS countries is at the rate of Rs.10 per kg or 25% of the airfreight rate approved by IATA or 1/3<sup>rd</sup> of the FOB value whichever is the least.
- (iii) The rate of subsidy for export to Europe other than CIS countries, North America and Far East at the rate of Rs.25 per kg or 25% of the airfreight rate approved by IATA or 1/3<sup>rd</sup> of the FOB value whichever is the least.
- (iv) 50% subsidy is given for the development of infrastructure like refrigerated van, packaging, export promotion, market development, consultancy services and feasibility studies, organization building and human resource development.
- (v) Financial assistance is also given for strengthening quality control facilities and implementation of ISO 9000.

## **c. National Horticulture Board (NHB)**

The mandate of NHB is to promote integrated development of Horticulture and to help in coordinating, stimulating and sustaining the production and processing of fruits and vegetables. It also helps in establishing a sound infrastructure in the field of production, processing and marketing with a focus on post harvest management. For setting up of a new tissue culture lab there is a provision for back-ended capital subsidy not exceeding 20% of the project cost with a

maximum limit of Rs. 25 lakh per project. For the North-Eastern/Tribal/Hilly Areas, maximum limit of subsidy would be Rs. 30.0 lakh per project. NHB also has a scheme for providing subsidy for cultivation under controlled climate conditions in poly houses, green houses, net houses, etc. The units planning expansion in the domestic market by having a network of nurseries or additional hardening facilities can avail this scheme. The provision also exists for high quality commercial horticulture crops, Indigenous crops/produce, herbs, aromatic & medicinal plants, seed & nursery, bio-pesticide and establishment of Hort. Health Clinics/ Laboratory. In all these cases, the subsidy is routed through the involvement of a financial institution on the completion of the project. For projects in the cooperative sector funded by National Cooperative Development Centre (NCDC), the subsidy is through NCDC.

**d. Small Farmers Agri business Consortium (SFAC)**

SFAC under the MoA give soft loans up to 50 lakhs for setting up of small tissue culture labs by cooperative societies formed by small scale farmers.

**e. Department of Biotechnology (DBT)**

DBT supports R & D projects across the country at the various laboratories in the universities and the research institutions for development and standardization of tissue culture protocols for various species through tissue culture. DBT has supported 150 projects so far for development of micropropagation related protocols for about 50 plant species.

**f. State Level Incentives**

The states of Karnataka, Gujarat, Maharashtra and Andhra Pradesh are giving financial assistance for setting up tissue culture labs under the new agro industrial policy. Karnataka gives capital subsidy of 20% on investments in

setting up tissue culture unit whereas the subsidy is 6% in Gujarat. Maharashtra gives a subsidy on power consumption and Andhra Pradesh provides 50% subsidy on purchase of tissue culture banana plants.

#### **g. Financial Assistance by Banks**

Apart from the fiscal incentives given by the central and state governments, the financial institutions have also been financing tissue culture projects as a priority sector. Some nationalized banks like Canara Bank has opened a special cell for financing high tech agriculture projects. National Bank for Agriculture and Rural Development (NABARD) under its refinancing scheme has supported some 30 projects.

#### **4. RECOMMENDATIONS**

It is recommended that the above incentives provided by Central, State governments and financial institutions etc., could be availed by the new units to reduce the initial financial burden. The new as well as existing tissue culture units must network closely with the research institutions working in the area to keep abreast with the latest research developments and modern equipments for improving their competitiveness.

Proper management of operations by selecting alternatives for costly inputs and thrust on developing indigenous varieties with enhanced traits would definitely improve the sustainability of the tissue culture units.

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