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## Tissue cultured plants and domestic market in India

**Dr. MS Dudhare and Naresh Jayewar**

### Abstract

Plant tissue culture refers to growing and multiplication of cells, tissues and organs of plants on defined solid or liquid media under aseptic and controlled environment. The commercial technology is primarily based on micropropagation, in which rapid proliferation is achieved from tiny stem cuttings, auxiliary buds, and to a limited extent from somatic embryos, cell clumps in suspension cultures and bioreactors. The cultured cells and tissue can take several pathways. The pathways that lead to the production of true-to-type plants in large numbers are the preferred ones for commercial multiplication. The process of micropropagation is usually divided into several stages i.e., pre-propagation, initiation of explants, subculture of explants for proliferation, shooting and rooting, and hardening. These stages are universally applicable in large-scale multiplication of plants. The delivery of hardened small micro-propagated plants to growers and market also requires extra care.

The plant tissue culture technology have great potential in agriculture sector for mass propagation of elite, high yielding and disease free plants throughout the year, A number of companies have been established supported by public sector institutions for perfecting protocols of important plant species. Tissue-culture techniques are part of a large group of strategies and technologies, ranging through molecular genetics, recombinant DNA studies, genome characterization, gene-transfer techniques, aseptic growth of cells, tissues, organs and *in vitro* regeneration of plants that are considered to be plant biotechnologies. The use of the term biotechnology has become widespread recently but, in its most restricted sense, it refers to the molecular techniques used to modify the genetic composition of a host plant, i.e. genetic engineering.

**Keywords:** tissue culture, biotechnology, horticulture

### Introduction

The plant tissue culture technology have great potential in agriculture sector for mass propagation of elite, high yielding and disease free plants throughout the year, A number of companies have been established supported by public sector institutions for perfecting protocols of important plant species.

### Technologies which have been available for large scale propagation of following plants

Fruits: Banana, grapes, pineapple, strawberry, sapota

Cash crops: Sugarcane, potato

Spices: Turmeric, ginger, vanilla, large cardamom, small, cardamom

Medicinal plants: Aloe vera, geranium, stevia, patchouli, neem

Ornamentals: Gerbera, carnation, anthurium, lily, syngonium, cymbidium

Trees: Teak, white teak, bamboo, eucalyptus, populus

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.

### Status of Domestic Market

The highlights of the market survey on TCPs conducted by Biotechnology Consortium India Limited (BCIL) for Department of Biotechnology, GOI, New Delhi (DBT) and Small Farmers Agri-Business Consortium (SFAC) are as below,

**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 largescale 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 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

**Priority Plants for Tissue Culture**

The plants prioritized based industries/ associations /export promotion boards Industry Priority plants and state agriculture departments for tissue culture propagation by the above consumer segments are banana, grapes, pineapple, strawberry, sugarcane, potato, turmeric, ginger, large and

small cardamom, vanilla, aloe vera, geranium, stevia, patchouli, gerbera, carnations, anthuriums, syngonium, lily and for few tree species namely teak, bamboo etc

**Current Market and Future Projections**

The consumption of TCPs in 2002-03 is given in table,

**Table 1:** Current domestic consumption of TCPs

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

(Volume in thousand nos., Value in Rs. lakhs)

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%.

**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 plant tissue culture units in different zones of India is given Table.

**Table 2:** Distribution of PTC units in India

Zones	Demand of TCPs (000)	No. of units
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.

## **Schemes and incentives for the development of PTC Units**

The 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 different 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). State Department also given subsidy to the farmers for horticultural crops, e.g. the Andhra Pradesh State Agriculture Department given 50% subsidy to the farmers for purchase of tissue culture banana 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 Horticulture 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 micro propagation 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.

There is need of national network of existing plant tissue culture units and the research institutions working in the area to keep abreast with the latest research developments for improving their competitiveness. Proper management of operations using low cost technology, developing new varieties would improve the sustainability of the tissue culture units.

## **References**

