

# *Growth of Plant Tissue Culture in India*

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## **ABSTRACT**

Plant tissue culture is having remarkable effect in different sectors. It has its own beauty in cultivation of tissues, plant cells, organs in artificial medium. One of the most important techniques is the micro-propagation. Micro-propagation has ability to reproduce large number of plants of true to type of our choice. Many developing countries including India mastered this technique. Industries based on plant tissue culture have significant role in national and international economies. Because of greater turnover large numbers of industries based on this technique are increasing every year. The present article covers the growth of plant tissue culture industries in India since 1987.

## **INTRODUCTION**

India is one of the most populated countries and the population is expected to reach the pinnacle at the end of this century. Obviously, there will be an increase in demand for food in near future. But the land is scarce. Hence, large amount of food should be produced within in a limited piece of land. Adopting high yielding varieties increased the yield to greater extent. But still there are many constraints say for example, pest and diseases causing significant yield losses. So, tremendous increase in demand for high yield and production of disease-free plants highlighted the concept of plant tissue culture (PTC). PTC technology is widely used for large scale production of plants of choice from explants within short period of time and limited space. Roots of this technology widely

spread after its initial success in different sectors like agriculture, medicine and forestry. PTC has wide range of applications. These applications are broadly categorized into three as follows: basic research, environmental application and commercial application.

With modifications in micropropagation and adaptation of new technology, PTC became major industrial importance in recent years. Different targets include the production of disease and virus free plants, secondary metabolites production, crop improvement, production of somaclonal and gametoclonal variants and still more. Because of globalization and great turn over, large numbers of PTC based industries are increasing every year.

### **When does commercialization of PTC started in India???**

It was great early 1980's, where PTC based industries started spreading its wing. The first and foremost company that started the commercialization of PTC is AV Thomas Company. This company is based on Cochin in Kerala. It was started for plant improvement of cardamom plants. The cardamom plants with superior genotypes were selected and clonally propagated. The propagated plants were released by the indigenous company National Chemical Laboratory (NCL), Pune, India. Over a period of time, this company collaborated with UK based firm to become most economically feasible commercial unit. Indo-American Hybrid Seeds at Bengaluru, Karnataka was the second successful company started in the year 1988. This company mainly associated with nursery and production of hybrid vegetables and fruits.

### **Rise in number of PTC industries from 1987 to 2021**

After two successful industries in 1987 and 1988, people started realizing the sweetness of success of PTC industries. With great industry turnover, a large number of plants started increasing every year from one in 1987 to 105 in the 1997. The production capacity raised from 5 million to 190 million in the course of 10 years. Later, because of financial constraints, the number of plants reduced to half to around 70-75. But the increased technology and techniques, automation, use of robotics, globalization, greater consumer demand and acceptance of PTC products became the major factors for increased plant establishment in the later years. To the date, PTC industries exceeding 200 numbers are present in India with an annual capacity of 350 million plants per annum (Patil et al., 2021).

Impact of PTC commercialization in different sectors

#### **a) Medicine**

Commercialization of PTC benefited the sector of medicine in two ways like first, large scale production of medicine plants and second is the conservation of endangered and

rare species. Production of secondary metabolites like alkaloids, steroids, terpenoids, quinones etc., are the targets for pharmaceutical industries using PTC technique. It has been reported that, nearly 560 species of medicinal plants of India were included under Red List of threatened species. Out of which, nearly 247 are added to threatened category by Resources (IUCN) (Yadav, 2016). GOI started the gene conservation of rare and endangered species with more emphasis to the medicinal plants of Western Ghats (Patil et al., 2021).

#### **b) Agriculture**

Commercialization of large scale production of crop plants and fruit crops based industries provided a reliable source of income and continuous market. One such successful example is tissue culture of banana in Maharashtra. In Maharashtra, 50 % of planting used for cultivation in 50,000 ha. are raised through PTC. The annual production capacity of the units was reached to 125 million plants (Patil et al., 2021). In case of food crops, rice, ragi and wheat are great preference in point of view of micropropagation and food security. Recently, initiation in development for protocols for the improvement of crops like oats, maize and barley have been started (Ragavendran and Natarajan, 2017).

#### **c) Forestry**

In the context of forestry, commercialization of PTC highly focused on conservation of species and germplasm. PTC technique found to be successful in many forest trees and nearly 350 million plants can be produced per annum. Interestingly, Non-wood forest products (NWFPs) have been reported to produce nano-materials, having greater impact in the field of science and technology (Behera and Samal, 2020).

### **Plant Tissue Culture units in India**

Depending on the production of area, the units are categorized into small with production capacity of < 1.0 million plants annually. Medium and large scale plants produces 1-10 million and 10-20 million plants capacity per year. Nearly 70% belongs to the category of

small units. Large numbers of plants are present in Maharashtra. Number of units and their annual production capacity of some states are listed in the table 1.

### Assistance

Centralized universities like ICAR, New Delhi, NCL, Pune, NCS-TCP, agricultural universities, research institutes, extended the support for commercialization of plant tissue culture.

### Role of national certification system for tissue culture raised plants (ncs-tcp) in commercialization of PTC

NCS-TCP was implemented by Department of Biotechnology (DBT), under the Seeds Act 1996. It assists the tissue culture plants for the production of quality planting material. NCS-TCP strengthens the market reach of planting material through certification process. Till 2021, NCS-TCP certifies nearly 700 million plants (<https://dbtncstcp.nic.in/About-NCS-TCP>).

States	Number of units	Capacity of annual production (in millions)
Maharashtra	25	31
Karnataka	9	31
West Bengal	9	5
Kalimpong (Darjeeling)	46	1
Andhra Pradesh	4	10
Delhi	4	7
Tamil Nadu	4	27
Kerala	4	25
Haryana	3	13
Gujarat	3	12
Uttar Pradesh	3	25
Punjab	1	2
Himachal Pradesh	1	5
Odisha	1	1
Rajasthan	1	1

**Table.1. Shows the outcome of PTC units of some states in India.**

### Role of DBT in commercialization of plant tissue culture

DBT encourages various universities, laboratories, research academics for the refinement of PTC industries. At present there are 6 national centers under DBT for virus detection and quality control. DBT encouraged the establishment of two national parks in Maharashtra and New Delhi which are mainly involved in the transfer of new technology to entrepreneurs and needy people. So DBT acts as bridge between research centers and tissue culture industries (Patil et al., 2021).

### Financial assistance to commercial units

Ministry of agriculture providing assistance up to 10 and 20 lakhs for the private and public sectors, respectively. Various State Governments is providing subsidy up to 50% under fruit scheme. GOI provides maximum of 20% of project cost and 25% of airfreight subsidy. To the extent of 50% subsidy is provided for market development, development of export promotion, feasibility studies, human resource development, and organization building. There are various banks providing financial assistance like NABARD, Dena bank, Bank of Baroda, Central Bank of India and State bank of India. Each bank is having various norms in providing financial assistance (Patil et al., 2021).

### CONCLUSION

PTC is having wide scope in different sectors of greater industrial importance. It is estimated that plant tissue culture industries make \$895.006 million by 2030. Major constraints faced by the commercial plants are in financial aspects, research facilities and marketing. India is blessed with various resources and can limit this constraint using the facilities provided by GOI, various research institutes and banks. With these facilities, India can increase the capacity of commercial plants and can stand in global market.

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