



## Elementary Idea of Tissue Culture Techniques

Ashish Kumar<sup>1\*</sup>, Saurabh Singh<sup>2</sup>, Prabhat Kumar Singh<sup>1</sup>, Ram Milan<sup>2</sup> and N.A. Khan<sup>1</sup>

<sup>1</sup>Dept. of Molecular Biology and Biotechnology, <sup>2</sup>Dept. of Crop Physiology, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh (224 229), India



Open Access

### Corresponding Author

Ashish Kumar

✉: ashishkumar00094@gmail.com

**Conflict of interests:** The author has declared that no conflict of interest exists.

### How to cite this article?

Kumar *et al.*, 2024. Elementary Idea of Tissue Culture Techniques. *Biotica Research Today* 6(1),01-02.

**Copyright:** © 2024 Kumar *et al.* This is an open access article that permits unrestricted use, distribution and reproduction in any medium after the author(s) and source are credited.

### Abstract

The technique of plant tissue culture is used to propagate plants in sterile environments, frequently leading to the production of plant clones. Various plant tissue culture techniques offer benefits over traditional propagation methods, such as the capacity to create exact plant clones - even in the absence of seeds and low-germinating seeds, as well as the creation of genetically altered plants free from disease. Because it is the most promising area of biotechnological tools for today's and tomorrow's agriculture, plant tissue culture has taken the lead in the rapidly evolving field of biological research.

**Keywords:** Micropropagation, Propagation, Seed culture, Tissue culture

### Introduction

The process of growing tissues or cells outside of their original organism in a synthetic medium is known as tissue culture. Another name for this method is micropropagation. Using a liquid, semi-solid, or solid growth medium - like broth or agar - usually helps with this. While tissue culture usually refers to the culture of animal cells and tissues, the word "plant tissue culture" is more specifically used to describe the culture of plants. The term "tissue culture" is credited to American pathologist Montrose Thomas Burrows. Global food consumption has increased as a result of uneven and unstable wealth distribution. Caused food producers to feel more and more pressure and they have increased their demands for new technology that will allow for higher yields and higher-quality products (Christou and Twyman, 2004). Plant cells have two characteristics that serve as the foundation for tissue culture methods: totipotency and plasticity (Thorpe, 2007).

### Types of Tissue Culture

#### 1. Seed Culture

The most common kind of tissue culture for plants like orchids is seed culture. Explants, or plant tissue, are removed from a plant grown in vitro and used this technique to multiply by placing them in a synthetic environment. Should

a plant material be utilized specifically for this procedure, Sterilization is necessary to ensure optimal regeneration and prevent tissue damage.

#### 2. Embryo Culture

A type of tissue culture known as embryo culture entails removing an embryo from a specific organism in order to grow it *in vitro*. Using an immature or mature embryo is one way that embryo culture works. Mature embryos for culture are mainly derived from ripe seeds, whereas immature embryos (also called embryo rescue) are used from unripe or hybrid seeds that did not germinate. By doing this, the embryo eventually develops into a live plant.

Note that zygotic embryo culture produced through sexual reproduction is referred to as embryo culture.

#### 3. Callus Culture

This word describes a dividing mass of cells that is unorganized, unspecialized and disperse. When explants, or cells, are cultivated in the proper media, a callus forms. Tumor tissue that develops from the wounds of differentiated tissues or organs is an excellent illustration of this.

#### 4. Organ Culture

Organ culture is a kind of tissue culture in which an organ

### Article History

RECEIVED on 22<sup>nd</sup> December 2023

RECEIVED in revised form 01<sup>st</sup> January 2024

ACCEPTED in final form 03<sup>th</sup> January 2024

is isolated for the in vitro growth. Here, any organ of plant (shoot, root, leaf and flower) utilized as an explants for the cultivation procedure.

#### 5. Protoplast Culture

Protoplasts are also known as naked cells because they are any type of cell (bacteria, fungi, plant cells, etc.) that don't have a cell wall.

#### Major Steps of Plant Tissue Culture

##### Initiation Phase

The initiating phase is the first stage of tissue culture. Here, the desired tissue is taken out, put in, and sterilized to prevent germs from getting in the way of the process. This stage involves introducing the tissue to culture.

##### Multiplication Phase

The multiplication phase is the second stage in tissue culture, involves dividing the in vitro plant material again and adding it to the medium. Here, the medium is made up of nutrients and regulators that are suitable for growth. These are responsible of the tissue's growth and the development of several shoot.

##### Root Formation

This stage is when roots start to appearance. Hormones are necessary for rooting and, as a result, complete plantlets.

#### Importance of Tissue Culture

- Tissue culture very useful in biology because it's wide range of applications.
- It is possible to culture both plant and animal tissues. For example, animal tissue culture helps preserve an organ or tissue.
- Plant tissue culture can be used to increase yield or change a plant's genetic composition. Plant cells can be genetically altered to produce plants with desired characteristics.
- The rapid tissue regeneration of the plant is utilized in this technique. It produces clones, which are exact replicas of the original.
- Tissue culture is growing plants fast that don't require any bulbs, seeds, or tubers.
- It also helps to conserve plant biodiversity by giving rise to endangered plants.

#### Advantages of Tissue Culture

The numerous benefits of the tissue culture method are as follows:

- The plantlets can produce by using small amount of plant tissue in a very short time.

- Tissue culture use for the production of disease free plants.
- Plants can be grown all year round, regardless of the season.
- Growing plants does not require a large area when using the tissue culture method.
- New varieties are produced at a faster rate in the marketplace.
- Ornamental plants like orchids, chrysanthemum and dahlia are produced using this method.

#### Disadvantages of Tissue Culture

- Tissue culture may be more expensive and labor-intensive.
- The propagated plants may be less disease-resistant due to the type of environment in which they are grown.
- Screening is necessary before the product is enhanced. Otherwise, abnormalities may be missed and the new plants may become infected.
- Although tissue cultures have a high success rate when done correctly, success is not ensured. It is still possible that the procedure will set off a second metabolic chemical reaction, slowing or even stopping the growth of the newly transplanted cells.

#### Conclusion

The most promising application areas currently offering a glimpse of what lies ahead are those involving plant tissue culture. To produce compounds with potential applications in medicine, to enhance the nutritional value of banana crop plants and to enhance forests and fruit trees. Compared to traditional vegetative propagation techniques, *in vitro* micropropagation techniques have the following notable advantages: minimal space requirements, high rates of multiplication, independence from seasonal fluctuations, regulated culture conditions and immunity to microorganisms.

#### References

- Christou, P., Twyman, R.M., 2004. The potential of genetically enhanced plants to address food in security. *Nutrition Research Reviews* 17(1), 23-42. DOI: <https://doi.org/10.1079/NRR200373>.
- Thorpe, T., 2007. History of plant tissue culture. *Molecular Biotechnology* 37(2), 169-180. DOI: <https://doi.org/10.1007/s12033-007-0031-3>.