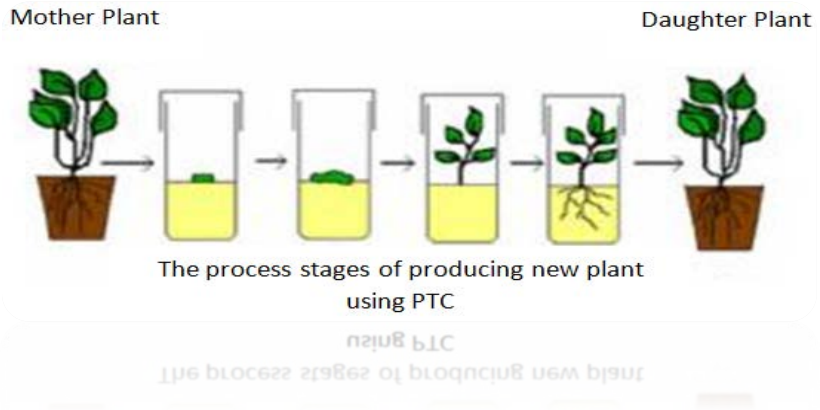
Lecture: Plant Tissue Culture

Plant Tissue Culture: the growth or regeneration of plant cells, tissues, organs or whole plants in artificial medium under aseptic or sterilized conditions and controlled environment.

Or, it is the process of producing new identical plants from any tissue of mother or original plant in an artificial nutrient medium under controlled environment.



The process stages of producing new plant using PTC

The Method of Plant Tissue Culture

- Start material includes
  - Explant
  - Culture media
- Sterilization
- Procedure

Explant: Plant tissue cultures are generally initiated from multicellular tissue fragments, called explants which obtained from living plants. Explants may originate from a wide range of plant cells or tissues such as leaf, stem, root, embryo, meristem …. etc.

Explant Selection

1-Physiological or ontogenetic age

2- Season in which the explant is obtained.

3- Size.

4- Quality of the source plant.

5- Ultimate goal of tissue culture.

Culture Media

Explants usually placed on a solid medium, or sometimes placed directly to a liquid medium. Culture media are generally composed of inorganic salts, organic and inorganic nutritional materials, vitamins and plant hormones.

Nutritional Component

1. Macro & Micro inorganic nutrients.
2. Iron (as chelating agent)
3. Vitamins
4. Plant growth regulators
5. Agar (as gelling substance)
6. Organic or Natural Compounds

Subculture

After a period of time, it becomes necessary, due to nutrient depletion and medium drying, to transfer organs and tissues to fresh media. In general, callus cultures are subcultured every 4-6 weeks. Theoretically plant cell and tissue cultures may be maintained indefinitely by serial subculturing.

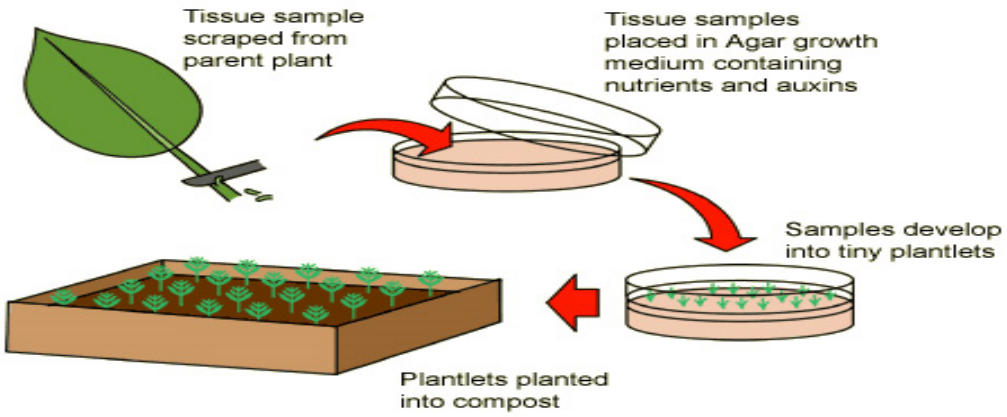
Sterilization

Three levels of containment are applied to preserve sterile conditions during culture:
1. Sterilized medium, tools, containers and explants
2. Working under sterilized environment
3. Practicing sterilizing techniques

Sterilization is the process of inactivating or removing all living organisms from a substance or surface. Different kinds of sterilization procedures were adapted in plant tissue culture

1. Heating
2. Radiation
3. Chemicals
4. Ultra-filtration

The Procedure of Pant Tissue Culture:



Application

1. The commercial production of plants used as potting, landscape and florist subjects.
2. Germplasm preservation for rare or endangered plant species.
3. To screen cells rather than plants for advantages characters, e.g. herbicide resistance/tolerance.
4. To cross distantly related species by protoplast fusion and regeneration of the novel hybrid.
5. To produce pathogen free plants.
6. Large scale growth of plant cells in liquid culture in bioreactors for production of valuable compounds, like plant-derived secondary metabolites and recombinant proteins used as biopharmaceuticals.

Limitation

1. Specialized equipment required including Laminar flow cabinets, autoclave, water purification systems, glassware ….etc.
2. High labor cost is the most limiting factor, highly skilled labor required.
3. Contamination risks:

Maintenance of aseptic (sterile) environment is difficult. Rapid spread of contaminants = widespread loss.

4. Risk of mutation arising: Artificial environment induces mutations.