Tissue Culture Fact Sheet No. 1 April 2000

Plant Tissue Culture

BARC
Biotechnology Unit
Brunei Agricultural
Research Centre

Tissue culture is an important method of plant propagation that can be readily available to growers. In the absence of microorganisms and in the presence of a balanced diet of chemicals, a piece of plant tissue will produce numerous tiny replicas of its single parent. The cells must be physically divided repeatedly and frequently in order to survive. Therefore, plant tissue culture or in vitro culture is defined as the technique of culturing plants from seeds, embryos, organs, explants, cells and protoplasts on nutrient media under sterile conditions.

Methods for In Vitro Culture

1. Callus/cell culture.
2. Protoplast culture.
3. Anther/microspore culture.
4. Organ culture-meristem/shoot tip, embryo/seed, explant e.g. node, leaf, root.

Advantages of Micropropagation of Plants Via Tissue Culture

1. Large number of plants that are true-to-type can be obtained from a small sample of tissue.
2. Establishment and maintenance of "virus-free" mother plant stock.
3. It requires only a small space for maintenance and multiplication of plants.
4. Plants are grown under controlled environment where they survive better and production rate is higher.
5. Hybrid plants can be propagated where sterility of plant is common.
6. Continuous production all year round is possible.
7. Maintenance of plants is minimal between subcultures.

Factors Affecting Growth and Development

Selection of plant materials

Healthy plants are the first line of defense against diseases. Therefore, genotype of the plant (i.e. genetic make up of the plant) is the first criterion. Secondly, the age of the plant and the position of the organ and/or tissue. Thirdly, the physiological state of plant i.e. the health of plant and fourthly, the size of explant.

Nutrients

The nutrient requirement for plant tissue culture is different from those plants propagated conventionally. The medium composition can be categorized into different groups of substances such as macroelements, microelements, vitamins/organic substances, sugars and other undefined substances. Additionally, some plants propagated in vitro need plant growth regulators such as auxins, cytokinins and gibberellins. In contrast to conventional methods, the media are prepared in either solid or liquid form depending on the nature of plants or explants to be cultured.

Physical Factors

In nature, plants need light and temperature for growth. Hence, in plant tissue culture, physical factors such as artificial light, temperature, humidity and container size determine the survival and success of plant tissue culture.

Basic Laboratory Set-Up

The basic requirements for plant tissue culture work are:-

1. An area for medium preparation.
2. A sterile room or sterile air cabinet for aseptic transfer of plant tissue.
3. A constant temperature room or incubator for growth of callus cultures.
4. Shaker facilities for cell suspension cultures.

Shoot tip culture

Runner tip culture

Seed culture

The potential for profit in a tissue culture laboratory lies in producing a significantly greater number of healthier plants in less time, space, labour and at less cost compared to other means of vegetative propagation. This concept could be the ultimate aim of a grower where an installation of a tissue culture laboratory can be the key component of project.

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