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Tissue Culture Techniques in Banana

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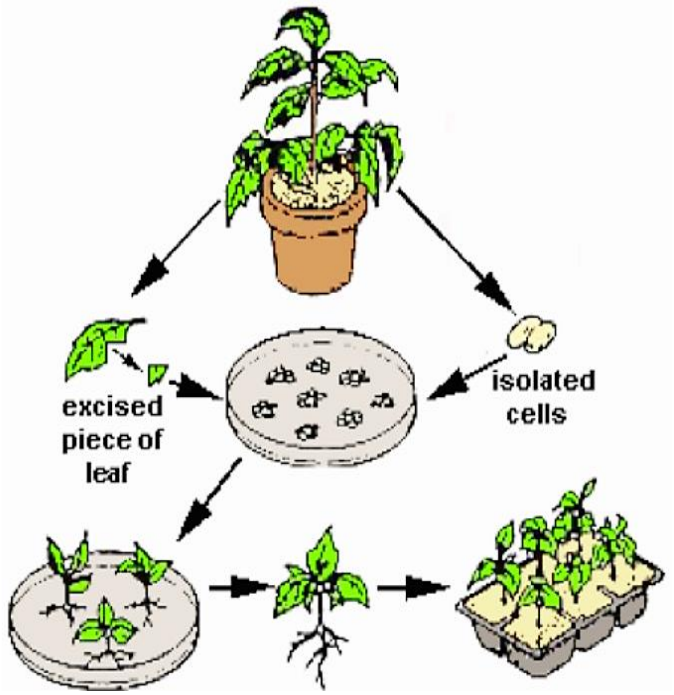
SUMMARY

Tissue culture propagation in banana is preferred for its faster multiplication rate compared to sucker propagation. Crop improvement through tissue culture has been widely and successfully attempted in different varieties of banana. The major advantages accrued as a result of crop improvement through tissue culture being substantial increase in the yield, improved quality of fruits and reduced maturity period. Hardening is an important step in tissue culture of any species as it involves acclimatization of plants for the shift from relatively comfortable laboratory conditions to the field conditions. Stage of Tissue culture i.e. Initiation, Multification , Shooting and rooting, Semi hardening and Hardening these are five stages are studied. In biological research, tissue culture refers to a method in which fragments of a tissue (plant or animal tissue) are introduced into a new, artificial environment, where they continue to function or grow. While fragments of a tissue are often used, it is important to note that entire organs are also used for tissue culture purposes. Here, such growth media as broth and agar are used to facilitate the process.

INTRODUCTION

Banana and Plantains (Musa spp.) are one of the most valued fruit products. Banana belongs to the family Musaceae and section Eumusa. It signifies variable benefits, both as a staple food as well as a major export commodity for many tropical and subtropical countries. Banana provides a balanced diet than other fruits. Banana is composed of mainly water and carbohydrates which provides energy.It is rich in Minerals, Phosphorus and Calcium. Banana Cultivation in India Banana is a globally important fruit crop with 97.5 million tones of production. In India it supports livelihood of million of people. With total annual production of 16.91 million tones from 490.70 thousand ha., with national average of 33.5 T/ha. Maharashtra ranks first in production with 60 T/ha. Banana contributes 37% to total fruit production in India. Jalgaon is a major Banana growing district in Maharashtra which occupy 50,000 hectares area under Banan (Anonymous, 2018). But most of Banana is grown by planting suckers. The technology development in agriculture isvery fast, it results in developing Tissue Culture Technique.

A Simple way of understanding Tissue Culture



Tissue Culture

Tissue culture is typically facilitated via the use of a liquid, semi-solid, or solid growth medium, such as broth or agar, in vitro under sterile growing conditions. Tissue culture is the growth of tissues or cells separate from the organism. If anybody ask why tissue culture? The tissue culture is Suckers generally may be infected with some pathogens and nematodes. Similarly due to the variation in age and size of sucker the crop is not uniform, harvesting is prolonged and management becomes difficult. (Damasco, O.P. 2005) Therefore, in-vitro colonel propagation i.e. Tissue culture plants are recommended for planting. They are healthy, disease free, uniform and authentic. Properly hardened secondary seedlings are only recommended for planting. Tissue culture is an established technique for crop improvement (Bhojwani et al., 1990). It can produce uniform, true to type and disease free plant in short time, in a small space and high volumes round the year under controlled conditions (Ganapati et al.,1992) .

Varieties

In Maharashtra different banana varieties like Safed Velchi, Dwarf Cavendish, Robusta, Grand nain, Sindhurni, Hanuman, Ardhapuri, Lalvelchi and Rajeli are grown.

Banana tissue culture involved following steps:

Procurement of mother plants

Disease free banana plantation areas are located. From these areas, the best yielding farms are chosen. The elite mother plants are selected from the disease free farms and maintained under hygienic conditions by spraying fungicides, bactericides and insecticides. At the time of use, these plants are sterilized and then used for initiation. In the laboratory five major steps are involved in the production process.

Stage I: Initiation

In the laboratory, after the surface sterilization of the plant part, the innermost tissue (ex-plant) is dissected in sterile conditions and put onto the initiation medium for growth. Initiation medium contains micro and macro elements, vitamins, irons and growth promoting hormones, solidified by agar agar.

Stage II : Multiplication

This is the next stage to multiply the plants in sterile conditions. When the tissue starts growing and forms a shoot, it is transferred to another medium containing growth-promoting hormones that enhance the cell division. The growing shoot multiplies and forms a cluster of three or four shoots. Same cycles are repeated for ten to twelve times to reach to the optimum production.

Stage III : Shooting and rooting

When the plant is ready, it has to be transferred to the rooting medium. The single shoots are separated and placed onto a shooting and rooting medium. At this stage the hormones may or may not be required. The shoot elongates and new roots come up. Rooting takes about three or four weeks and the plant becomes ready for hardening.

Stage IV : Semi-Hardening

In the semi-hardening process, the plants are made ready to sustain in the natural farm conditions. Hardening is done in the controlled conditions of the green house. The plants are taken out of the bottle and the media adhering to the root system is washed fiilly. Afterwards, the plants are graded as per their size and then transferred singly into the seed tray containing sterile, soil-less medium (a mixture of peat moss, soilrite, sand or perlite). These trays are kept in the humidity chambers for six weeks and thereafter they are kept in open in the Green House. Regular spraying of fungicides, bactericides and insecticides is done to achieve good hygienic condition of the plants.

Stage V : Hardening

In the hardening process, the plants from the seed tray are separated and transferred into polythene bags preferably black coloured, containing a mixture of sand, soil, peat moss, soilrite, perlite or compost. These plants are kept in the shade-house where Fifty to Seventy-five percent of the sunlight is reduced through the nets and entry of insects is also eliminated. Irrigation is done by drip in each polybag and sprinklers or misters maintain humidity. This hardening also takes another six weeks and the plants get fully acclimatized to environmental stresses. These plants are directly used for planfing into the field.

Flow Chart

Advantages

1.Plant tissue culture is used widely in the plant sciences, forestry, and in horticulture.
2.The commercial production of plants used as potting, landscape, and florist subjects, which uses meristem and shoot culture to produce large numbers of identical individuals.
3.To conserve rare or endangered plant species.
4.A plant breeder may use tissue culture to screen cells rather than plants for advantageous characters, e.g. herbicide resistance/tolerance.
5.Production of identical sterile hybrid species can be obtained.
6.To rapidly study the molecular basis for physiological, biochemical, and reproductive mechanisms in plants, for example in vitro selection for stress tolerant plants.

CONCLUSION

In reality, there are numerous methods used for tissue culture given that there are different types of tissues that require specific conditions for the culture process yield desired results. Both plant and animal tissue can be used for tissue culture purposes for a wide range of purposes. For instance, animal tissue culture may serve such purposes as preservation of an organ/tissue, studying the tutors or given tissues or for diagnosis purposes.On the other hand, plant tissue culture may be used for cloning purposes, genetic modification of a given plant or simply to accelerate or increase yield of the plant of interest.Tissue culture is therefore of great significance in biological studies due to its wide range of applications. The processes involved in tissue culture may be complex, requiring a lot of care to avoid such effects as contamination. Because of the complexities that may be involved in some of the steps, this may not be an experiment for everyone.

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