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PLANT TISSUE CULTURE APPLICATIONS IN HORTICULTURAL CROPS

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Abstract :

Producing plants from single cell which are true to type on artificial media in monitored environment is done through plant tissue culture. Tissue culture has been suitable method for producing disease free planting materials of vegetative propagated crops in horticulture industry. Some methodologies of tissue culture like micropropagation which is vastly used because of its production quality and time saving procedure, Though it is cost effective procedure. Somaclonal variations can produce desirable regenerated plants with improved quality and traits and also these desirable and true to type vegetative clones can be conservedfor future use to avoid their loss from biotic and abiotic stress related problems .

Keywords: plant tissue culture, micro propagation, in-vitro, somaclonal variation , horticultural crops.

Introduction

The plant tissue culture refers to production of whole plants by using all plant parts (single cells , tissues and organs) under *invitro* condition which is helpful in studying physiological, genetic , structural and biochemical problems related to plants. Tissue culture system technology is widely used for production of plants in large scale plant. In recent years, techniques of tissue culture became major industrial importance in the area of plant propagation, disease eliminating , improvement in plants and yield and production of secondary metabolites apart from their use as a tool of research . Small pieces of plant tissuescan be used for producing hundreds and thousands of plants in a continuous process. A single excised part of plant can be multiplied into thousands of plants in short period of time and space under monitored conditions, without any relation to the season and weather on a year round basis. (Gottlieb Haberlandt, 1902) A German physiologist for the first time cultured the isolated single palisade cells of leaves in knop's salt solution rich with sucrose. Those cells were alive for up to one month, they even increased in size, accumulated starch but failed to divide. He was unsuccessful but laid down the foundation for tissue culture so regarded as the father of tissue culture.(Kolte and Robbins, 1922) successors of Haberlandlt successfully cultured root and stem tips respectively. (Went, 1928) A botanist discovered firstplant growth hormone –Indole acetic acid which is helpful for growth of the cells. Hannig (1904) discovered that embryos of some crucifers which are isolated grew successfully on

sugar solutions and mineral salts. Simon (1908) by using IAA containing culture media which help in multiplication of cell he regenerated mass of callus, roots, buds from popular tree explant.(Gautheret, 1939)discovered the continuously growing tissue cultures root cambium from carrot.(Gautheret, white 1930-40) were responsible for the culture media composition we use today. (Skoog and Miller, 1957) put forth the concept of hormonal control of organ formation. With the help of micropropagation which has high coefficient of multiplication andless criteria on number of intial plants and space used the Endangered, threatened and rare species have successfully been grown and conserved. The micropropagation is also known asclonal propagation has a wide potential to produce plants of great and desirable quality, isolation is done by taking useful variants of well-adapted high yielding genotypes which has better disease resistance and stress tolerance capacities. Particular type of callus cultures give rise to progeny that have inheritable characteristics different from parent plants due to the occurrence of somaclonal variation which in turn leads to development of improved varieties which are important commercially. It is rapid propagation processes that helps in production virus free plants. Meristem tip culture in plants of banana produced plants freed from bananabunchy top virus and brome mosaic virus.

Around the mid 20th century, the idea of plants recovering or increased in their size from either callus or organ society was generally studied and get used to it and useful application in the plant multiplication industry was seen. Nowadays, plant tissue culture community applications are in a great deal more than clonal multliplication and micro propagation. In agribusiness and horticulture of plant tissue culture department uses go well past the limits.

Micropropagation:

Micro-propagation could be a method used for rapid and faithful type multiplication of plants on artificial culture media under monitored environment. Micro propagation is that the mostcommercially used area of plant part culture technique, it's widely used for production of desirable planting propagule in asexually propagated species. The significant usages offered by clonal propagation are production of disease free propagules are often obtained from oneplant in an exceedingly short period in large scale, throughout the year propagation may be disbursed and the planting material is stored in a very small space, labour costs will reduce for conservation of germplasm, for field inspections & environmental hazards should be avoided.

(Chadha. Et. al ,2010) in step with them steps involved in producing plantlets free from pathogen by meristem tip culture are: firstly the parent plant is tested for the virus and pathogens. if they're tested +ve for presence of microorganisms they ought to undergo chemotherapy , just in case if there non availability of disease free material. Meristem shouldbe excised under controlled conditions and apical dome with 1 or 2 leaf primordia should becultured on medium for production of plantlets, and plantlets should be indexed for presence or absence of viruses and pathogens then seedlings are transferred to soil , pathogen free nuclear plant stocks are maintained and in vitro mass propagation is followed.

uses of micropropagation:

- Rapid multiplication of genetically clones that possess desirable characteristics. Small pieceof explant will be proliferated into thousands of plants briefly period time. After establishing , actively dividing mass of cells are a continue of micro cuttings which may result in plant production under greenhouse conditions no matter seasons
- Micropropagation is employed for production of plants within the absence of seeds or necessary pollinators to provide seeds.
- By using micro propagation methods, can rapidly introduce selected dominant clones fromplants of ornamentals in adequate quantities to own an effect on the landscape plant market.
- By producing plants in sterilized containers that enables them to be reduced chances of transmitting diseases, pests and pathogens.

Application of Micropropagation:

- cells are screened within the place of plants for useful characters, e.g. herbicide resistance.
- Large scale development of plant cells on media inside bioreactors as a source familiar to genetically modified proteins used as biopharmaceuticals.
- To cross species which aren't related by fusion of protoplast and recover the novel partner breed.
- In vitro germplasm conservation is employed for conserving plants which don't produce seed

Conservation of germplasm :

in vitro cell and organ culture allows an alternate function for the conservation of endangered genotypes . Germplasm conservation is becoming a vital and compulsory technique worldwide due to extinction of some species of plants which require to be safeguarded for his or her speciality in countries with the assistance of tissue culture these genotypes is preserved within the kind of vegetative tissues of clones rather than seeds, to preserve the pedigree of crop and avoid it's loss due to present disasters I.e; abiotic and biotic stress . thesterile plants which can not be viable for very long time may be conserved through TC methodologies for gene banks maintenance. Cryopreservation plays important role in preservation of genotypes and genetic materials for while . during which the tissues are stored in liquid nitrogen(-196 degree) . a brand new technique named Cryobionomics is employed to check genetic stability of cryoconserved materials which may be employed in future or for germplasm conservation.

Somaclonal variations :

Bairu et al. 2011; Currais et al. 2013) concluded that Variations in genetic material do occur in undifferentiated mass of cells, protoplasts which are isolated, callus , tissues of cells and phenotypic traits of tissue culturally raised plants. In 1981, Larkin and Scowkraft coined a general term "somaclonal variation" for plant variants derived from any type of cell or tissuecultures. In somaclonal variations we will see variability in structure and number of chromosomes are observed commonly. Plants which are regenerated with changes in chromosomal changes often show changes in natural shape and colour , rate

etc. causes of somaclonal variations are : genetic cause, physiological cause, biochemical cause. (Heniz et.al, 1977) somaclonal variations are appeared in phenotypical , biochemical , genetic traits of plants which produced from in vitro cultivation . useful genetic variants are seen in sugarcane . (Mantell. Et.al , 1985) reported that dihaploids of tobacco plants isolated from pollen or anther culture show certain morphological variations in yield, plant height, leaf number, flowering, alkaloids etc . (Cassells et al. 1998) analogous DNA changes of same frequency in genetic variation can be done by induced mutations in a qualitative manner.

Applications of somaclonal variations:

- (Karp , 1995) reported that somaclonal variations coming out of tissue culture environment are very generally noticed work in vegetatively propagated plants, which can be used as a resource of new variation improvement in horticultural crops.
- (Sahijram *et al.* 2003) concluded that eligible equipments used for detection, evaluation, identification and improvement of clones which are resistant evaluated inorder to show benefits of it.
- (Yusnita *et al.* 2005)said that through somaclonal variations breeders can visualize Crop improvement by obtaining clones which can withstand to the biotic and abiotic stress as drought, pH of soil and disease tolerance.

Case studies :

1. Potato:

- (shepard , 1980) reported that somaclonal variations regenerated plants are with good growth habit, colour of tuber and tuber size uniformity, maturity date.
- (Evans .*et.al* , 1984) observed that potato and sugarcane both are somacloned which are both propagated asexually and polyploid in nature can tolerate few genetic material changes without any loss in agronomic characteristics

2. Banana:

- (Elias. *Et.al* , 1983) observed that the banana plantlets which are produced from of clonal propagation shows that isolated shoot tips from suckers were found better as material for production . shoot tip with young leaves whichis used as explant produced one plantlet. Meanwhile, explant shoot tip which consists of older leaves along with axillary buds produced multiple plantlets and single shootlets which used as explant when isolated and sub cultured developed multiple shoots.

3. Tomato :

- (Karim. *Et.al,* 2007) according to his research conducted leaves and internodeswere taken as explants for tissue culture which are cultured on MS media. The explants formed callus in combination of BAP and NAA. But internodes which used as explants showed more callus and leaf explants showed increase in shoot with BAP and shoots which are regenerated cut and transferred to IAA media for root development. internode explants showed that they ae suitablefor root production.

Conclusion :

Plant tissue culture play important role in biotechnology for helping mankind. This technique basically depends on the totipotency of cells. Micropropagation the easiest and less time consuming method which provide plantlets in large scale with desirable quality , disease free plants. Through suspension culture secondary metabolites can be produced . genotypes and vegetative tissues of species which are about to extinct can be conserved and cryopreserved in gene banks. Plants produced through somaclonal variation

can be used , proliferated or regenerated with desirable traits.

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