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Micropropagation: A Back-Bone of Fruit Crop Production of Next Generation in India

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ARTICLE ID: 080

Abstract:

Most of fruit crops are propagated commercially through cuttings because it is the easiest and most convenient method of vegetative propagation. There are certain tropical and sub-tropical fruit species (e.g., grape, lime, lemon) which root easily on cuttings, whereas certain other plants (e.g., guava, litchi, mango, avocado, jackfruit) produce root only when some manipulative treatments are given. Although, propagation of these fruits through cutting is the least expensive method of vegetative propagation and the root initiating hormones can induce early and uniform rooting. Pre-conditioning in fruits like, girdling, blanching, etiolation of shoots has been induced the roots in some difficult-to-root tropical and subtropical fruit plants.

Keywords: Cuttings, Etiolation, Girdling, Roots initiating hormones, Vegetative propagation.

Introduction:

Production of tropical and subtropical fruits has been increasing significantly faster than temperate fruits in recent years (FAO Production Yearbook, 1987). Fruit plants do not show their actual characters of their progeny, if they raised from seed and so fruit plants should be raised through vegetative means of propagation like by cutting or layering techniques or by budding and grafting techniques. The plants raised through asexual process are identical to mother plants like Cutting, budding, grafting, division and layering are main techniques of asexual propagation. Asexual propagation also includes clone and apomixes. Micropropagation has increased in popularity over the past 15 years because walnut is difficult to propagate clonally from cuttings. Different grafting and budding techniques are employed for the vegetative propagation of commercial apple cultivars, but tongue and cleft grafting are most widely used.

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Micropropagation Methods of Fruits Crop:

A plant micropropagation defined as the multiplication of an individual plant in which smallest portion of the plant is used and also have specific value to mankind. Advance methods of propagation in fruit crops such as-

1. **Meristem culture**
   - A procedure is used to elimination of disease from plants, by using a very small piece of tissue from the shoot tip as the initial explants.
   - Meristem cultures utilize the smallest part of the shoot tip as the explants, including the meristem dome and a few subtending leaves primordial.
   - The number of additional structures depends on the length of the excised stem. The primary season for this procedure is to produce a plantlet that is free of systematic viruses, virus like organisms and superficial fungi and bacteria.
   - The meristem usually free from disease organism; therefore, the smaller explants is more effective to elimination of pathogen.
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2. **Shoot tip micrografting**
   - Grafting very small meristem tips comparable to those describe in the preceding section can be used as an alternative method to produce virus free meristems for various woody plants, such as citrus and prunus.
   - For example, this procedure is important in citrus not only because its successful but also because explants can be use from onto genetically mature trees, which avoids the juvenile phenotype of nucellar seedlings also used in citrus cleanup in citrus.
   - The method fopr micrografting can be illustrated with citrus. Citrus embryos are excised from rootstock seeds, surface disinfested and planted in standard inorganic salt medium with 1% agar.
   - Seedlings are then removed and decapitated to a 1 to 1.5 cm length; cotyledons and lateral buds are excised with a mounted razor blade.
   - A 0.14 to 0.18 mm tip with 3 leaf primordial is used as scion and this give seasonable success, and the shoot tip eliminates viruses.

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- An inserted t-bud cut is made in the seedling rootstock, cutting 1mm down the stem, followed by a horizontal cut on the bottom.
- The excised shoot tip is place inside the flap next to the cambium.
- Grafted plants are placed in the liquid medium.
- Culture kept in the light for 3 to 5 weeks to heal.

3. **Anther culture**
   - The immature anther is removed ascetically and planted on the agar with a standard nutrient medium without hormones and also pollen should be at the uninucleate, microspore stage of development.
   - Somatic embryos developed from the callus derived from the haploid microspore.
   - Haploid embryo germinates to from plantlets and it's used for plant breeding to produce haploid plants.
4. **Embryo culture or embryo rescue**
   - This method mostly used by plant breeders for embryo rescue of genetic crosses and it involves the excision of an embryo from a seed and germinating it in aseptic culture.
   - These immature crucifer embryos germinated but growth was weak.
   - A principle use of embryo culture is to "rescue" embryo that would have aborted within the seed before the fruit was mature.
   - Much interspecific and inter-generic hybridization are initially successful but the embryo aborts during development.
5. **Ovary and ovule culture**
   - Ovary and ovule culture include the aseptic culture of the excised ovary, ovule and placenta attached within the ovule.
   - Although this technique was first utilizing to investigate problem of the fruit and seed development, adoptions of the procedure have uses in propagation, particularly genetic improvement.
   - Unfertilized ovules have been excised growth in culture, supplied with pollen and subsequently fertilized invitro.
   - Pollen can be placed directly on the placenta inside the ovule, where pollen tube can develop and grow immediately into the ovules without passing down the style.

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- Cultured ovule is useful for rescuing embryo that abort at a very young stage if not separated from the plant.

6. **Callus culture**
   - Callus culture results from the cell division in non-differentiated parenchyma cells.
   - Eventually a callus culture does form stratified cell layers with outer meristematic layers and inner cells that can form vascular tissue. Callus is produced on explants invitro as a response to wounding and growth substances, either within the tissue or supplied in the medium.
   - Explants from almost any plant structure or part seeds, stems, roots, leaves, storage organs or fruits can be excised, disinfested induced to form callus.
   - Continues subculture at 3 to 4 weeks interval of small cell clusters taken from these callus masses can maintain the callus culture for long period.
7. **Cell suspension culture**
   - In this method of propagation, placing a piece of friable callus in liquid medium so that the cells disassociate from each other.
   - Batch culture, cells are grown in a flask placed on a shaking device that allow and liquid to mix. Rotating device that results in continuous bathing of the tissue are available.
   - In a third method, cells on a filter paper layer are placed on a shallow liquid medium in a Petridis with no agitation.
   - Growth of cells follows a typical pattern based on changes in rates of cell division.
   - Cells firstly divided slowly (lag phage), then more rapidly (exponential) increasing to a steady state (linear), followed by a declining rate until a stationary state is reached.
   - When cells are transferred to a new liquid medium, the process will be repeated. Under proper environment condition with under proper environment condition with media control, the process can go on indefinitely.
8. **Protoplast culture**

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- Protoplast is very important method of micropropagation which is living parts of the plant cells, containing the nucleus, cytoplasm, vacuoles and various cellular structures and this is surrounded by a semi-permeable membrane.
- With the cell wall remove protoplasts can be obtained from cells in derived directly from mesophyll leaf cells.

- It permitted protoplast culture to be made was the discovery that plant cell wall could be removed by enzymes that digest pectin and allow the protoplast surrounded by its cellular membrane to survive.

Conclusion:

India is the second largest producer of fruits in the and there is a need to multiply important fruit crops in order to increase commercial production of these crops because of day by day increasing population. The micropropagation protocols for Indian fruits need scaling up for mass multiplication in order to encourage economic development and to ensure the nutritional security of small and marginal farmers and for the development of marginal farmland and wasteland.

References:

Bower JP (1982) Tissue culture of bananas, Intl Banana Nutr Newslett Bull Intl Nutr Banana. UPEB **5**: 10–11.

Cupidi, A.C. (1992). Problems in tissue culture: culture contamination. In Debergh, P.C. & Zimmerman, R.H. (Eds) Micropropagation. Netherlands: Kluwer Academic Publishers, pp. 31-44.

FAO (Food and Agricultural Organization of the UN) (1987) FAO Production Yearbook. FAO, Rome.

De Winnaar W (1988) Clonal propagation of papaya in vitro, Plant Cell Tissue Organ Culture **12**: 305–310.

Litz RE, Conover RA (1983) High frequency somatic embryogenesis from *Carica* suspension cultures, Ann Bot **51**: 683–686.