

Chapter 13

Importance of Artificial Environment Conditions on Plant Biotechnology, Plant Growth, and Secondary Metabolites

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ABSTRACT

Plant biotechnology (micropropagation, secondary metabolites, etc.) is the science of growing different plant cells under controlled artificial environment conditions. Thence, successful plant biotechnology depends on the techniques of plant tissue culture. Plant tissue culture laboratories have style needs that distinguish them from alternative forms of laboratories and a few wants are distinctive for successfully plant growth as well as production of plant secondary metabolites. The most often manipulated physical parameters are light, temperature, and relative humidity within the culture vessels. The light is most important physical factor which might have an effect on metabolite production. Light not only affects the in vitro growth and developments but also very important factor affecting the production of plant secondary metabolites. The action of light on plants happens in the most part in two ways. In the first way, the light source gives the energy required by the plant for photosynthesis. In the second way, the signal which gotten by photoreceptors it regulates plant metabolism, differentiation, and growth. Temperature is different with the different in vitro life cycle, as well as the aim of production such as plant growth or secondary metabolites production.

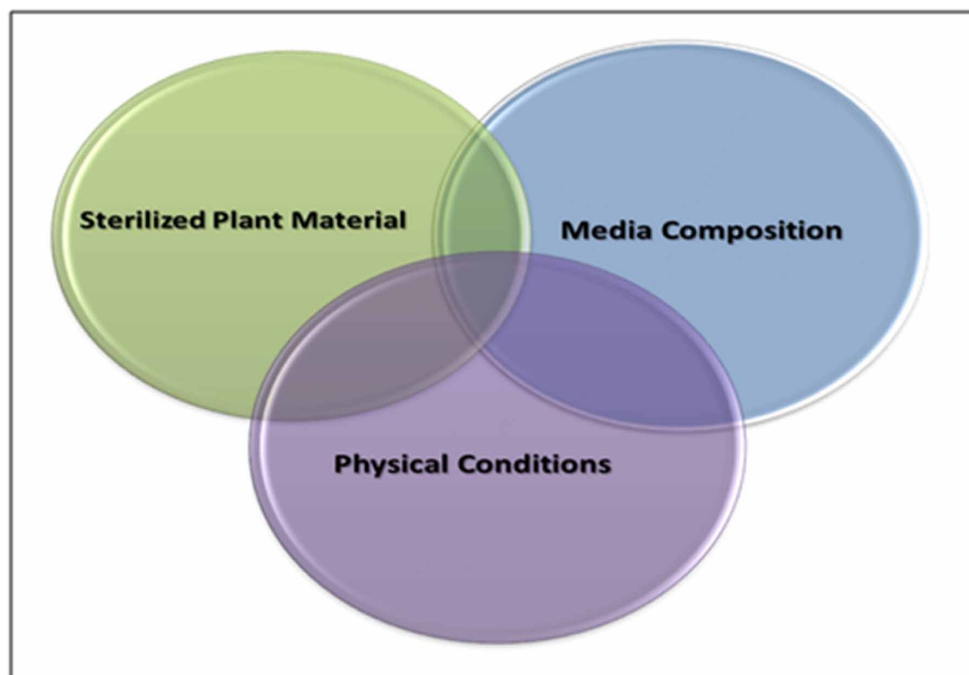
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INTRODUCTION

Plant biotechnology is presently utilized in several fields to attain completely different objectives like: micropropagation, *in vitro* preservation and cryopreservation, secondary metabolites' production etc. (Kozai and Smith, 1995).

The major factors of plant tissue culture, which are interconnected or linked to each other (Figure 1), are a) establishment and sterilized plant material, b) media composition for culture, and c) *in vitro* physical conditions for the growth room and the culture vessel (DeFossard, 1986).

Figure 1. The main barriers of plant tissue culture



The importance of *in vitro* culture futures, as contrasted to any other plant production system, is the exacting controlled, artificial, of the environment condition surrounded the *in vitro* cultures. All These environmental factors had a significantly affected on the growth characteristics (Lumsden *et al.* 1994; Chen, 2015). Unlike plants in the field, which is growing at the unpredictable environment changes, each factor of the tissue culture condition, surrounding the plant cell cultures within a vessel, can be managed (Kozai and Smith, 1995; Isah, 2015) (Figure 2).

Physical condition, factors including temperature, light (quality, quantity and duration), air movement, and the culture vessels are predetermined and can be maintained as a constant or changing during the growth cycle of plant cell cultures. These physical factors can be modified, controlled, to achieve a desired effect by controlling growth room temperature, changing vessel bottom to influence internal humidity, modified the light quality and quantity to reach the optimum growth of plant cell cultures (Kozai and Smith, 1995; Chen, 2004). This high opportunity for physical conditions control is unique to

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