Mass Propagation of Plants via Bioreactors

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Development of efficient protocols for large-scale culture of selected plant species via plant tissue culture techniques is crucial for production of not only secondary metabolites, but also recombinant proteins such as antibodies, enzymes, vaccines and blood factors. Mass propagation of both differentiated (i.e., embryos, shoots, seedlings, transformed or adventitious roots) and dedifferentiated (suspended cells) plant cultures could be succeeded by usage of liquid media, under controlled environmental conditions in bioreactor systems. In accordance with this, different types of bioreactors including airlift, stirred-tank, and temporary immersion systems (TIS, i.e., twin-flask system, ebb-and-flow, RITA®, SETISTM, BioMINT™, PLANTIMA® etc.) were optimized. Moreover, recent studies have also been directed to cut down the production costs with the usage of disposable bioreactors such as "Box-in-Bag", "Wave and Undertow", and "Slug Bubble" bioreactors. In addition, since photosynthesis, transpiration and uptake of water and nutrients can be suppressed due to the high relative humidity, poor gas exchange and the accumulation of toxic gases inside the bioreactors, forced ventilation in the culture vessels is also utilized. Thus, benefits and constraints of above-mentioned bioreactors together with our recent experiences with the usage of TIS for large-scale propagation of pistachio and photinia will be discussed as case studies. Finally, future prospects of usage of especially TIS for the industrial realization will also be outlined.

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