

THE NEW GENERATION BIOREACTORS, PGR's AND PLANT ORGAN DEVELOPMENT

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ABSTRACT

Plant tissue culture protocols largely involve adjusting ratios of synthetic auxins and cytokinins on semi-solid media to stimulate formation of callus, somatic embryos, shoots and roots. Liquid culture creates a more dynamic exchange interface between tissue and media, but requires active management of water and oxygen. Simplicity and economy have driven a new generation of bioreactor designs. Full immersion bioreactors are usually used with cell or hairy root systems. Partial immersion bioreactors allow shoot development in a more oxygenated condition. Traditional vessel sizes ranging contain 50 to 500 ml of agar media are generally increased to the 2 - 20 l in partial immersion systems and up to 10 tons in the full immersion systems. This talk focuses on partial immersion systems where shoots became larger based upon greater availability of nutrients and greater volume headspace.

The rate of solute transfer to the plant, particularly sucrose, was enhanced by liquid media vs. agar. Efficient handling of larger, wet floppy plants requires using growth retardants. Reducing plant size by adjusting the cytokinins and introducing gibberellin-inhibitors (e.g. ancymidol) allowed plants to be cut more quickly and more plants to be grown in a vessel. Examples are illustrated with ornamental taros (elephant ears), hosta and dalylilies.

Storage organ development, such as micro-tubers, micro-corms, micro-rhizomes, etc., is promoted by greater availability of sugar. Controlling shoot elongation is important to develop storage organs. The interaction between sugar and the gibberellin inhibitors (e.g. ancymidol, pacloburtazol and cycocel) has been effective in developing storage organs, *in vitro*. Similarly, jasmonic acid, dark, cold, and a variety of other environmental manipulations may be necessary. Numerous herbaceous crops including garlic, konjac, taro, and tumeric have been manipulated to form storage organs *in vitro*. Woody plants, and their somatic embryo systems, are subjects for further work.

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