IN VITRO COCONUT PROPAGATION RESEARCH BY PNGCCRI AND ACIAR

By

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Abstract

The ACIAR Coconut Improvement project is now in its third year. Research conducted in both Papua New Guinea and Australia have yielded important progress in the field of embryo-culture and promising initial results with somatic embryogenesis. Embryo culture techniques have been to collect germplasm from throughout the Pacific region. Efforts in embryo culture have concentrated on explanting methods, transportation systems, refinement of in vitro development, and acclimatization methods. Embryogenic callus lines have been established from juvenile leaf tissue and immature inflorescences. Initial results have been encouraging and rapid progress is hoped to occur in the future; possibly through collaborative research.

Introduction

The ACIAR Coocnut improvement project; a collaboration between the PNG CCRI, CSIRO and the Victorian Department of Agriculture and Rural Affairs, is now in its third year. The main objectives of the tissue culture component are: 1. to develop techniques of embryo culture suitable for use in germplasm transfer both within PNG and internationally, and 2. to evaluate the potential for somatic embryogenesis.

Discussion

To date, we have concentrated most effort on embryo culture. This research is being done

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concurrently between Australia and Papua New Guinea. We have received a collection of embryos from Solomon Island, Western Samoa, Tonga, Vanuatu, and Cocos Islands. Arrangements are in place to receive further embryos from Cook Islands, Fiji, and Kiribati. The importation of exotic material will continue and will form a useful collection for the production of hybrids suitable for Papua New Guinea as well as the Pacific Islands. At present, the germplasm collection is stranded in Melbourne whilst the Cadand-cadang - like viroid situation is clarified.

The collection of germplasm by in vitro techniques has necessitated research in the following areas:

1. Development of a field explanting method suitable for inexperiented people.

2. Development of suitable methods of transporting the collected embryos.

3. Refinement of embryos culture techniques for in vitro manipulation to allow for easy acclimatization of the plantlet.

4. Development of approriate acclimatization techniques for in vitro germinated embryos, and the discovery of the optimal stage of growth for transfer to soil.

Preliminary results show us that the use of water purification tablets for surface sterilization of the coconut embryos is perfectly adequate and simple for the person doing the job.

For transport, M'Cartney bottles have been found to be suitable because their robustness and good sealing qualities. Sterile distilled water has shown to be a good medium for transport because if contamination is present, there is very little for the contamination to grow on. The embryos may then be resterilized. A KCl solution (16.3 g/l) was found to be unsuitable because of detrimental effects on

germination and growth that occurs if used for longer than one week.

It has found that more rapid germination and growth are achieved at 30°C than 25°C.

It has been established that the modified liquid M & S Medium of Assy Bah (1986) is the best medium of three tested for germination, but that of Y3 (Eeuwens, 1978) is better for growth of the plantlet.

Research has been conducted into strategies for the development of a suitable root system for acclimatizatioon. An increase in the length of primary root has been observed by use of 8% sucrose content of basal medium, and also by the post-germination aplication of high NAA concentrations (40 mg/l). This hormonal application also stimulates a high production secondary roots and adventitious roots. However, this increase in root production is accompanied by a decrease in shoot production. An optimum ratio must be determined and work in this area is being conducted.

We are currently investigating the effect on growth and development in vitro of different carbon-sources and solid versus liquid phase of the basal medium.

Preliminary trials have shown a degree of success in acclimatization methods for transplanting out of the test tube. There is potential in both hydroponics and use of a solid medium.

Work in the area of somatic embryogenesis has been conducted at the Horticultural Research Institute in Melbourne where considerable expertise in tissue culture and recombinant DNA technology has been brought together.

Research in somatic embryogenesis started last year. It was instigated as part of the ACIAR coconut improvement project to mass propagate useful palm types once they have been developed in PNG.

Even though we are just starting-out, our initial results are quite encouraging. If there is a breakthrough in vegetative propagation, and details were published, the PNG breeding programme would be able to utilize such technology either through workers in Australia or through ACIAR trained workers in PNG.

To date, our work has been aimed at comparisons between basal media, explant sources, carbon sources, gelling agents, and the use of hormonal and osmotic manipulation.

We have established embryogenic lines from juvenile leaf tissue and immature inflorescences. Work has recently begun on mature leaf tissue.

Low auxin treatments on juvenile leaf tissue has yielded soft friable callus tending towards the production of nodular structures with time. Sporadic embryoid germination has been observed from this callus line.

Low auxin treatments on immature inflorescences has very recently shown some interesting organization; however, the outcome of this development is not yet known.

Hard, compact, nodular callus of the Wye College (Branton L Blake, 1983) type has been achieved from both juvenile leaf and immature inflorescence tissue using a high concentration of 2, 4-D.

In the short time that we have been working on somatic embryogenesis techniques, we have achieved rapid progress, thanks to the ground work done by the other workers in the field. Initial results show a potential for success; but only after considerable work. Success for everyone may come early if there was to be a collaborative effort and sharing experiences through close communication and periods of exchange visiting.

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