B-37: Mass propagation of ginger through tissue culture

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Ginger (*Zingiber officinale* Roscoe) is a plant with high commercial value, both as a medicinal plant and as a cooking ingredient (spice). Some varieties of ginger are used commercially to make ginger preserve which has high export potential. In the Ayurvedic System of medicine ginger is used for several diseases such as dyspepsia, flatulence, colic, vomiting and pains in the stomach. Also it is effective for colds, coughs and fevers. "Chinese ginger" (here referred to as variety 1)is especially suitable for making ginger preserve due to its large size and fleshy (juicy) consistency. The variety which is found locally (variety 2) with small compact rhizomes is preferably used in traditional medicine.

The plant rarely produces seeds and is propagated by vegetative means. Large-scale cultivation of this plant is limited by lack of uniform planting material. Therefore the methodology described was perfected for large-scale production of propagules of the 2 varieties of ginger.

Shoot-meristems (approx. 5 mm in length) of the 2 varieties of ginger obtained from field-grown plants were used as explants. They were surface sterilized in 70% ethanol (30 sec) and 20% v/v commercial "Clorox" with Teepol (2-3 drops/100 ml) for 10 min followed by 0.1% $HgCl_2$ (5 min) under constant stirring. After rinsing 3 times with sterilized distilled water, the final explants (about 2 mm) were prepared by removing the outermost layers. Then the shoot-meristems were cultured in agar-solidified (0.8%) MS medium supplemented with 3% sucrose, cytokinin BAP (0.1-1 mg/1) and auxin (0.01-0.5 mg/1) for primary culture establishment.

Shoots of primary cultures were transferred to shoot multiplication media based an MS constituents. These media (liquid) contained BAP (0.1-2 mg/1) and were agitated (60 rpm) to facilitate shoot multiplication.

Well grown shoots were then isolated and cultured in root induction media (liquid) incorporated with sand. These media were also based on MS constituents supplemented with BAP (0.1-1 mg/1) and IBA or NAA (0.0-0.5 mg/l). Subsequently the rooted plantlets were transferred to a soil mixture of sand : topsoil : compost 1:1:1.

The most effective growth regulators and their concentrations in culture establishment medium for early and satisfactory shoot-formation for both varieties was the medium containing BAP (1 mg/l) and IBA (0.5 mg/l). In this medium well developed shoots were formed within 3-4 weeks of culture. Transference of these single shoots to liquid media containing BAP (1-2 mg/l) kept under agitation resulted in multiple shoot formation. BAP at these concentrations yielded 10-12 shoots from variety 1 and
6-8 shoots in variety 2 within 3-4 weeks and there was no significant difference between the treatments.

The best medium for root induction was the medium containing BAP (0.1 mg/l) and NAA (0.4 mg/l). In this medium 4-5 roots were visible per plant within 4 weeks of culture. In the present study, ginger plantlets could easily be established in soil with a high rate of survival (80- 90%).

An initial problem was encountered in elimating microorganisms from the explants as they were taken from rhizomes grown in ordinary soil. However it was overcome when the rhizomes were washed thoroughly using a soap solution, and rinsed under runinng tap water for 30 min followed by chemical sterilization. The sterilization procedure adopted in this study gave 80% survival. The contaminants were mostly fungal and rarely bacterial.

An extremely high multiplication rate was obtained by this technique when cultures were agitated. Stationary cultures can also be used for multiplication, but the rate of proliferation was less. Rooting of individual shoots was achieved easily and transfer of plantlets did not require any sterilization of

soil. The growth of plants obtained by tissue culture was found to be more rapid and healthy when compared to ginger plants propagated by the conventional method.