In Vitro Propagation of Sweet Potato

R. E. Litz\(^2\) and R. A. Conover\(^3\)
University of Florida, Institute of Food and Agricultural Sciences, Agricultural Research and Education Center, Homestead, FL 33031

Additional index words. Ipomoea batatas, boniato, tissue culture

Abstract. In vitro propagation of 2 selections of white-fleshed sweet potato (Ipomoea batatas (L.) Lam) was obtained on modified Murashige and Skoog media using lateral buds and shoot apices as primary explants. Cultivars differed in response to exogenous levels of growth substances and in rate of proliferation. Optimum shoot regeneration from 'White Star' explants was induced by 1 mg/liter benzyladenine (BA) and from Plant Introduction (PI) 315343 by 1 mg/liter kinetin with 1 mg/liter indoleacetic acid (IAA).

The sweet potato is conventionally propagated by vine cuttings in the tropics and sub-tropics. This method is ineffective for maintaining stock plants free from disease and from insect pests such as the sweet potato weevil, Cylas formicarius elegantus (Sum.). In addition considerable variation can occur within sweet potato over a period of time as a result of mutation.

A large collection of white-fleshed sweet potato breeding lines is available at the Univ. of Florida Agricultural Research and Education Center in Homestead. This study was initiated to investigate tissue culture of sweet potato by induction of axillary bud growth from vine cuttings in order to devise a rapid propagation method, to avoid genetic instability that can result from callus cultures (1), and to maintain pest-free propagules.

Primary explants were isolated from shoot tips and axillary buds of trellis-grown vines of the white-fleshed 'White Star' and selection PI 315343. Explants (3mm) were sterilized with a brief rinse in absolute alcohol, in 1% (by vol) sodium hypochlorite for 10 min with constant agitation, and then transferred through 3 rinses of sterile distilled water before transferring onto solid media in culture tubes.

Murashige and Skoog (2) basal medium was used with the addition of 30 g/liter sucrose, 8 g/liter Difco Bacto agar and 10 g/liter activated charcoal. Responses of the 2 selections to 0.5—2.0 mg/liter BA and to 0.5—2.0 mg/liter kinetin, with 0.5—2.0 mg/liter IAA were measured. The pH was adjusted to 5.8 with 1N KOH and the media were sterilized by autoclaving at 1 kg/cm\(^2\) and 120\(^\circ\)C for 15 min. Growth room temperature was constant at 27-29\(^\circ\)C with a photoperiod of 16 hr light (3.5 klx) and 8 hr darkness.

Within 2 weeks of isolation on culture media, callus was initiated at the cut surfaces of explants of both sweet potato lines. The rapidly growing callus had a hard texture and turned bright green within 2-3 days of formation. Excess callus growth was removed at intervals and activated charcoal was incorporated into the medium to inhibit excessive callus formation. 'White Star' explants formed less callus than PI 315343 and shoots were regenerated on media containing 1 mg/liter BA. 'White Star' callus formation was stimulated on media containing IAA, and particularly from lateral bud explants. Compared with 'White Star' explants, PI 315343 did not form much callus on media containing 1 mg/liter kinetin and 1 mg/liter IAA.

Shoot induction from quiescent apical meristems became apparent 5 weeks after culture establishment, although lateral bud explants continued to produce callus for another 2-3 weeks before shoot growth was observed. Adventitious roots were initiated from callus and from the base of young plantlets. Small, rooted transferrable plantlets were formed from apical explants within 8 weeks after explanting (Fig. 1 and 2) and 2-3 weeks later from

<table>
<thead>
<tr>
<th>Passage no.</th>
<th>Weeks after initial culture</th>
<th>Avg no. of shoots/plantlet</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>9.6</td>
</tr>
<tr>
<td>2</td>
<td>13</td>
<td>8.7</td>
</tr>
<tr>
<td>3</td>
<td>18</td>
<td>7.8</td>
</tr>
<tr>
<td>4</td>
<td>23</td>
<td>7.2</td>
</tr>
<tr>
<td>5</td>
<td>28</td>
<td>9.5</td>
</tr>
<tr>
<td>6</td>
<td>33</td>
<td>9.2</td>
</tr>
<tr>
<td>7</td>
<td>38</td>
<td>7.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Avg increase/5 week period</th>
<th>White Star</th>
<th>PI 315343</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8.5</td>
<td>5.1</td>
</tr>
</tbody>
</table>

Fig. 1. Regenerated 'White Star' sweet potato plantlet on Murashige and Skoog medium with 1 mg/liter BA.

Fig. 2. Regenerated PI 315343 sweet potato plantlet on Murashige and Skoog medium with 1 mg/liter kinetin and 1 mg/liter NAA.

Fig. 3. Field plot of tissue culture-derived sweet potato selection PI 315343.
lateral bud explants. Shoot proliferation averaged 8.5/5 weeks for 'White Star' and 5.1/5 weeks for PI 315343 (Table 1).

Rooted and unrooted plantlets were removed from culture and transferred to potting mixture under intermittent mist, and were successfully transferred to 15 cm pots in a greenhouse prior to field trails. Established plants were transferred after 4 months into prepared beds, grown under field conditions for 3 more months (Fig. 3) and roots harvested.

At no time during proliferation of the stocks in culture, or during growth after potting and transplanting to the field, was there evidence of variability in vine growth or storage roots. These results suggest that in vitro culture of sweet potato might be useful for rapid increase of planting stock of new cultivars or in the propagation of seed stock in certification programs for established cultivars.

Literature Cited


Propagation of Cordyline terminalis from Callus Culture1

Grace W. P. Mee2
Genetics and Pathology Department, Experiment Station, Hawaiian Sugar Planters' Association, Aiea, HI 96701

Additional index words. 2,4-D, Hawaiian ti

The Hawaiian ti plant, Cordyline terminalis (L.) Kunth, a woody ornamental plant, can be propagated in vitro from shoot tips, using several medium modifications (2,3). Propagation of the ti plant can also be achieved by differentiation from callus tissue derived from young leaves near the apical meristem. Using this technique, it is possible to rapidly propagate ti plants to satisfy local needs and to supply foreign countries with large shipments of possibly disease- and pest-free plants. The procedure may be applicable to herbaceous as well as to woody monocotyledonous as plants.

The method of propagation used is a modification of the routine procedures for tissue culture of sugarcane (1). Shoot tips 2.5-cm long were obtained from vigorously growing plants of C. terminalis, surface sterilized with 95% ethanol, followed by a 1 min dip in 95% ethanol. The shoot tips were then soaked for 20 min in 1% sodium hypochlorite (20% Clorox) and rinsed 3 times with sterile distilled water. After removal of the outside tissue, shoot apices were cut into 3-mm-long sections and placed on the basal MS (Murashige and Skoog) medium (4), plus 2,4-dichlorophenoxyacetic acid (2,4-D), 3 mg/liter; thiamine hydrochloride, 1 mg/liter; myo-inositol, 100 mg/liter; coconut water, 10% (by vol); sucrose, 20 g/liter; and agar, 9 g/liter. pH was adjusted to 5.6 before adding agar. Cultures were incubated at 28 to 30C under continuous lighting of 1 klx (Sylvania GRO-LUX F40-GRO).

Callus growth developed on the exposed cut surface of shoot apices in 2 to 4 weeks (Fig. 1). Differentiation of plants from callus tissue was accomplished by transferring callus to a basal medium without 2,4-D (Fig. 2). The greatest number of plants were produced when callus was transferred to a basal medium 2 or 3 times at monthly intervals before final transfer to the differentiation medium. No roots were induced in the presence of 2,4-D.

The addition of NAA (5 mg/liter) to MS medium improved root growth. Further growth occurred when differentiated and rooted plantlets were potted in vermiculite (Fig. 3). After 3 months of callus growth and differentiation, each shoot apex yielded 200 to 300 plants.

Fig. 1. Callus tissue of Hawaiian ti plants developed in vitro from exposed young leaf sections on the cut surface on MS basal medium with 2,4-D, 3 mg/liter; and coconut water, 10% (by vol).

Fig. 2. Shoots of Hawaiian ti plants forming in vitro from young leaf callus tissues on MS basal medium plus coconut water, 10% (by vol).

Fig. 3. Rooted plant of Hawaiian ti plant differentiated from callus tissue is ready for potting after 4-month culturing on MS basal medium with coconut water, 10% (by vol).

Literature Cited