In Vitro Propagation of Jícama (*Polymnia sonchifolia* Poeppig & Endlicher): A Neglected Andean Crop

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Polymnia sonchifolia, a Composite commonly referred to as jícama, yacon, or aricama, is an Andean distant relative of the sunflower. Jícama is grown for its edible tubers that usually are eaten raw. Its flavor has been described as similar to a fresh-picked apple with a sweet taste reminiscent of watermelon (National Research Council, 1989). The plant grows at medium altitudes 900–2750 m in the Andean highlands of Colombia, Ecuador, Perú, and Bolivia, but it has been cultivated at elevations up to 3400 m in Ecuador (Castillo and Nieto, 1990; Hermann, 1992; Nieto et al., 1984). This neglected plant is part of the diversity of crops that served as important storage food during the evolution of the Andean civilization, which emerged ≈4500 years ago. Roots and tubers of most species store carbohydrates in the form of starch, a glucose polymer. Jícama, however, stores carbohydrates in the form of inulin (fructose). Thus, its cultivation could provide dietetic products and perhaps a natural sugar substitute (Hermann, 1992).

Jícama is a herbaceous plant propagated easily from offset, stem cuttings and tuber divisions. However, an in vitro propagation method to establish, propagate, and maintain

valuable collections of *P. sonchifolia* in the Germplasm Bank of the Instituto Nacional Autónomo de Investigaciones Agropecuarias (INIAP) in Quito, Ecuador, needed development. Selections planted in the field demanded intensive cultural practices and, when left unattended, were lost because of prolific offset production.

Explant preparation and culture media. Stem cuttings (10–15 mm long) were collected from field-grown plants, dipped quickly in 80% ethanol, disinfected for 20 min in a 1% sodium hypochlorite solution containing 0.05% Tween-20, and rinsed twice for 1-min intervals in sterile distilled water. Explants (1–2 mm) were excised from axillary buds and placed in 18 × 150-mm test tubes containing 5 ml of establishment medium composed of MS basal medium (Murashige and Skoog, 1962) plus 4.4 μM 6-benzylaminopurine (BA), 0.49 μM indole-3-butyric acid (IBA), 3% sucrose, and 0.8% Difco Bacto agar. The pH was adjusted to 5.7 before autoclaving for 15 min at 121°C. Explants were cultured at 20±2°C under a 16-h photoperiod (40–50 μmol·m⁻²·s⁻¹).

Shoot development and rooting. Combinations of BA and IBA in concentrations 10 times below and above the establishment medium were compared for their effect on axillary budbreak and shoot and root development. Each treatment was replicated 10 times in 7.5 × 7.5 × 10-cm Magenta GA7 (Chicago) vessels containing 20 ml of medium. The best

response was obtained with 4.4 μM BA and 0.49 μM IBA, which provided the shortest time to budbreak, the highest levels of shoot development, and the most shoots and roots per plantlet (Table 1). BA was not removed from the medium for rooting because, for germplasm conservation, it is important to induce shoot development and some rooting. Jícama rooting was not inhibited by the cytokinin BA. Two to three explants were used per Magenta container for reculturing every 4 weeks. In treatments with 44 μM BA and 4.9 μM IBA, 16.2 days were needed to budbreak. A total of 40% of cultures developed shoots, and 2.9 shoots and 2.2 roots per plantlet were recorded. Explants treated with 0.4 μM BA and 0.05 μM IBA grew more slowly, and only half developed shoots. They had fewer shoots and showed low rooting levels compared to plants with 10 times higher levels of growth regulators. Explants cultured on medium lacking plant growth regulators did not develop shoots or roots (Table 1), but callus masses proliferated. Plantlets (with shoots 2–3 cm long and roots >3 cm long) that were transplanted to sandy loam soil, covered with transparent plastic cups to retain humidity, and shaded 40% were acclimatized successfully in 4 weeks.

The micropropagation procedure established through this research has subsequently permitted the preservation of >28 collected jícama genotypes in INIAP's Ecuadorian germplasm bank.

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Table 1. Effect of BA and IBA on budbreak and shoot and root development of jícama during in vitro propagation. Data are means of 10 replications.

Growth regulator (μM)		Time to budbreak (days)	Shoot development (%)	Avg no.	
				Shoots/explant	Roots/plantlet
				Wks of culture	
BA	IBA			4	8
0.0	0.00	---	0	0.0	0.0
0.4	0.05	20.0	50	4.3	6.0
4.4	0.49	10.1**	90**	7.6**	12.4**
44.0	4.90	16.2	40	2.9	2.2

**Significant difference between the treatment noted and all others, using F test at $P < 0.01$.