# ABSTRACT

## Development of a micropropagation system for Jamaican yams (*Dioscorea* spp.): Initiation to tuber production

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The traditional method of yam propagation, which uses tuber heads as the planting material, has a low multiplication rate and is associated with soil diseases. Yam has been micropropagated but previous multiplication rates were low. The purpose of this research was to develop a rapid micropropagation system for the Jamaican yams *D. cayenensis* cv Round Leaf Yellow Yam (RLYY) and *D. trifida* cv Short Neck Yampie (SNY), compare the efficiency of this system with other propagation methods, and examine the effects of various factors on the physiology and growth of the yam plantlets.

Due to the difficulty encountered in increasing the *in vitro* multiplication rate, several factors were examined *in vitro*. A rapid micropropagation system for SNY and RLYY, from initiation to tuber production, was developed. This micropropagation system was also successfully evaluated with other Caribbean and African yam cultivars. A reliable initiation method was devised using nodal explants from vines less than two months old from sprouted minisetts, leafy cuttings or small tubers. A new basal medium (BM) was devised. Several PPO inhibitors increased the

multiplication rate as well as decreased browning of the medium. The best growth regulator supplement was 0.5 mg $l^{-1}$ BAP. During Stage II, media needed to be supplemented with ammonium nitrate for one subculture for RLYY and the pH adjusted to pH6 for SNY and to pH4 for RLYY. During Stage III, propagules rooted best on BM with or without IBA. Three hardening methods were identified which gave a high survival rate: hardening in small bags filled with sawdust (or sand), soil and manure mix (1:1:1) and covered with a plastic cup for one week; hardening *in vitro*; or direct hardening in the field. $R_0$ tubers averaged 1.9 per micropropagated RLYY plant at 100 g/plant and 4.4 per SNY plant at 40 g/plant. Leafy cuttings from micropro-pagated RLYY plants yielded 1.3 $R_0$ tubers (74g/plant). $R_1$ tubers averaged one per RLYY plant averaging 1422 g or 13.0 tubers per SNY plant at 521 g/plant. Sprouting of RLYY minisetts cut from $R_1$ tubers was high (95% after 5 weeks).

Two growth forms were identified: slow-growing juvenile-like (type I) shoots and faster-growing adult-like (type II) shoots. The *in vitro* type II shoots grew quickly (8x per month) on BM0.5BAP, especially when the pH of the medium was adjusted. The plantlets, when transferred *ex vitro*, changed from type I to type II growth in a step-by-step process, with lateral tip development, internode lengthening and tuber formation. This phase-change also occurred as microtubers (RLYY) and small tubers (SNY) sprouted. Maximising adult-like growth in culture decreased the cost of production of this newly developed micropropagation system, and shortening the juvenile type I phase *ex vitro*, resulted in a larger harvest (tubers twice as heavy).