Vegetative multiplication of the coconut by somatic embryogenesis

Jean-Luc Verdeil, Stéphane Dussert,
Frédérique Grosdemange, Christine Huet,
Jacqueline Buffard-Morel

In coconut, productivity could be significantly increased if homogeneous material obtained by cloning of highly productive individuals were available. At the present time the coconut, which is generally allogamous, is reproduced by seed. For the past decade CIRAD and ORSTOM have been working jointly on a technique for cloning the coconut, a plant which is particularly recalcitrant *in vitro*.

Recently considerable progress was made when vitroplants were obtained on six different clones using methods that could be reproduced.

The experimental procedure was as follows: callogenesis using fragments of young leaves or inflorescences from adult select trees (20-25 years); isolation of the calli and induction of embryogenesis; maturation and conversion of somatic embryos.

Histological description of embryogenic calli

The calli obtained (Plate V, 2) were isolated from the explant from the sixth month on, placed on a medium supplemented with 2.4-D (as compared to the

callogenesis medium) and containing activated charcoal. Two embryogenesis processes were observed.

One of the processes started from complex epidermized meristemic structures with organogenic capacity which produced embryos of pluricellular origin. This process resulted in embryo-type structures that were normally incomplete (no caulinary meristem).

The second process, of unicellular origin with individualization of typical embryogenic cells as in the oil palm, led to the formation of typical proembryos (Plate V, 3) presenting all the characteristics of the first stage of zygotic embryogenesis as described by HACCIUS and PHILIP (1978).

Demonstration of specific nutritive requirements during initiation of embryogenesis

The main cations and the main anions were measured (Dionex ionic chromatography) in multiplication and embryogenesis media carrying the lines of homogeneous calli produced by multiplication of granulous calli. In a given tissue line, absorption of ammonium, calcium and magnesium increased during embryogenesis initiation.

These specific nutritive requirements were accompanied by an increase in proteosynthesis resulting in the accumulation of protein in embryogenic cells. This study led to better control of initiation of embryogenesis through modification of the composition of the medium and of the frequency of transfer of cultures.

Maturation and conversion of embryos

Maturation of embryos is obtained by progressive reduction of 2.4-D concentration. Histological sections allowed us to show—for the first time in coconut—somatic embryos presenting a perfectly structured shoot meristem. The development of leaf shoots took place in light on a medium without hormones (Plate VI, 1, 2 and 3). Rooting generally required treatment in the presence of naphthalene acetic acid (NAA).

Mastery of the multiplication of embryoids, which is presently under study, should allow—in the not too distant future—mass production of vitroplants.

Bibliography

BUFFARD-MOREL J., VERDEIL J.-L., PANNETIER C., 1992. Embryogenèse somatique du cocotier (*Cocos nucifera* L.) à partir d'explants foliaires : étude histologique. Canadian Journal of Botany, 70 (4) : 735-741.

HACCIUS B., PHILIP V., 1979. Embryo development in *Cocos nucifera* L. A critical contribution to a general understanding of palm embryogenesis. Plant Systematics and Evolution, 132 : 91-106.

SCHWENDIMAN J., PANNETIER C., MICHAU-FERRIERE N., 1988. Histology of somatic embryogenesis from leaf explants of the oil palm *(Elaeis guineensis).* Annals of Botany, 62 (1) : 43-52.

VERDEIL J.-L., HUET C., GROSDEMANGE F., RIVAL A., BUFFARD-MOREL J., 1992. Embryogenèse somatique du cocotier (*Cocos nucifera* L.) : obtention de plusieurs clones de vitroplants. Oléagineux, 47 (7) : 465-469.

Verdeil J.L., Dussert Stéphane, Grosdemange Frédérique, Huet Christine, Buffard-Morel Jacqueline. (1994).

Vegetative multiplication of the coconut by somatic embryogenesis.

In : Teisson C. (ed.) In vitro culture of tropical plants. Montpellier : CIRAD, 65-67.

(Repères). ISBN 2-87614-162-0