Coconut Plumule: Tissue With an Efficient Regeneration Capacity

The coconut industry is currently burdened with a number of problems such as senility of existing plantations and prevalence of various pests and diseases. Due to its long pre-bearing age, high heterozygosity, long interval between generations and exclusively seed propagated nature, crop improvement in coconut is a difficult and time consuming programme. The predominantly cross-fertilized nature of coconut results in enormous variability in the seedling progenies. Only about 20 per cent of the estimated annual requirement of quality planting material to replace senile and disease ravaged plantations is met.

In vitro vegetative multiplication of high performance individuals thus offers the only hope for the production of homogenous planting materials and for substantial improvement in plantation productivity. Standardization of a viable protocol for clonal propagation would open up tremendous possibilities of meeting the requirement for quality, uniform, disease resistant/tolerant planting material and of breaking down productivity barriers. A reliable regeneration system is also an important prerequisite for successful genetic transformation.

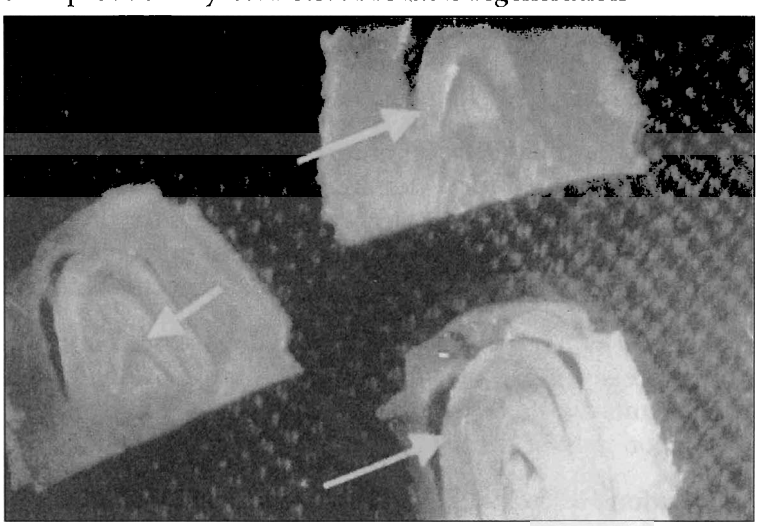

Fig. 1. Plumular slices

Unfortunately, coconut is a highly recalcitrant species with respect to tissue culture. Over the past few decades, many researchers have directed their efforts towards developing a method for clonal propagation of coconut. Despite this concerted effort, success in this area has been limited and only a few clonal plants have been ever established in the field. Various problems encountered during *in vitro* propagation of coconut are intensive tissue browning (due to oxidation of polyphenols), slow *in vitro* response, low rate of somatic embryogenesis and variation in tissue response due to heterogeneity of explants taken from different individuals. A variety of protocols have been developed using a range of explants *viz.* immature inflorescence, immature and mature zygotic embryos, young tender leaflets, leaf bases from unopened spindle and plumular tissue.

Plumular tissues, which are juvenile and highly meristematic, have shown potential for *in vitro* regeneration. They exhibit more rapid development of calli and somatic embryos and greater frequencies of plant regeneration compared with calli from inflorescence or leaf tissues. Zygotic embryos are scooped out along with a portion of the endosperm using a cork borer from mature dehusked and split coconuts (11-12 months old). The embryos are extracted from the endosperm plug using a scalpel. Under asceptic condition the embryos are washed in 50% chlorine water for 20 minutes and then rinsed four times with sterile distilled water. The sterilized embryos are then inoculated into plain, solidified Y3 medium (Eeuwens, 1976) supplemented with charcoal. The cultures are then incubated in the dark.

After a month in the conditioning medium, the plumular ends are sliced out from the embryos and inoculated into Y3 supplemented with an auxin (usually 2,4-D or picloram). The cultures are then incubated in the dark for two months. The calli developed are transferred to media containing the auxin (at reduced concentrations) in combination with a growth regulator (cytokinins or polyamines). Somatic embryoids and meristemoids, when formed, are transferred initially to plain liquid Y3 medium without any growth regulators and later to a medium containing BAP. Plantlets derived from meristemoids are transferred to a rooting medium (liquid Y3 medium supplemented with IBA). Plantlets with 3-5 leaves and adequate rooting are removed individually from the culture tubes and washed with sterile water. Before transferring to pots, the plantlets were treated with a fungicide and thereafter with IBA solution for an hour. The potting mixture consists of sterilized soil, sand and coir dust in equal proportions. Initially, the plantlets are covered with polythene

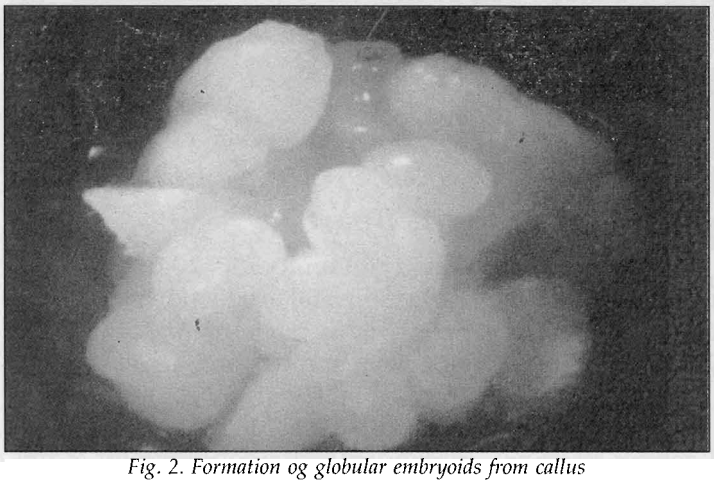

Fig. 2. Formation og globular embryoids from callus

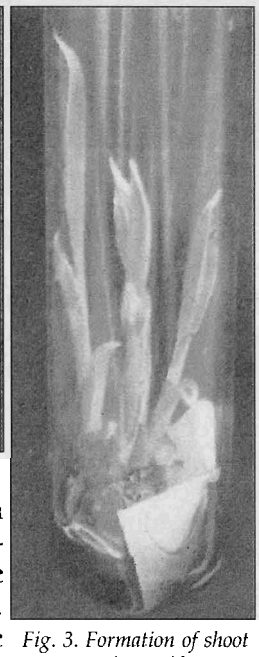

Fig. 3. Formation of shoot meristemoids

bag for two weeks. Gradually the bags are perforated to reduce humidity and later the bags are removed during the night. After 4 weeks, the bags are removed completely.

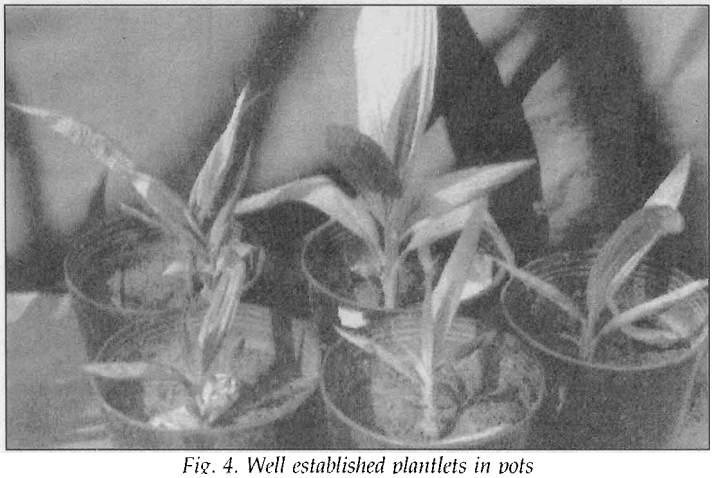

Fig. 4. Well established plantlets in pots

Plumular tissue is not an ideal source of explant for *in vitro* propagation given the cross-pollinated nature of coconut. However, the development of an efficient method of cloning coconut using plumular explants offers a potential for rapid multiplication of proven hybrids. It also offers the possibility of long-term *in vitro* conservation of significant coconut germplasm by cryopreservation of plumular explants (Hornung *et al.*, 2001). Oropeza *et al.* (2002) have suggested the possibility of massive multiplication of elite palms selected on the basis of resistance to lethal yellowing disease of coconut using plumular explants. Also, the encouraging results of *in vitro* plumule cultures can form a model for future regeneration studies from adult tissues of coconut.

References

Eeuwens CJ (1976) Mineral requirements for growth and callus initiation of tissue explants excised from mature coconut palm (*Cocos nucifera* L.). *Physiol. Plant.* 36 :23-28

Hornung R, Domas R, Lynch PT (2001) Cryopreservation of plumular explants of coconut (*Cocos nucifera* L.) to support programmes for mass clonal propogation through somatic embryogenesis. *Cryoletters* 22: 211-220

Nair MK, Anitha Karun, Rajesh MK (1999) Research potentialities of coconut biotechnology. *AgBiotechNet* 1: 1-7

Oropeza C, Chan JL, Sáenz L, Azpeitia A, Reyes E, Zéñiga JJ, González T (2002) Tissue culture for propagating lethal yellowing-resistant coconut, Paper presented at CIMbios conference, November 25th -28th, CICY, Mérida, Mexico.

M.K.Rajesh, E.Radha, K.K.Sajini, Anitha Karun

Biotechnology Section, Crop Improvement Division, CPCRI, Kasaragod 671124

Drumstick (Murungai) with a Promise

Drumstick is a valuable vegetable with a number of minerals and vitamins that are essential for human system. The leaves are used as green vegetable. A number of delicacies are prepared using pods of drumstick. Drumstick has medicinal properties. Tamil Nadu Agricultural University has released a number of varieties suitable for different agro climatic zones. New varieties of drumstick which are of one year duration with high yield potential under irrigated conditions are being cultivated widely. With encouragements and guidance from the departments of horticulture a number of short duration crops viz., cabbage (egg plant), cauliflower, radish, chillies, tomato, onion, ladies finger (bendai) etc., are raised as inter crops with murungai in districts of Cuddalore, Villupuram, etc. Ratoon crops of Murungai can be taken up during the subsequent years. Murungai is also cultivated under rain fed conditions in Karur, Dindigal and Theni districts. Varieties of drumstick are reared as tree crops which continue to yield for a number of years. This crop can also be raised in marginal lands, cultivable waste lands, fallow lands and in hilly terrains. It is also raised in kitchen gardens. This crop fetches good returns as a vegetable. Having understood the importance of drumstick, China is evincing great interest to propagate cultivation of drumstick in their province of Yunnam in China. An expert team consisting of horticulturists, bio-technologists and administrators from Yunnam has recently visited Tamil Nadu Agricultural University for collaboration, technology, guidance and supply of planting materials. The area under drumstick which is a valuable vegetable and health supplement can be expanded with lasting benefits.

-Kisan World