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RATIONALE FOR DEVELOPING TEAK CLONAL PLANTATIONS

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Introduction

Despite being the most prized timber species, teak wood supplies represent currently only 1% of the total volume of high value timber used worldwide (Behaghel 1999). Stronger international demands for good quality teak have resulted in an ever-increasing depletion of natural resources which are more and more protected by strict conservation policies aiming at preserving *in situ* biodiversity. This situation has been responsible lately for a basic change in the teak plantation concept. Traditional teak plantations, managed mostly by state organizations and harvested after 60 or 80 years, are no longer adapted to the current context. There is now an increasing demographic pressure on land tenure accounting for an overall intensification of crop productivity (Ball et al. 2000, Nair 2000). The emerging trend is therefore characterized by a stronger involvement of private investors looking for the best returns on investment in the shortest delays. Suitably selected and wisely deployed teak clones appear to be the best options to meet this goal (Behaghel and Monteuuis 1999).

Methodology

Techniques for mass producing teak clones from Plus trees of any age were developed in Sabah in the early 1990's within the framework of a collaboration between Cirad-Forêt and Innoprise Corporation Sdn Bhd, "ICSB" for short (Goh and Monteuuis 1997). Efficient and economically-viable nursery (Monteuuis 1995) or tissue culture (Monteuuis et al. 1998) procedures can be used, depending on the situation. The respective advantages and limitations of the nursery versus in vitro systems have been highlighted elsewhere (Monteuuis 2000).

Trees clonally or bulk-produced from cuttings and microcuttings have been established and assessed since 1994 on ICSB's research areas and various locations within Malaysia as well as countries such as Australia, and in Africa and South America. Concomitantly, rich base populations comprising of various natural provenances and seed-sources have been set up under ICSB for an enhanced selection of superior trees (Goh et al. 2003). These provenance and progeny trials were designed in such a way that the plots can be easily converted to seed production areas for supplying genetically improved quality seeds without inbreeding risks, while at the same time can be considered as *ex situ* biodiversity conservation sites encompassing a very diverse collection of teak origins from around the world

Results and discussion

Clonal mass propagation techniques

In Sabah, where there is no distinct dry season, 450 to 500 rooted cuttings per square meter of properly managed and container-grown stock plants can be produced annually in adapted nursery conditions. Average rooting rates range from 70 to 80% once the rejuvenation process has been achieved for mature selected genotypes – 60 year-old or more (Monteuuis et al. 1995). Applying this procedure, 250,000 cuttings have been produced since 1992 for various uses such as: establishment of demonstration plots, clonal tests, commercial plantations and sale to local clients, demonstrating the efficiency of the developed technique as being totally adapted to the mass production of superior quality teak clones.

Nevertheless, comparative economical analyses had clearly shown that for the production of more than 100,000 cuttings per year, the tissue culture procedures are more efficient. This is particularly true for exporting clones to various oversea clients in absence of any phytosanitation restrictions, contrary to rooted cuttings. About 300,000 vitroplants have so far been produced by the Plant Biotechnology

Laboratory – "PBL" for short - on a pilote scale and shipped to different countries all around the world – Australia, South and Central America, Africa and in South East Asia.

Field behavior of the cuttings and microcuttings-derived plants

Contrary to many forest trees species, teak plants issued from cuttings and microcuttings developed true-to-type in absence of any phenotypic abnormalities – the so-called "C effects" -. Growth rate is impressive in the first years with 3 to 4 meters in height, then the trees increase more in diameter with average annual increment of 2.5 to 3cm. Some of these cutting-issued trees have attained 28-30m in height and 40 cm in diameter 10 years after planting, while measurements of 29m in height and 36cm in diameter were recorded 8 years after planting for microcuttings-derived teak trees.

Investigations underway

Advanced wood characteristic analyses will be used for refining the initial selection based mainly on phenotypic criteria. Possible genotype X site effects on these criteria will be similarly assessed. The networking established among the various buyer countries and on different continents in which the same clones have been introduced appears to be highly enlightening and useful in this respect

Resorting to molecular biology for DNA profiling will allow a better identification of the genotypes and of their genetic relatedness for wiser clonal deployment and seed orchard establishment, thus preventing risks of inbreeding. Another application will be the genotypic characterization through DNA fingerprinting of the clones available for sale, in particular where property rights are concerned.

Prospects

The advantages of developing clonal plantations for teak were advocated since a few years ago (Monteuuis and Goh 1999). Recent promising field results from cuttings or microcuttings- produced teak plants and the noticeable change of mentality as far as timber plantations and land uses are concerned have greatly reinforced this point of view. The possibility to establish fast growing, high wood quality and uniform teak plantations to enhance the yield and the commercial value of this highly prized timber species in the shortest delays should be determining factors for any investors or even land owners. These plantations can be wisely developed as monoculture or agroforestry systems applying proper silvicultural practices. Plant material with narrow crowns will be preferably adapted to agroforestry, with the possibility to get early cash flow from the associated crops, which, especially when legumes, can benefit the teak trees. In view of all these arguments, and aware of the serious limitations of seed-issued planting stock (Monteuuis 2000, Goh and Monteuuis 2001), the clonal option appears to be the best if not the only way to maximize the investments with regard to the establishment of teak plantations, and from a more general standpoint, to land use.

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