

An ITTO fellowship has provided training in biotechnology techniques for improving trees and pest management

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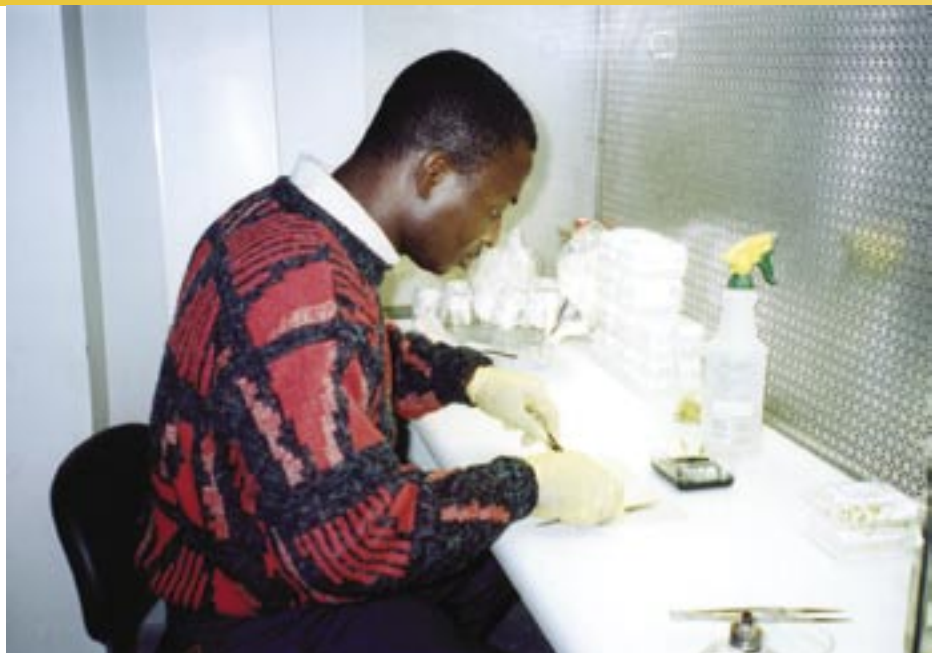
AS INTERNATIONAL demand grows for valuable timber species such as iroko and sapelli, their availability in the natural forest diminishes. Therefore, to both meet the demand and generate export revenue we need techniques for growing high-quality, pest-resistant trees of such species in plantations.

Increasingly, the traditional techniques of tree-breeding are being complemented by genetic engineering, tissue culture and molecular biological methods. To acquire skills and knowledge in these areas, I obtained an ITTO Fellowship to pursue training in biotechnology at the Michigan Technological University's School of Forestry and Wood Products.

The training was oriented towards developing the skills necessary to micropropagate trees using Chinese elm (*Ulmus parvifolia*) as the host species. Methods to sterilise explants, prepare semi-solid media, and culture and subculture explants from initial planting through to rooting were shown and demonstrated. In addition, I was introduced to other research activities going on in the School's biotechnology laboratory. These included larch breeding and hybridisation, the genetic engineering of *Populus*, and the effect of elevated atmospheric concentration of two gases on tree growth. Activities of the pine shoot borer were also evaluated in the field.

Micropropagation

Micropropagation is used worldwide to propagate large numbers of a few genetically superior individuals. I was trained in all aspects of micropropagation, from the sterilisation of explants through media preparation, to the culture and subculture of explants. I learnt each step and



Lab culture: The author places sterilised explants onto the tissue culture media. Photos: D. Karnosky

participated fully using the autoclave, balances, laminar flow hoods and growth chamber.

Material preparation: excised young leaves and twigs were obtained from greenhouse-grown plants and surface-sterilised in 20% (v/v) bleach with a few drops of Tween-20 for ten minutes, followed by no fewer than five rinses in sterile water. The leaves and twigs were then cut and cultured onto the medium.

Larch breeding and hybridisation

I was shown several larch (*Larix* species and hybrids) breeding trials, including provenance trials, hybrid trials, and growth/yield plots and seed orchards. I was involved in cone collection and seed extraction, cleaning and de-winging in a European larch seed orchard. I also visited the largest commercial grower of larch in the USA—Mead Corporation in Escanaba, Michigan—and toured its greenhouse, seed-handling areas, seed orchards, and larch and red pine plantations. Mead Corporation and the Michigan Technological University are members of the Lake States Forest Research and Environmental Management Cooperative, an example of a cooperative research and development model involving universities, industry and government.

Genetic engineering of poplars

It is now possible to insert single genes or a small number of genes into trees via *Agrobacterium*-mediated gene transfer. I was introduced to the process of culturing the *Agrobacterium* strains and inoculating aspen with *Agrobacterium* vectors carrying genes that control flowering. The potential for inserting insect-resistant genes into trees was noted. I was also introduced to the various steps involved in growing transgenic aspen plants, including shoot elongation, rooting and transfer to greenhouse.

Fellowship reports available

The following ITTO fellowship reports are available on request from the authors:

Forest mensuration manual: a practical guide

Contact: Dr Sunil K. Nepal, 18 Manley Road, Pennington, NJ 08534, USA; snepal1@comcast.net

A comparative study on understorey vegetation diversity of *Eucalyptus* plantation in Hainan Island

Contact: Dr Yu Xuebiao, Rubber Cultivation Institution, Chinese Academy of Tropical Agriculture, Hainan, China; rcrri@public.dzptt.hi.cn

Mapping of the forest types in Acre, Brazil, using remote sensing and canopy tree interpretation

Contact: Ms Ana Margarida Castro Euler, Foreign Student House Room C-318, Yokohama National University, 2-31-1 O-oka, Minami-ku, Yokohama, 232-0061, Japan; anaeuler@hotmail.com

Impact of CO₂ and O₃ on forest trees

The gases carbon dioxide (CO₂) and ozone (O₃) are increasing in the atmosphere and are expected to have significant impacts on the global environment. We need to know the effects that such impacts will have on the world's future forests. I spent three days at the Aspen FACE (Free-Air CO₂ and O₃ Enrichment) project at the US Forest Service laboratory in Rhinelander, Wisconsin. There, the impacts of elevated concentrations of these atmospheric gases on the growth, morphology and phenology of aspen seedlings are obvious.

Assessment of the pine shoot borer

The major host plants of the pine shoot borer are 4–10 year-old white, Scots and red pines. Larval feeding and tunnelling in the pith of new shoots causes damage to the plant. I observed this damage to be similar to that inflicted on African mahogany by the mahogany shoot borer, which I have been working on for the past seven years at the Forest Research Institute of Ghana (FORIG). The shoot borer attacks the leader and lateral shoots, resulting in weakened shoots that may drop or break. Environmental pressure such as adverse climatic conditions and parasites play an important role in reducing shoot borer populations. I also observed that white pines in the natural forest tolerate shoot borer attack and grow with good form. An integrated pest management strategy is recommended for the pine shoot borer.

Conclusion

This training has equipped me with skills and knowledge in biotechnology. I hope to use these to support tree improvement, pest management and reforestation programs in the tropics. The contact established between FORIG and the School of Forestry at the Michigan Technological University through my training is also worth mentioning. The School's professor, David F. Karnosky, officially visited FORIG in December 2001 and held discussions with the Director of FORIG on collaborative research on tropical trees, especially mahogany. It is my hope that what I learnt at the Michigan Technological University can be adapted to indigenous tropical timbers of Ghana, with the continued assistance of such institutions.

Acknowledgements

I am very grateful to Professor D. F. Karnosky and his secretary Janet. I also appreciate the support of the multinational graduate students in Karnosky's lab: Bixial, Michiko, Pooja, Daver and Anita.



ITTO Fellowships offered

ITTO offers fellowships through the Freezailah Fellowship Fund to promote human resource development and to strengthen professional expertise in member countries in tropical forestry and related disciplines. The goal is to promote the sustainable management of tropical forests, the efficient use and processing of tropical timber, and better economic information about the international trade in tropical timber.

Eligible activities include:

- participation in short-term training courses, training internships, study tours, lecture/demonstration tours and international/regional conferences;
- technical document preparation, publication and dissemination, such as manuals and monographs; and
- post-graduate studies.

Priority areas: eligible activities aim to develop human resources and professional expertise in one or more of the following areas:

- improving the transparency of the tropical timber market;
- improving the marketing and distribution of tropical timber species from sustainably managed sources;

- improving market access for tropical timber exports from sustainably managed sources;
- securing the tropical timber resource base;
- improving the tropical timber resource base, including through the application of criteria and indicators for sustainable forest management;
- enhancing technical, financial and human capacities to manage the tropical timber resource base;
- promoting increased and further processing of tropical timber from sustainably managed sources;
- improving the marketing and standardisation of tropical timber exports; and
- improving the efficiency of tropical timber processing.

In any of the above, the following are relevant:

- enhancing public relations, awareness and education;
- improving statistics;
- research and development; and
- sharing information, knowledge and technology.

Selection criteria: Fellowship applications will be assessed against the following selection criteria (in no priority order):

- consistency of the proposed activity with the Program's objective and priority areas;
- qualifications of the applicant to undertake the proposed fellowship activity;
- the potential of the skills and knowledge acquired or advanced under the fellowship activity to lead to wider applications and benefits nationally and internationally; and
- reasonableness of costs in relation to the proposed fellowship activity.

The maximum amount for a fellowship grant is US\$10 000. Only nationals of ITTO member countries are eligible to apply. The next deadline for applications is **12 March 2003** for activities that will begin no sooner than July 2003. Applications are appraised in May and November each year.

Further details and application forms (in English, French or Spanish) are available from Dr Chisato Aoki, Fellowship Program, ITTO; Fax 81-45-223 1111; fellowship@itto.or.jp (see page 2 for ITTO's postal address).