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Propagation in the Chiquibul Rainforest, Belize©

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INTRODUCTION

This paper is based on work carried out at Las Cuevas Research Station, Belize, during a 6-week work placement, as part of the author's Bachelor of Science Honours Degree, in Horticulture with Plantsmanship, at the Royal Botanic Garden, Edinburgh (RBGE) and Scottish Agricultural College, Edinburgh, sponsored by RBGE and Maya Forest Enterprises, in Summer 2007.

THE CHIQUIBUL RAINFOREST AND LAS CUEVAS RESEARCH STATION

The Chiquibul Forest Reserve and National Park of Belize is located in the Maya mountain range in the west of the country and bordering with Guatemala. The rainforest lies at the centre of the tri-national Maya Forest, the largest remaining intact tropical forest north of the Amazon, and includes the countries of Mexico and Guatemala. Covering an area of more than 500,000 ha, the Chiquibul Forest is the largest protected area within Belize. Its rich diversity of plant and animal species makes this natural reserve an important area of biodiversity. The Maya forest is categorised as lowland tropical broad-leafed rainforest and has been noted as having over 375 plant species not found elsewhere. It is characterised by trees such as big-leaf mahogany (*Swietenia macrophylla*), Spanish cedar (*Cedrela odorata*), and quamwood (*Schizolobium parahybum)* and the occasional stands of Caribbean pine (*Pinus caribaea*) (Maya Forest Enterprises, 2004).

Annual weather patterns are split into wet and dry seasons. The wet season, June to October, can include hurricanes, particularly during August and September. Temperatures are highest from May to September, with averages of 27 °C, and down to as low as 23 °C in November to January. Humidity in Belize is typically 75%–80%.

In 1995 the Belizean Government's Forestry Department and the Natural History Museum, London, collaborated in establishing Las Cuevas Research Station in the heart of the Chiquibul Forest Reserve and National Park of Belize. In 2004 the site's management changed to RBGE and Maya Forest Enterprises. Its purpose remains the same today, in supporting the Belizean Government's commitment to Agenda 21 of the UN Convention on Biodiversity (1992).

The research station is located deep within the forest (Fig. 1), standing in a clearing, 77-km drive along forestry tracks from the nearest town, San Ignacio. In the past few years the RBGE has hosted a field botany course at the station, as part of its MSc Degree in the Biodiversity and Taxonomy of Plants course, to help improve students' tropical plant identification, collection, and inventory skills.

Figure 1. Las Cuevas Research Station in the Chiquibul Forest, Belize.

DEVELOPING HORTICULTURAL FACILITIES AT LAS CUEVAS

In the previous 10 years, horticulture work at Las Cuevas had concentrated on site maintenance and occasional plantings of trees or palms as part of conservation work. Work began during the Summer of 2006, by RBGE students Kevin Dowding and Neil Bancroft, to establish nursery facilities at the site, with the aim of providing a facility for in-situ and ex-situ conservation and as a practical base for horticultural research. The author, along with a RBGE HND student Claire Rasell, returned in the summer of 2007 to develop a nursery structure capable of propagating and growing on tree stock for reforestation, and for research trials.

A structure was constructed and covered in shade netting to provide natural "forest canopy" light intensity. Plant material had to be kept off the ground, particularly to protect them from herbivores and other disruptive creatures and to provide a relatively clean growing environment. Benches were constructed to a working height of approximately 90 cm above soil level. Corrugated sheets were used for the bench tops to aid drainage of excess water away from the base of containers during heavy rains in the wet season.

The size of the facility (6 m × 3.6 m) meant hand-hose watering from a nearby tap was sufficient for irrigation.

On completion (Fig. 2), it was decided to name the nursery after one of the main species of timber used in its construction — 'My Lady's Nursery', after the Belizean common name for *Aspidosperma megalocarpon*.

USES OF THE NURSERY

The first crop was a trial investigating the effects of fungicides on mycorrhizal colonisation. This research is part of work being carried out by the author for his degree and is linked to ongoing research work being carried out by Oxford University. The University began a 3-year project in May 2007, investigating succession of tree species and the density of seedling carpets affecting pathogen and herbivore damage. As part of their research trials, applications of contact and systemic fungicides are

Figure 2. The completed 'My Lady's Nursery' shade house.

made to in-situ forest tree seedlings to control different fungal pathogens. The author's research project is to assess the effect of using these fungicides on seedlings of three tropical tree species (*Stemmadenia donnell-smithii*, *Cordia alliodora*, and *Cedrela odorata*) and the colonisation of roots with associated mycorrhizal fungi (mycorrhizal), from soil and fine roots from the parent trees.

Should inhibition of mycorrhizal colonisation be occurring due to fungicide application, then the in-situ forest seedlings will not grow as well as under natural conditions, and may be less likely to succeed. This is also a pertinent study in relation to the compatibility of fungicide use in horticulture with the increasing use of mycorrhizas.

Following the trial, root samples will be analysed to check for the presence or absence of mycorrhizal hyphae following treatments.

The new shade house is also being used to grow orchid plants that had been dislodged from trees and found on forest trails, for identification by botanists. The plants will then labelled and added to an orchid trail established by RBGE horticultural staff.

PROPAGATION OF FOREST PLANTS FROM SEEDS

Propagules are collected as naturally fallen seeds in traps, or as seedlings from identified seedling carpets. The seeds, seedlings, and plants must be identified to species and records made of identifying characteristics for future reference. A photographic record and herbarium voucher of the seed and seedling, and a log of its provenance is taken, forming a catalogue for future botanical and horticultural studies at the station.

For trials being undertaken by Oxford staff a stock of seedlings of known taxa is required. This involves locating a natural seed fall, collecting sufficient seed from the forest floor, and cleaning and germinating it. Germination needed to be without soil or compost to ensure they came from as sterile and healthy a growing environment as possible.

Many of the seeds had thick testas and a simple technique used previously for sweet pea (*Lathyrus odoratus*) seeds in the U.K. was adopted for germination. It involves lining a seed tray with a water-retaining material, such as polythene, followed by a double layer of kitchen tissue paper. This has clean water sprayed over evenly, until thoroughly soaked, and onto which the seeds are then laid out, allowing enough room for increase in size once imbibed and germinated (Fig. 3). A double layer of kitchen tissue paper is laid over the top of the seeds and soaked until it makes good contact with the seeds. Finally, a sheet of clear polythene is placed over the surface of the tray, in such a way as it is kept taut and prevented from sagging.

The polythene cover is removed daily, shaken, and returned but inverted to allow condensation to evaporate and for mould spores, which might otherwise infect the seeds, to desiccate. While the polythene is lifted, the top layers of tissue paper are carefully pulled back to check for germination. Moisture levels are maintained using a handheld sprayer.

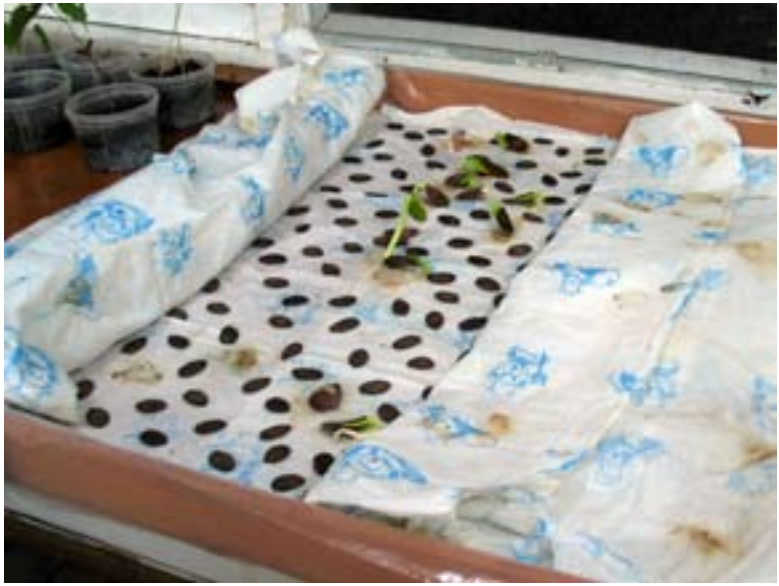

Figure 3. The technique adopted to germinate seeds.

The upper layers of tissue paper are removed when the batch is judged to have finished germinating. Misting is slightly increased and the polythene removed during the day until the seedlings are above the height of the tray, and then it is removed permanently.

Collecting seeds from the forest floor means they are likely to be contaminated with parasitic fungal spores that germinate on the seeds within the seed tray. When noticed, infected seeds were promptly removed, before fruiting bodies could sporulate.

Uneven germination, such as occurred with quamwood seeds, required the adoption of a technique to maintain growth of the germinated seedlings, while the remainder were kept in the propagation tray. Germinated seedlings were removed from trays and rolled in damp tissue paper around the roots. They were supported in a cardboard tube and sat in a water-retaining tray (Fig. 4). If the tissue paper and roots were kept moist, this sustained developing seedlings for more than 2 weeks while germination of the remaining seeds continued. Germinated seeds were only grown on for a short while, rarely beyond cotyledon stage, to reduce the risk of nutrient deficiency and damage at transplanting.

Figure 4. Rolled, damp tissue paper technique to overcome the problem of uneven germination rates with quamwood (*Schizolobium parahybum*) seeds.

Construction of nursery facilities at Las Cuevas has meant more propagation and applied scientific research can be carried out. Research and conservation work in association with other educational institutions such as Oxford University will continue to develop at the station, through the RBGE's commitment to forging links with organisations involved in the study of plants around the globe. Student study tours and work placements are to continue to Las Cuevas Research Station from RBGE, for example the MSc degree Field Botany course to attend in January 2008, and will see further study of the diversity of the Chiquibul rainforest plant species and further horticultural facilities to be developed.

LITERATURE CITED

Maya Forest Enterprises. 2004. Las Cuevas Research Station and Explorers Lodge. <http://www.mayaforest.com/index.htm> (Accessed June 9th 2007).