Rationale for Clonal Teak Plantations

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BACKGROUND OF COMPANY

Started as a R & D joint project (PLANT BIOTECHNOLOGY LAB) between the Forestry Division of the Sabah Foundation and CIRAD (French R & D organization) - 1993-2013

Development of *in vitro* protocols for forest species – 3 spp of Acacias and Teak
- Industrial spp selected for fast growth and demanded by pulp and paper industry
- High value timber much sought after in world market
R & D on TEAK - focusing on selected mother plants with outstanding qualities for higher yield: Straightness, minimal branching, high heartwood/sapwood content, pest and disease resistance, vigorous/fast growth

Origin of selected mother plants - **SOLOMON ISLAND**
Sample from 10-yr old clone growing under Sabah conditions
Collection of young branches and shoots from selected tree

Introduction of Explants for in vitro culture

Shoot development from responsive explants

Multiplication of plantlets

Plantation Establishment

Mass production of clonal plants

Elongation and Rooting stage

Tissue Culture Process of Teak
Developed optimal protocol leads to-

- High multiplication rate that is simple and cost-efficient
- Possibility of introducing and mass multiplying any selected genotypes (clones) regardless of ortet age using the same protocol (same culture medium for all genotypes)
- Ensure homogenous growth and more predictable yield for plantation establishment
Ex-vitro acclimatization of plantlets at nursery complements the in vitro mass multiplication.

Field Testing to verify In vitro technique

> 90% survival rate
7 year-old clonal plot at Sabah Softwoods Plantation, Brumas, Tawau, Sabah. Trees on the left are seed-derived whereas the trees on the right are derived from one of the Solomon Island clones.
Advanced Research with CIRAD: Wood and DNA analysis of clones useful for CERTIFICATION & MARKETING purposes

- Plank sampling
- Core sampling of standing trees
- Destructive method
- Non-destructive method
- Near InfraRed Spectroscopy (NIRS): calibration/prediction principle
ICSB/CIRAD Teak Clone

Identification

Species: Tectona grandis
Origin: Solomon Island
Clone number: TG2

Available in the form of rooted cuttings or tissue-cultured microcuttings

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DNA Fingerprinting

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DNA Fingerprinting - Wood characteristics

| Tissue density | 55 % |
| Moisture of Embrittled wood | - |
| Moisture of Splint | - |
| Moisture of Sapwood | 932 MPa |
| Moisture of Heartwood | 670 MPa |
| Moisture of Resin | 4.3 % |
| Moisture of Heartwood | - |
| Moisture of Sapwood | 2.5 % |
| Moisture of Resin | 4.7 % |
| Moisture of Embrittled wood | 2.5 % |
| Moisture of Splint | - |

Data produced by: Doreen KSI Goh, Biotechnology and Horticulture Division, Yayasan Sabah Group, Mile 2 1/2, Off Jalan Tuaran, Kota Kinabalu, Sabah, Malaysia. Tel: 60-88-263-105; Fax: 60-88-263-424; Email: domoh@pc.jnrr.my.
Worldwide Despatch of Clonal Teak plantlets to countries in Four Continents

- Ivory Coast
- Gabon
- Nicaragua
- Cambodia

Map showing the distribution of clonal teak plantlets to countries in four continents.
Comparative mean scores of YSG Biotech clones vs clones from Thailand for height, diameter at breast height (DBH), volume index, bole length and straightness 7 years after planting in Northern Queensland, Australia

<table>
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<tr>
<th>Source &amp; No of clones compared</th>
<th>Height (m)</th>
<th>DBH (cm)</th>
<th>Volume Index (m³)</th>
<th>Bole length (m)</th>
<th>Straightness (scale 1-6, 6 best)</th>
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<tr>
<td>YSG Biotech clones</td>
<td>19.2</td>
<td>21</td>
<td>0.23</td>
<td>12.1</td>
<td>4.4</td>
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<td>Thailand clones</td>
<td>15.7</td>
<td>13.6</td>
<td>0.09</td>
<td>9.7</td>
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Teak trial established in Matto Grosso, Brazil

At age 3 years

Clones from YSG Biotech

Seed-derived (local sources)

At age 8 years
Results from plantation at age 9 years in Matto Grosso, Brazil, indicate that clonal forest has outperformed seedling forest by 50% in total volume and 48% in DBH, both under the same site and management conditions, indicating the possibility to undertake a final harvest between 15-18 years.

Source: Proteca.com.br
Teak Plantation (30 months) in Tabasco, Mexico
After several decades of expectation, teak clonal forestry has become a reality and is rapidly expanding.
Using YSG Biotech selected Teak clones can be attractive to investors as:

- **Productivity** can be increased and is more predictable
- **Rotation** can be shortened
- **Losses can be reduced** (from mortality and pests/diseases)
- **Wood quality** is improved
- Can be combined to other cash crops in **Agroforestry systems** (oil palm, rubber, cocoa)
The company currently owns the world’s richest teak gene pool that can be used for genetic improvement as well as for commercial considerations.

For more information - www.ysgbiotech.com
TEAK PRODUCTS FROM YSG BIOTECH:

1. TISSUE CULTURE PLANTLETS
2. FIELD-READY PLANTS FOR LOCAL MARKETS
3. QUALITY SEEDS FROM TEAK TRIALS
4. GERMPLASM – ACCESSION TO TEAK GENETICS FROM ORIGINS

THANK YOU FOR YOUR ATTENTION