

# Propagation Techniques & Growth of Tubi in Ultramafic Soils of Isabel: Implications for Tubi Conservation & Rehabilitation

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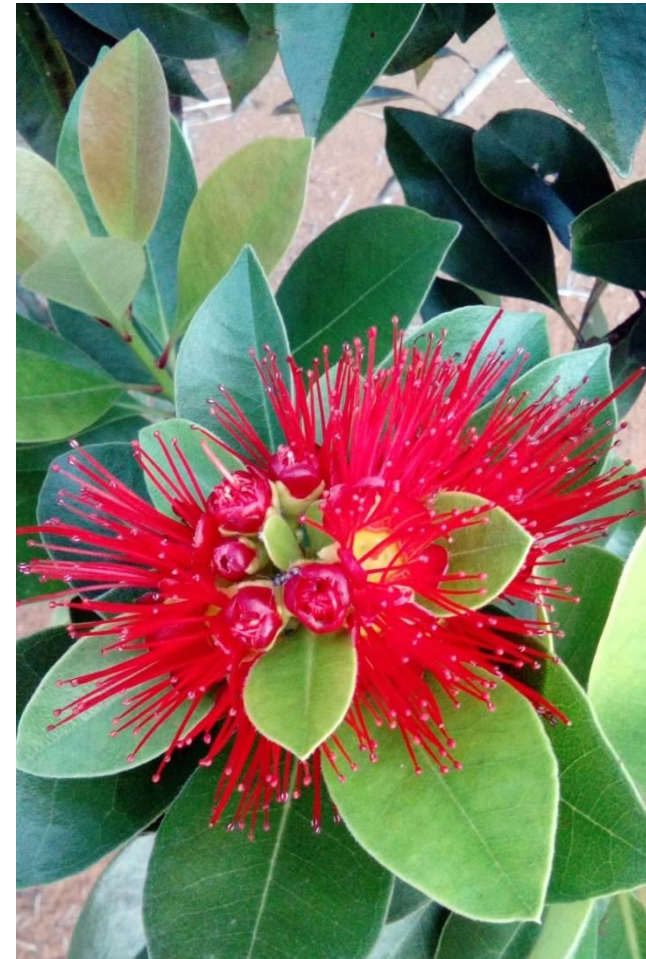
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# Background

- **Tubi, *Xanthostemon melanoxylo*, is a rare plant species since it is only found in certain locations in Solomon Islands**
- **It is banned or restricted from commercial exploitation due to rarity and slow stem growth**
- **Becoming a threatened or endangered species due to increasing interest in mining nickel in its habitat – the ultramafic soils of Isabel and Choiseul, where the plant species is endemic.**
- **It is also threatened by loggers who want to export it.**
- **Thus there is a need to develop methods to conserve tubi or rehabilitate its population from the impacts of mining and/or logging**



# Background

- **SMM Solomons Limited (SMMS) is a nickel mining company that has an interest to mine nickel on Isabel and Choiseul. Its proposed mining activities are a threat to the ultramafic forest ecosystem, which is the habitat for Tubi.**
- **Thus under its obligation towards the Solomon Islands Government Environment Act 1998 and Environment Regulation 2008, SMMS intends to carry out progressive rehabilitation of mined out sites once operational.**
- **Therefore this work is part of a wider mine rehabilitation study by SMMS on Isabel Province to assess appropriate methods of ensuring rapid vegetation cover to restore ecosystem functions for SMMS on Isabel Province.**



# SPECIFIC OBJECTIVES OF THIS STUDY

- **To explore different methods of raising Tubi (and other species) seedlings for mine rehabilitation or revegetation activities.**
- **To understand how/what makes it grow(s)**



# **RATIONALE**

**-Limited knowledge on the propagation Tubi and other ultrabasic forest species**

# Methodology

# Trial Site



Island



Leleghia 6 (LL6)



200km

Isabel Island  
Leleghia6 (LL6)

Guadalcanal Island

200 km

Data SIO, NOAA, U.S. Navy, NGA, GEBCO

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8° 13'48.89" S 158° 22'59.70" E 標高 -494 m

高度 824.15 km

# Leleghia 6 Research Site – established since 2011



Mine Rehabilitation Study Site  
Since 2011  
Area = 2.7ha  
4 yrs program started from 2014





# **Methodology**

**We trialed several seedling production methods**

- 1. Wilding collection**
- 2. Seed collection & Sowing**
- 3. Vegetative propagation**
- 4. Buds/Shoots**

# Wilding Trial



# Seed collection & Germination



**Litter/Seed Traps under large Tubi Trees**



# Seed Collection and Germination Trial: Tubi seed germination trials



*Testing different methods of germinating tubi seeds from 1.5-2 yr old trees*

# Vegetative (cuttings) Propagation Trial Using a Rooting Hormone (Powder)



*Selecting and cutting out shoots before inserting in growth media inside a makeshift growth chamber*

# Budding/Shoots

**Young tubi trees 1.5 – 2 years old produce buds or shoots on their stems**

**Buds were broken off from the stem and planted directly into soil/coconut husk media then covered to maintain humidity**



# Results



# **Sourcing seedlings from wildings in the forest floor is a very successful method of raising seedlings**



**Sourcing wildings less than 10 cm from the forest floor increases survival rates**

# Propagation by Seeds from 1.5-2 year old trees



**Germination rate is less than 10%**

# Vegetative (cuttings) Propagation



*Rooting of Tubi  
and Local Pine  
after 3 months*

# Growth and Survival Rates of Vegetatively Propagated Seedlings/Plantlets after 2 years

Species										
Tubi	874	744	710	887	914	711	835	884	919	958
	12cm	9cm	18cm	5cm	16cm	14cm	12cm	13cm	18cm	12cm
	892	908	912	838	858	930	831	905	927	153
	12cm	6.5cm	19.5cm	21.8	9cm	12cm	17cm	11cm	20cm	16.5
Survival Rate = Live Plants / Total Plants										
Dacrydium	901	932	985	940	959	723	876	743	947	883
Local pine	8cm	6.9cm	7.2cm	5.1cm	6.8cm	6.0	16cm	5cm	11.5 cm	5cm
	885	875	872	951	886	717	739	950	903	195
	9cm	16cm	6.5cm	7cm	7cm	15cm	10cm	8cm	6cm	10cm
Survival Rate = Live Plants / Total Plants										
Fagraea	900	-	-	-	-	-	-	-	-	-
Bou	5.3cm									
	-	-	-	-	-	-	-	-	-	-
Survival Rate = Live Plants / Total Plants										
Dillenia	845	989	879	-	-	-	-	-	-	-
	10cm	13cm	3cm							
	-	-	-	-	-	-	-	-	-	-
Survival Rate = Live Plants / Total Plants										
C.P ketekete	-	-	-	-	-	-	-	-	-	-
Survival Rat = Live Plants / Total Plants										

# **Buddings/Cuttings with No Root Hormone, only Increased Humidity**



# **Field Growth**

# Planting Trial Design

## TRIAL DESIGN/LAYOUT AT LELEGHIA 6

The Trial is a Randomised Complete Block Design

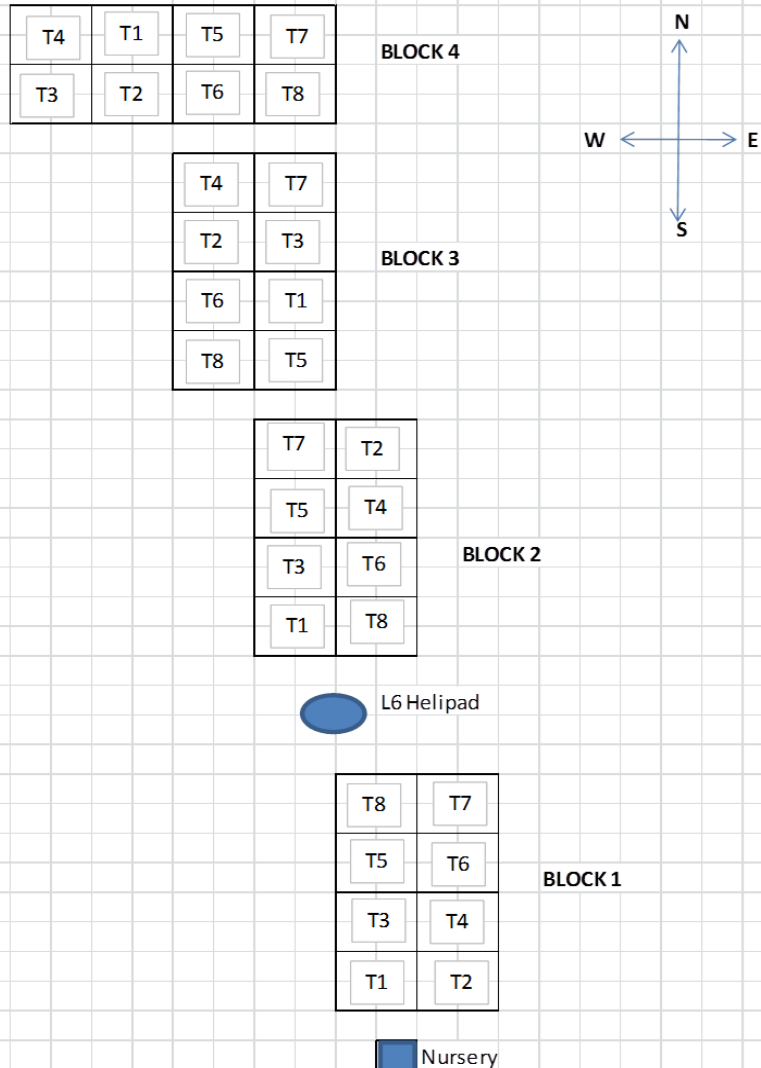
Blocks or Replicates = 4

Treatments/Vegetation Types = 8

Each Treatment Plot is 24 x 24 m (0.0576 ha)

Each Block is 96 x 48 m (0.4608 ha)

Total Area = 1.85 ha



# Leleghia 6 Tree Planting Trial





# Growth of Tubi and other Species in ultramafic soils on Isabel

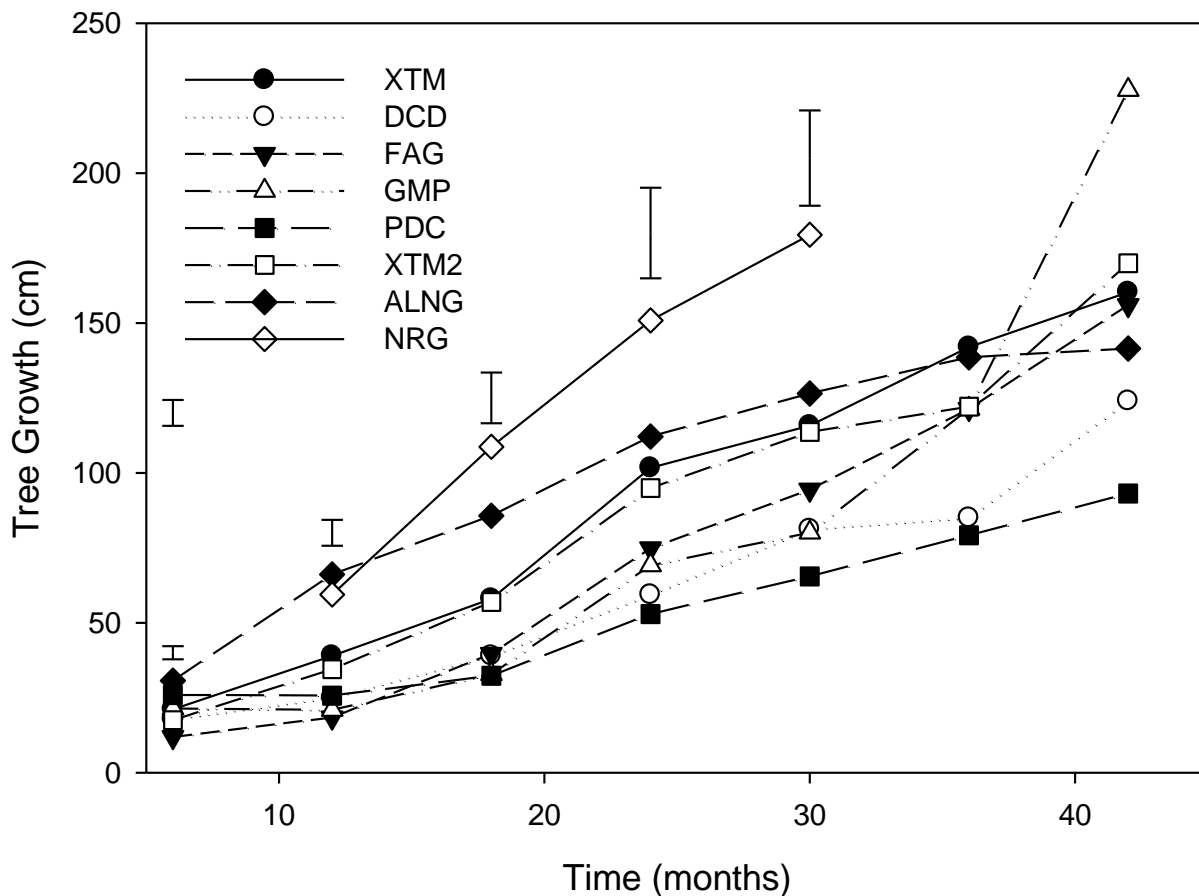
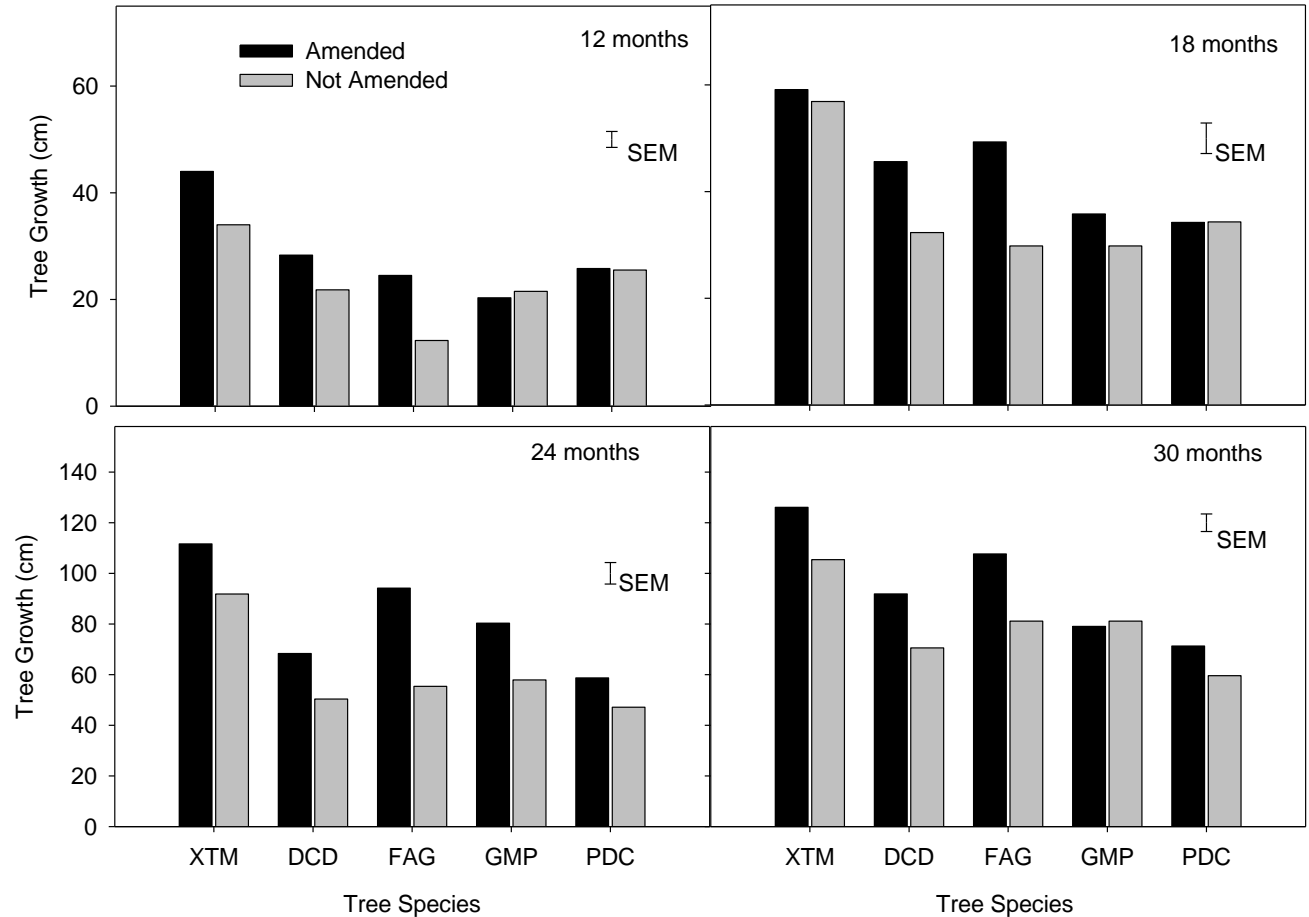


Fig 1. Growth of tree species with potential for rehabilitating mined out sites over 30 months in a limonitic soil at Leleghia 6, Isabel Province, where species XTM = *X. melanoxylon*, DCD = *D. elatum*, FAG = *Fagraea sp.*, GMP = *G. papuana*, PDC = *Podocarpus sp.*, XTM2 = *X. melanoxylon* with 3x2 and 2x1.5m spacing, ALNG = mixed species plantings of *T. catappa* and *C. indicum*, and NRG = Naturally regenerated pioneer species.

# Response of Tubi and Other Species to Soil Amendments - Charcoal/Coconut Husk



XTM = Xanthostemon Melanoxydon (tubi), DCD = Dacrydium sp, FAG = Fagraea (bou) sp., GMP = Gymnostoma(niaru) and PDC = Podocarpus (Ghairigi) sp.

# Nickel Tolerance of Tubi



**Growth of Tubi,  
Xanthostemon  
melanoxyton, in low,  
medium and high Ni  
soils**



***Melochia sp.***

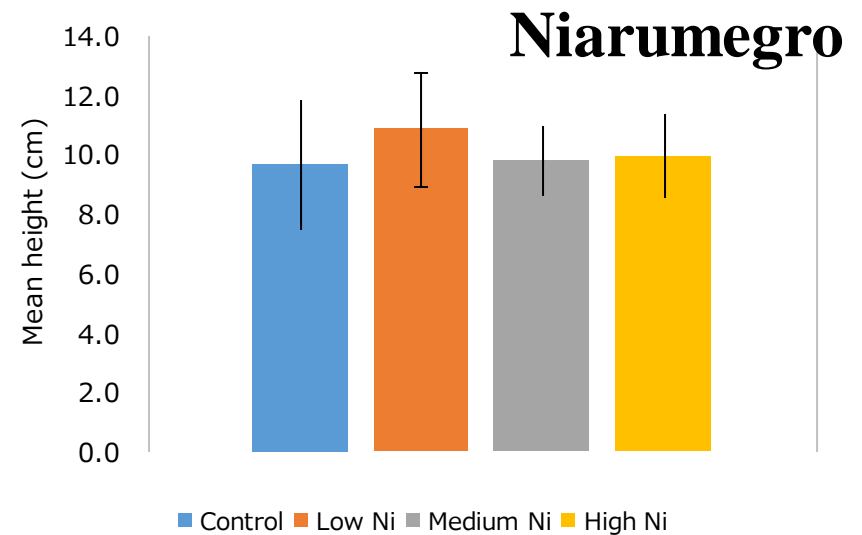
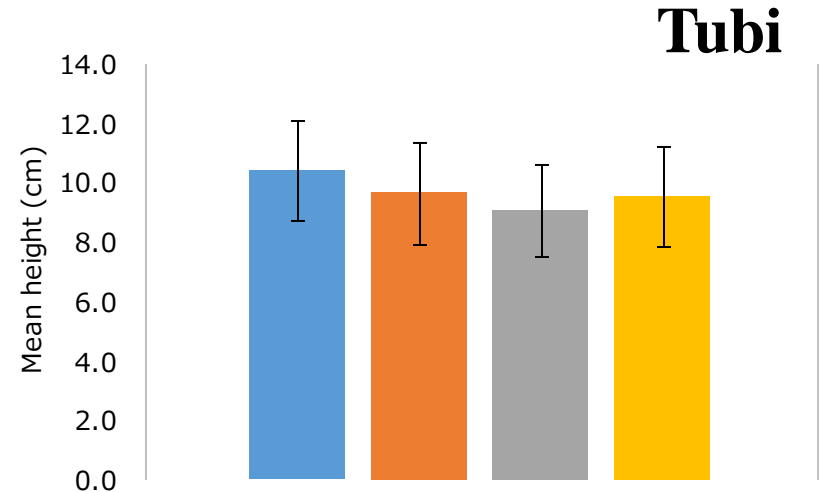
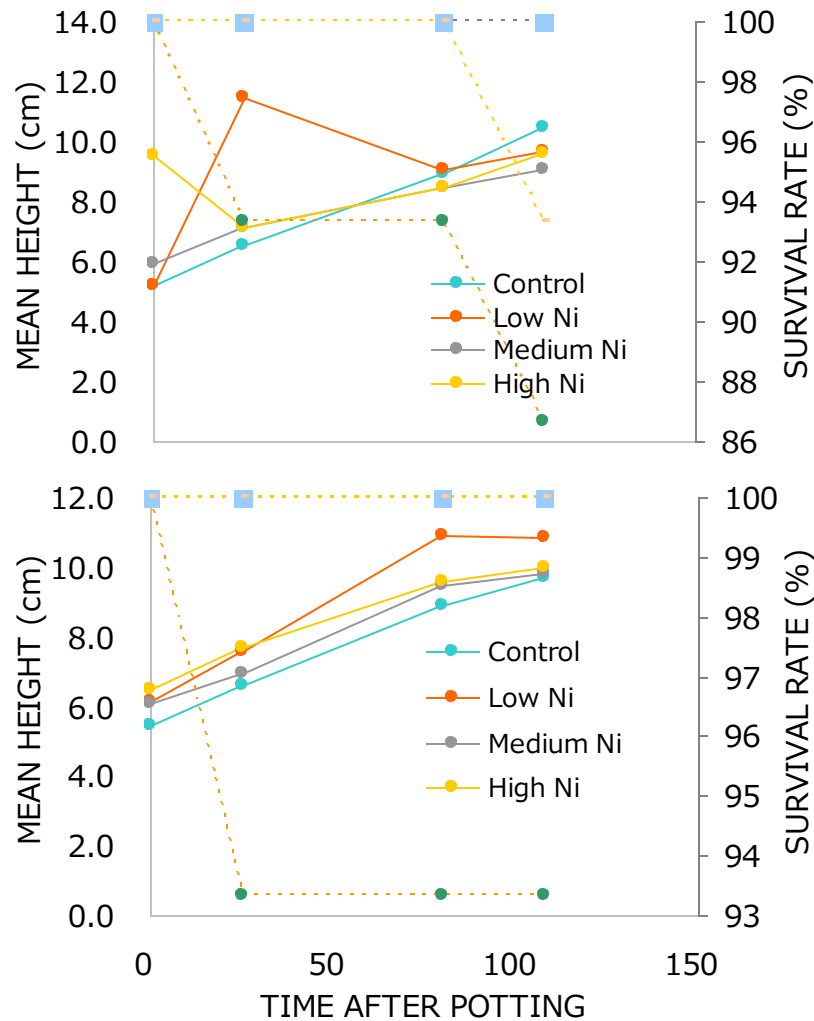


***T. Catappa (alite)***



***Dillenia sp.***

# Ni Tolerance of Tubi and another species



**Tubi Growth; not significantly different: Survival rate; OK**  
**Niarumegro Growth; not significantly different: Survival rate; OK**

# Summary/Conclusion

- **Tubi can be propagated from both Seeds and Cuttings**
- **However, wilding collection and vegetative propagation are potential methods to mass produce seedlings for rehabilitation or re-population purposes. This requires the conservation of original stands as sources of planting materials is important**
- **Tubi early growth in the field is faster compared to some species**
- **Tubi responds to soil amendments in the early stage of establishment**
- **This study demonstrated that apart from reserving specific areas for the conservation of tubi, conservation or rehabilitation of the species can be aided through human intervention.**
- **Any exploitation requires replanting given the duration to reach merchantable size**

# *Tangio tumas for your attention*

