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Comparison on the Height Growth Performance of Teak Tissue Plant, Teak Shoot Cutting Plant and Teak Seedling Plant

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ကျွန်းတစ်သျူးမျိုးပွားပင်၊ ကျွန်းအညွန့်ကိုင်းထိုးမျိုးပွားပင်နှင့် ကျွန်းသစ်စေ့မျိုးပွားပင်တို့၏ အမြင့်ကြီးထွားမှုနှိုင်းယှဉ်လေ့လာခြင်း

အောင်ဇော်မိုး၊ လက်ထောက်သုတေသနအရာရှိ၊ သစ်တောသုတေသနဌာန
အုန်းလွင်၊ ပါမောက္ခ၊ သစ်တောတက္ကသိုလ်
ဇော်မင်းအေး၊ တောအုပ်ကြီး၊ သစ်တောသုတေသနဌာန
အေးချမ်းမောင်၊ တောအုပ်ကြီး၊ သစ်တောသုတေသနဌာန

စာတမ်းအကျဉ်း

သုတေသနစမ်းသပ်ကွက်ကို ပဲခူးတိုင်းဒေသကြီး၊ ကျောက်တံခါးမြို့နယ်၊ ရဲနွယ် သစ်တောကြိုးဝိုင်း၊ ရန်ကုန်-မန္တလေးအမြန်လမ်းမကြီး မိုင်တိုင်အမှတ် ၈၇/၆ နှင့် ၈၇/၅ အကြားရှိ ရဲနွယ်သစ်တောပျိုးဥယျာဉ် တည်ထောင်စမ်းသပ်ခဲ့ပါသည်။ ဤစာတမ်းတွင် ကျွန်းတစ်သျူးမျိုးပွားပင်၊ ကျွန်းအညွန့်ကိုင်းထိုးမျိုးပွားပင်နှင့် ကျွန်းသစ်စေ့ပျိုးပင်တို့၏ အမြင့်ကြီးထွားမှုကို နှိုင်းယှဉ်လေ့လာ တင်ပြထားပါသည်။ သုတေသနပြမှုအတွက် အပြည့်အဝကျဘမ်း အကွက်ကြီး (Randomized Complete Block Design-RCBD) ဒီဇိုင်းဖြင့် စမ်းသပ်ပြီး မျိုးပွားပင်တစ်မျိုးအတွက် ထပ်ကြိမ် ၆ ကြိမ်ခွဲ၍ စမ်းသပ်ခဲ့ပါသည်။ အမြင့်ကြီးထွားမှု နှိုင်းယှဉ်ခြင်းတွင် ၆ လ၊ ၁၂ လ နှင့် ၂၀ လ သက်တမ်းရှိ အမြင့် ကြီးထွားမှုကို ပဏာမ တွေ့ရှိချက်အဖြစ် နှိုင်းယှဉ်တင်ပြထားပါသည်။ သက်တမ်း ၆ လနှင့် ၁၂ လတွင်ရှိ ကျွန်းတစ်သျူး မျိုးပွားပင်၊ ကျွန်းအညွန့်ကိုင်းထိုးမျိုးပွားပင်နှင့် ကျွန်းသစ်စေ့ ပျိုးပင်တို့၏ အမြင့်ကြီးထွားမှုမှာ ထူးခြားစွာ ခြားနားခြင်း မရှိသည်ကို လေ့လာတွေ့ရှိ ရပါသည်။ သို့သော် သက်တမ်း ၂၀လတွင် ကျွန်းသစ်စေ့ပျိုးပင်နှင့် စိုက်ပျိုးသောကျွန်းပင်၏ အမြင့်ကြီးထွားမှုသည် ကျွန်းတစ်သျူး မျိုးပွားပင်နှင့် ကျွန်းအညွန့်ကိုင်းထိုး မျိုးပွားပင်နှင့် စိုက်ပျိုးသော ကျွန်းပင်များနှင့်နှိုင်းယှဉ်ပါက သည် စမ်းသပ်သောဒေသအတွင်းတွင် သိသာစွာ ကွာခြားလျက်ရှိ ကြောင်းလေ့လာတွေ့ရှိရပါသည်။

Comparison on Height Growth Performance of Teak Tissue Plant, Teak Shoot Cutting Plant and Teak Seedling

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Abstract

A field trial was conducted at at Yenwe Nursery Site, Yenwe Reserved Forest. It is situated at roadside of Yangon-Mandalay High Way between 87/6 and 87/5 mile, Kyauktaga Township, Bago Region. The present study compares the growth performance (height growth) of teak shoot cuttings plants, teak tissue plants and teak seedling plants. The field experiments were laid out in a randomized complete block design with 6 replications. Observation on the growth rate of different propagules (Tissue plants, Shoot cutting plants and seedling plant) and the interaction between relevance ages (6 months, 12 months and 20 months) were investigated. The result showed that there were no significant differences between three types of plant propagules for the examined in this study.

Content

Comparison of Height Growth performance of Teak Tissue Plant, Teak Shoot Cutting plant and Teak Seedling

1. Introduction

The Forest Department has establishing various kinds of plantation such as, commercial, watershed management, industrial, and village supply plantation. The problem arises annually in the establishment of plantations because of the difficulties of procuring and securing the good planting materials. The seeds are usually collected wherever it is available, no matter what the seed source may be. Nowadays, private teak plantations gradually develop and departmental teak plantations were established annually.

It is generally propagated from seeds. Therefore to obtain such large amount of seed became a problem for plantation establishment all over the country. However, with the view of obtaining good and sufficient seeds for annual planting, the Forest Department had establishment Seed Production Area (SPA) wherever necessary. But, problem still remains acquiring good and sufficient amount for all the plantations.

To solve the problem, various techniques had been sought, among which vegetative propagation especially in teak shoot cutting and teak tissue culture could become the solution for mass production of good planting stock.

The use of seedling and vegetative propagules of *Tectona grandis* L.f. has been an important tool for the large scale deployment of improved plants. However, the root systems between vegetative cuttings (including tissue culture), and seedlings, it may be differences affect on growth need to be addressed.

In the case of tree improvement programme, it is to deploy the best genetically improved plants, as effectively and extensively as possible, either by seed or through vegetative propagation (C. Lambeth et al., 1994). Forest Botany and Tree Improvement Section, Forest Research Institute had implemented the research on teak shoot cutting test last 10 years ago and teak tissue culture in 2000. From these researches can produce the planting material of teak shoot cutting plantlets and teak tissue plantlets.

For that, to know the growth performance of teak tissue plant, teak shoot cutting plant and teak seedling plant, this research have conducted.

2. Literature Reviews

2.1. Field Assessment and Height Growth

Although the number of reports of successful plant regeneration in forest tree species is now large, the results of field assessment of micropagated plantlets reported in literature are limited. Gupta *et al.* (1991) reviewed that micropropagated plants showed superior performance over seedling of the same trees. Growth was uniform and no morphological variation was observed in the plants derived from tissue culture.

Field trials have been carried out with tissue cultured plants and seedling controls in teak and eucalypt (Khuspe *et al.,* 1987; Gupta *et al.,* 1991: Gavinlertvatana, 1995 and Monteuuis *et al.,* 1998). Gavinlertvatana (1995) reported that over 500,000 micropropagated teak plants were planted in field and faster growth; more uniformity and less branching were observed in comparison with seedlings.

2.2. Tissue culture and vegetative propagation

It is generally propagated from seeds for establishment. Various methods of vegetative propagation have been used, such as budding and grafting (Mahmood & Somasundaram, 1975), rooting of cuttings (Lahiri, 1974) and rooting of buds from stock stumps raised in ploypots (Mahmood *et al.,* 1976). For large scale plantations stump are often used: they are prepared from seedling 30-40 cm long, about one year old.

Mullins *et al*., 1997 stated that tissue culture raised plants require hardening before they are ready for planting in the field. Maintenance of high humidity and protection from microbial infection is important at the early stages of the hardening procedure. At the end of the hardening procedure the plantlets has to be hardy enough to survive in the field.

3. Objective

To compare the high growth performance of teak seedling, teak shoots cutting and teak tissue plants.

To determine suitable planting propagules for teak plantation and teak tree improvement programme.

4. Materials and Methods

4.1. Planting materials

In this experiment, 3 different kinds of planting material were used. There were one year old of teak shoots cuttings, teak tissue plantlets and teak seedlings were used to investigate their height growth performance within the same experiment.

Table 1. A brief description of different kinds of planting material

Kind of planting material	Age	Average Initial high	Source
Teak Tissue plantlets	1 yr	1 ft 6 in	Kanbalu
Teak Shoot cutting plantlets	1 Yr	1 ft 4 in	Paukkhaung
Teak seedling plantlets	1 Yr	1 ft 5 in	Kyautaga

4.2. Description of the Study Site

The experiment was conducted at Yenwe Nursery Site. It is situated at roadside of Yangon-Mandalay High Way between 87/6 and 87/5 mile, Kyauktaga Township, Bago Region. The soil is sandy clay loam and has 5.5 – 7.8 pH.

4.3. Experimental design

The experiment was laid out in Randomized Complete Block Design (RCBD) replicated 6 times with 24 plantlets per replicate of each different kinds of planting material. In each replicate, there were 18 plots and the 3 different kinds of planting materials were assigned at random to each plot and 24 plantlets with 9ft x 9ft spacing were planted there. The orientation of the blocks was across the slope to avoid variation within a block.

Table 2. A brief information of the layout

No. of Replicate	Total Plots	No. of Plantlets per plot	Total Plantlets
6	18	24	432

4.4. Planting and Cultural Operations

Planting was carried out from June to mid of July when there was regular rainfall. Cultural operations such as weeding, fire protections were done according to annual work plan.

4.5. Measurement of height growth

Development of the height growth was measured and recorded when they reached in 6 months, 12 months and 20 months of age.

4.6. Data Analysis

Data on height growth of 3 different kinds of planting propagules were subjected to Analysis of Variance (ANOVA) using statistix 8.0 version soft ware program. Means and LSD were compared using also statistix 8.0 version soft ware.

5. Results and Discussion

5.1. Height growth rate of 3 different kinds of planting material

The growth and development in terms of stem height growth of three kinds of planting propagules indicated that were marked differences among the different planting propagules by different ages (Fig 1). In that, the height growths of three different propagules were not significant differences among the means in the age of 6 months and 12 months. In the case of height growth in 12 months age, teak tissue plants and teak shoot cutting plants were greatest but teak seedling was poor compare with them.

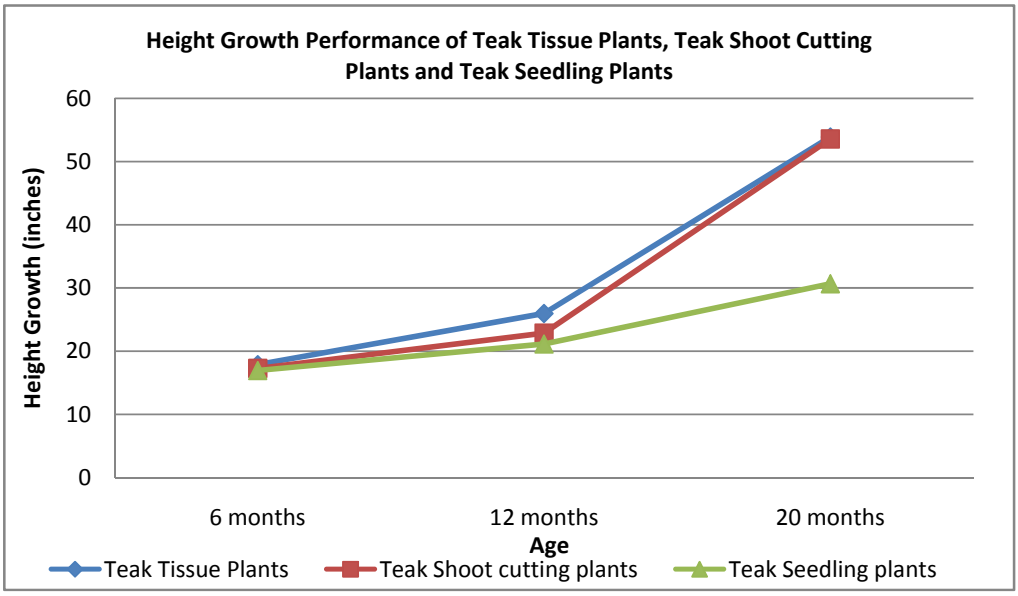

Figure 1. Height growth performance of three different propagules

According to the Randomized Complete Block Analysis of Variance (AOV) and LSD Comparison Test, in the height growth of three different propagules in 6 months and 12 months age, the results showed that there were no significantly at 0.05% level LSD (Table 3 and 4) . But, in height growth of 20 months of age, there were two groups (A and B) in which the means were not significantly different from one another at 0.05% level LSD comparison test (Table 5).

Table 3. LSD All-Pairwise Comparisons Test of 6 months height growth for Treatments

Treatment	**Mean**	**Homogeneous Groups**	
Tissue plant	17.875	A	
Shoot cutting plant	17.290	A	
Seedling plant	16.955	A	
Alpha	0.05	Standard Error for Comparison	2.3488
Critical T Value	2.228	Critical Value for Comparison	5.2334
Error term used:	Replication*Treatment, 10 DF		

Table 4. LSD All-Pairwise Comparisons Test of 12 months height growth for Treatments

Treatment	**Mean**	**Homogeneous Groups**	
Tissue plant	25.959	A	
Shoot cutting plant	22.870	AB	
Seedling plant	21.142	B	
Alpha	0.05	Standard Error for Comparison	2.1160
Critical T Value	2.228	Critical Value for Comparison	4.7146
Error term used:	Replication*Treatment, 10 DF		

Table 5. LSD All-Pairwise Comparisons Test of 20 months height growth for Treatments

Treatment	Mean	Homogeneous Groups	
Tissue plant	53.875	A	
Shoot cutting plant	53.858	A	
Seedling plant	30.680	B	
Alpha	0.05	Standard Error for Comparison	5.8187
Critical T Value	2.228	Critical Value for Comparison	12.965
Error term used:	Replication*Treatment, 10 DF		

The means of height growth of 20 months age for three different propagules ranged from 30.680 in to 53.875 in. Teak tissue plants gave the best height growth performance (53.875 in) compared to teak seedling plants the shortest height (30.680 in) (Table 5). However, the ANOVA (Appendix I) indicated that, growth development were not significant at the 0.05% level in terms of height.

6. CONCLUSIONS

The results of this experiment indicated that the following conclusions could be drawn.

(1) The height growth of three different propagules in the age of 6 months and 12 months were not different.
(2) According to the quantitative data, in the age of 20 months, tissue plants possess higher performance in height growth, but it is not significant different with shoot cutting plants. However, height growth performance of tissue plants and shoot cutting plants were higher than significantly different compare with seedling plants.
(3) Based on LSD comparison test and Analysis of Variance (AOV) of the Statistix 8.0, there were two groups of height growth (A and B) in which the means were not significantly different from one another.
(4) The result showed that the height of tissue plants and shoot cutting plants were nearly the same when they reached in 20 months age, fact that shoot cutting could be used in the field as planting material for plantation establishment.

7. REFERENCES

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APPENDIX 1

Statistix 8.0

Randomized Complete Block AOV Table for 6 months height growth

Source	DF	SS	MS	F	P
Replication	5	211.000	42.2000		
Treatment	2	2.601	1.3003	0.08	0.9250
Error	10	165.504	16.5504		
Total	17	379.105			

Grand Mean 17.373 CV 23.42

Tukey's 1 Degree of Freedom Test for Nonadditivity

Source	DF	SS	MS	F	P
Nonadditivity	1	64.272	64.2723	5.71	0.0405
Remainder	9	101.232	11.2480		

Relative Efficiency, RCB 1.39

Means of 6 month height growth for Treatments

Treatment	Mean
Tissue plant	17.875
Shoot cutting plant	17.290
Seedling plant	16.955

Observations Per Mean	6
Standard Error of a Mean	1.6608
Std Error (Diff of 2 Means)	2.3488

APPENDIX 2

Randomized Complete Block AOV Table for 12 months height growth

Source	DF	SS	MS	F	P
Replication	5	380.712	76.1425		
Treatment	2	71.457	35.7283	2.66	0.1185
Error	10	134.317	13.4317		
Total	17	586.486			

Grand Mean 23.324 CV 15.71

Tukey's 1 Degree of Freedom Test for Nonadditivity

Source	DF	SS	MS	F	P
Nonadditivity	1	42.3480	42.3480	4.14	0.0723
Remainder	9	91.9693	10.2188		

Relative Efficiency, RCB 2.26

Means of 12 month height growth for Treatments

Treatment	Mean
Tissue plant	25.959
Shoot cutting plant	22.871
Seedling plant	21.142

Observations Per Mean	6
Standard Error of a Mean	1.4962
Std Error (Diff of 2 Means)	2.1160

APPENDIX 3

Randomized Complete Block AOV Table for 20 months height growth

Source	DF	SS	MS	F	P
Replication	5	2464.72	492.94		
Treatment	2	2125.93	1062.96	10.47	0.0035
Error	10	1015.73	101.57		
Total	17	5606.38			

Grand Mean 46.048 CV 21.89

Tukey's 1 Degree of Freedom Test for Nonadditivity

Source	DF	SS	MS	F	P
Nonadditivity	1	520.671	520.671	9.47	0.0405
Remainder	9	495.061	55.007		

Relative Efficiency, RCB 2.03

Means of 6 month height growth for Treatments

Treatment	Mean
Tissue plant	53.879
Shoot cutting plant	53.585
Seedling plant	30.60

Observations Per Mean	6
Standard Error of a Mean	4.1145
Std Error (Diff of 2 Means)	5.8187

APPENDIX 4

Statistix 8.0

LSD All-Pairwise Comparisons Test of 6 months height growth for Treatments

Treatment	Mean	Homogeneous Groups
Tissue plant	17.875	A
Shoot cutting plant	17.290	A
Seedling plant	16.955	A

Alpha 0.05 Standard Error for Comparison 2.3488
Critical T Value 2.228 Critical Value for Comparison 5.2334
Error term used: Replication*Treatment, 10 DF
There are no significant pairwise differences among the means.

LSD All-Pairwise Comparisons Test of 12 months height growth for Treatments

Treatment	Mean	Homogeneous Groups
Tissue plant	25.959	A
Shoot cutting plant	22.870	AB
Seedling plant	21.142	B

Alpha 0.05 Standard Error for Comparison 2.1160
Critical T Value 2.228 Critical Value for Comparison 4.7146
Error term used: Replication*Treatment, 10 DF
There are 2 groups (A and B) in which the means are not significantly different from one another.

LSD All-Pairwise Comparisons Test of 20 months height growth for Treatments

Treatment	Mean	Homogeneous Groups
Tissue plant	53.875	A
Shoot cutting plant	53.858	A
Seedling plant	30.680	B

Alpha 0.05 Standard Error for Comparison 5.8187
Critical T Value 2.228 Critical Value for Comparison 12.965
Error term used: Replication*Treatment, 10 DF
There are 2 groups (A and B) in which the means are not significantly different from one another.

APPENDIX 5

Original Data of Height Growth for three different ages of three different treatments by means of replications

Treatment	Replication	Height Growth (in inches)		
		6 months	12 months	20 months
Tissue Plant	1	19.875	23.583	44.333
	2	21.333	26.542	43.250
	3	14.042	21.542	66.666
	4	14.708	26.083	73.261
	5	21.042	31.130	49.221
	6	16.250	26.875	46.542
Shoot Cutting Plant	1	12.783	16.522	33.875
	2	10.500	15.545	39.913
	3	15.708	21.542	70.391
	4	19.417	26.000	90.000
	5	24.625	31.739	45.636
	6	20.708	25.875	41.696
Seedling Plant	1	12.130	15.522	23.435
	2	13.348	18.545	21.391
	3	12.083	14.652	33.500
	4	14.818	17.318	35.043
	5	24.227	29.426	29.708
	6	25.125	31.391	41.000