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**Comparative Study on the Effect of  
Different Ratios of Soil and Manure on  
the Nursery Growth of Some Commercial  
Hard - Wood and Dry Zone Forest Species**

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မြေအချိုး အမျိုးမျိုးဖြင့် သစ်မာမျိုးများနှင့် အပူပိုင်း သစ်မျိုးများ၏  
ပျိုးပင် အဆင့်ကြီးထွားမှု၊ အခြေအနေကို လေ့လာခြင်း။

ဒေါ်တင်တင်အုန်း၊ B.Ag. (Mdy.), M.Sc. (I.F.A.S, U.F)

လက်ထောက်ညွှန်ကြားရေးမှူး

နှင့်

ဒေါ်ချိုချိုဝင်း၊ B.Sc (Chem.) (Mdy.)

သုတေသနလက်ထောက်

သစ်တောသုတေသနဌာန၊ ရေဆင်း။

## စာတမ်းအကျဉ်း

မြန်မာနိုင်ငံတွင် ပေါက်ရောက်ကြီးထွားလျက်ရှိသော သစ်မာမျိုးနှင့် အပူပိုင်းဒေသ သစ်မျိုးများကို မြေဆွေး၊ နွားချေး၊ သဲ တို့ဖြင့် အချိုး (၃)မျိုး ရောစပ်၍ သော်လည်းကောင်း၊ မြေ-အချဉ်၊ အင်ဓါတ် အတူညီသော ဒေသ (၆)မျိုးမှ မြေများကို အသုံးပြု၍ သော်လည်းကောင်း စမ်းသပ်ပျိုးထောင်ပြီး ၎င်းအပင်များ၏ ကြီးထွားမှု၊ အခြေအနေကို အပင်အမြင့်နှင့် အခြောက် အလေးချိန် အနေဖြင့် တိုင်းတာလေ့လာ၍ ဖော်ပြထားပါသည်။ ကျွန်း၊ ယင်းမာ၊ မဟောဂနီ၊ ယမနေ၊ စစ်၊ ဘောစကိုင်းနှင့် အော်ရီရှား စသည့် သစ်မျိုးများသည် မြေအမျိုးအစား ကွာခြားမှုပေါ် မူတည်၍ ပျိုးပင်အဆင့်တွင် ကြီးထွားနှုန်းမှာ သိသာထင်ရှားစွာ ကွဲပြားခြားနား သော်လည်း ပျဉ်းကတိုး၊ ပိတောက်၊ ရှား၊ မယ်ဇလီနှင့် တမာ စသော သစ်မျိုးများတွင် ကြီးထွားနှုန်းမှာ သိသာထင်ရှားစွာ ကွာခြားမှု မရှိသည်ကို တွေ့ရှိရပါသည်။

# **Comparative Study on the Effect of Different Ratios of Soil and Manure on the Nursery Growth of Some Commercial Hard - Wood and Dry Zone Forest Species**

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## **Abstract**

In order to evaluate the effectiveness of three different ratios of soil, Farm Yard Manure and sand and also to the effect of six soils with different  $p^H$  on the growth of widely grown Myanmar commercial hard-wood and dry zone forest species, experiments was carried out under nursery condition. Dry matter weight and plant height parameters are comparatively observed and presented in this paper. The significantly different growth rates of nurseries were found in Teak, Yinmar, Mahogany, Yemanae, Sit, Bawzaging and Aurisha

on the different soil types; however, nursery growth rates of Pyinkado, Padauk, Sha, Mezali and Tama were not apparently responded to the different soils.

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## 1. Introduction

New forest plantations are widely established in Myanmar forestry to fulfill the demand for domestic and export needs. The production of quality seeds and the propagation of nursery stock are crucial for successful in the operation of plantation forestry. Adequate supplies of seeds and seedlings on the other hand are main concern in the generation of forest.

In order to establish vigorous nursery seedlings soil fertility management in nursery stage is rather important the among growth influencing factors such as moisture, light, temperature and pest control, apart from genetic consideration.

The soil properties of Myanmar forest soils vary tremendously due to the different soil formation conditions. Different rations of soil mixture, therefore are used in nursery practices, so as to test and produce vigorous, healthy seedlings.

With the objectives of determining the most suitable soil mixture comprising soil, farmyard manure and sand, particularly for commercial hard-wood and dry zone forest tree species, experiments involving three different rations of soil mixture and six soil samples collected with their indigenous  $p^H$  as check were carried out at F.R.I, Yezin.

## 2. Materials and Methods

To study the growth of some hardwood and dryzone forest species as affected by the different soil ration and different soils with their different  $p^H$  values experiments were replicated three times under nursery condition.

In experiment I, six treatments, consisting of three soil mixtures ( 3:2:0, 2:1:1, 1:1:0 ) ratio of soil, Farmyard manure (FYM) and sand three soils ( Hlegu, Leinton and Meikhtila ) with five replications were assigned as randomized complete block (RCB) design on the individual species of Teak (*Tectona grandis*), Pyinkado (*Xylia dolabriformis*), Padauk (*Pterocarpus macrocarpus*), Yinmar (*Chukrasia tabularis*) and Mahogany (*Swietenia macrophylla*).

In experiment II, seven treatments, involving the same three soil mixtures as in experiment I and four soils from four different areas (Amatgyigone-Yetashae township, Moswe-Pyinmana township, Meikhtila township and Hmawbi township) with five replications were assigned randomized complete block (RCB) design. Treatments were assigned unbiasedly on each species of Pyinkado (*Xylia dolabriformis*), Yemane (*Gmelina arborea*), Yinmar (*Chukrasia tabularis*), Sit (*Albizia procera*) and Mahogany (*Swietenia macrophylla*).

In experiment III, seven treatments, comprising of four soil mixtures (3:2:0, 3:2:1, 2:1:1, 1:1:0) ratio of soil, FYM and sand and three soils (Magway, Meikhtila and Myingyan) with five replications were arranged as per randomized complete block (RCB) design. Treatments were tested on Sha (*Acacia catechu*), Mezali (*Cassia siamea*) Bawzaging (*Leucaena leucocephala*), Tama (*Azadirachta indica*) and Aurisha (*Acacia auriculaformis*).

The seeds of tested species were sown in soil media contained in a plastic bag of 7" x 4" size. Soil mixture and soils from different areas were analyzed at the soil laboratory of the Forest Research Institute (F.R.I) to characterize their physical and chemical properties.

Plant heights and dry matter weights were recorded at 6 months interval after sowing. Treatments description for experiment I, II and III are shown in following table.

## 2.1 Treatment description

Treatment No.	Experiments		
	I	II	III
	Soil : FYM : Sand	Soil : FYM : Sand	Soil : FYM : Sand
T <sub>1</sub>	3 : 2 : 0	3 : 2 : 0	3 : 2 : 0
T <sub>2</sub>	2 : 1 : 1	2 : 1 : 1	3 : 2 : 1
T <sub>3</sub>	1 : 1 : 0	1 : 1 : 0	2 : 1 : 1
T <sub>4</sub>	soil ( Hlegu )	soil ( Amatgyigon )	1 : 1 : 0
T <sub>5</sub>	soil ( Lein ton )	soil ( Moswe )	soil ( Magway )
T <sub>6</sub>	soil ( Meikhtila )	soil ( Meikhtila )	soil ( Meikhtila )
T <sub>7</sub>		soil ( Hmawbi )	soil ( Myingyan )

Some chemical analysis of soil media used for experiment I, II and III are described in Appendix I. Nursery performance are illustrated in Fig.1 for Experiment I, Fig. 2, 3, 4 and 5 for Experiment II and Fig. 6, 7, 8 and 9 for Experiment III respectively.

Analysis of variance (ANOVA) are worked out to test the treatment means while least significant difference (LSD) value are used to make treatment mean comparison.

## 3. Result and Discussion

### 3.1 Experiment I

Plant height and dry matter weight of seedling used as affected by the different soil mixtures and specific soil are shown in table 1. All soil mixtures are generally better than each particular soil of Hlegu, Leinton and Meikhtila to promote the nursery growth of Teak. Although plant height and dry matter of teak are not statistically different among the particular soils, clayey loam soil with p<sup>H</sup> 7.4 from Hlegu is much pronounced to enhance the nursery growth of teak. Highest growth of dry matter was observed in (2:1:1) soil mixture as compared to other soil mixture of (3:2) and (1:1).

In Pyinkado, no great differences within the treatments are noted because it is probably due to the habitual slow growth rate of that particular species.

Although the effect of soil mixtures on growth of nursery seedlings is generally greater than those from other soils tested we are unable to select the most suitable soil mixture for Padauk since dry weight and plant height of Padauk are not significantly different among the different soil mixtures.

Regarding Yinmar, growth of nursery seedlings in term of dry matter and plant height in soil mixtures are markedly superior than other particular soil. Soil mixture with (1:1) is found to be the most suitable soil media for in nursery stage.

In Mahogany, it is very similar to the Yinmar and that, the dry matter weight of Mahogany from (1:1) soil mixture is found to be the greatest as compared to other treatments.

### 3.2 Experiment II

Plant height and matter weight influenced by the soil mixture and other soils from experiment II are described in table (2).

As far as nursery growth of Pyinkado, in experiment II is concerned, it is very similar to experiment I in that dry matter and plant height do not apparently respond to either soil mixtures or other specific soils.

In Yemane and Yinmar, the effect of soil mixture on nursery growth is much greater than that of other soils. Although dry matter weight and plant height are not statistically different, (3:2) soil mixture in Yemane and (1:1) soil mixture in Yinmar are observed to be a suitable soil media for nursery stage.

In case of Mahogany, treatments are statistically quite different. However, the greatest dry matter weight is obtained from the soil mixture of (1:1).



**Table I.** Average Seedling Height and Dry matter weight of Hardwood Species. ( Experiment I )

No.	Treatment	Species									
		Teak		Pyinkado		Padauk		Yinmar		Mahogany	
		Hgt	D.wt	Hgt	D.wt	Hgt	D.wt	Hgt	D.wt	Hgt	D.wt
1.	Soil : FYM 3 : 2	4.4	7.344	12.324	8.517	27.05	19.532	17.05	14.568	17.65	11.344
2.	Soil : FYM : Sand 2 : 1 : 1	3.0	10.315	11.424	11.628	25.07	18.808	17.97	10.328	17.05	14.575
3.	Soil : FYM 1 : 1	3.5	8.584	13.16	6.876	27.17	17.302	22.8	18.36	15.184	15.54
4.	Soil (Hlegu)	2.15	3.405	5.212	8.639	15.05	7.062	10.75	2.827	12.39	7.87
	Soil (Leintone)	2.31	1.75	4.986	8.536	28.0	19.095	11.2	3.986	8.4	5.85
5.	Soil (Meikhtila)	2.4	2.332	4.598	3.643	11.324	4.898	7.85	0.662	10.56	6.014
6.	F Test	**	**	ns	ns	*	ns	**	**	*	*
7.	CV%	29.541	66.46	53.0102	96.3828	41.7419	70.0889	33.224	78.4155	20.4176	34.9776
8.	LSD 1%	1.5725	6.7196	8.2195	13.827	16.733	18.2229	8.7354	11.9697	5.0341	6.4188
9.	LSD 5%	1.1529	4.9269	6.0266	10.1514	12.2689	13.3612	6.4049	8.7764	3.691	4.7064

Hgt = Height of seedling (inches)

D.wt = Dry matter weight of seedling (gm/plant)

n.s = not significant

\*\* = significant at 1%level

\* = significant at 5%level

FYM = Farm Yard Manure

**Table II.** Average Seedling Height and Dry matter weight of Hardwood Species. ( Experiment II )

Sr. No.	Treatment	Species									
		Sit		Pyinkado		Yamanae		Yinmar		Mahogany	
		Hgt	D.wt	Hgt	D.wt	Hgt	D.wt	Hgt	D.wt	Hgt	D.wt
1.	Soil : FYM : Sand 3 : 2 : 0	27.4	22.79	5.1	1.62	36.4	38.83	16.6	6.65	14.0	6.48
2.	Soil : FYM : Sand 2 : 1 : 1	23.2	16.85	3.8	1.803	34.6	17.89	17.8	4.13	11.8	2.46
3.	Soil : FYM : Sand 1 : 1 : 0	21.4	9.57	4.2	1.36	24.8	10.49	12.8	6.64	12.6	8.25
4.	Soil (Amatgyigone)	14.4	4.36	3.6	1.86	21.0	4.77	2.4	0.57	10.0	2.14
5.	Soil (Moeswe)	15.2	4.43	3.0	1.28	20.0	7.79	7.2	1.77	9.6	4.72
6.	Soil (Meikhtila)	8.6	1.39	3.55	1.21	12.0	1.41	3.0	0.41	9.0	2.37
7.	Soil (Hmawbi)	15.0	5.81	3.75	1.45	15.6	5.03	2.2	0.67	9.8	2.92
	F Test	*	*	n.s	n.s	**	**	**	**	**	*
	CV%	49.576	127.956	22.1915	7.0345	17.1729	31.3327	27.5474	59.6069	15.44	33.0549
	L.S.D 1%	15.66	21.089	1.5815	1.4577	8.3237	7.964	5.0353	3.311	3.487	2.8595
	L.S.D 5%	11.5563	2.797	1.167	1.0757	6.1423	5.8769	3.7157	2.4433	2.5732	2.1101

Hgt = Height of seedling (inches)

D.wt = Dry matter weight of seedling (gm/plant)

n.s = not significant

\*\* = significant at 1%level

\* = significant at 5%level

FYM = Farm Yard Manure

**Table III.** Average Seedling Height and Dry matter weight of Hardwood Species. ( Experiment III )

Sr. No.	Treatment	Species									
		Sha		Mezali		Bawzagaing		Tama		Aurisha	
		Hgt	D.wt	Hgt	D.wt	Hgt	D.wt	Hgt	D.wt	Hgt	D.wt
1.	Soil : FYM : Sand 3 : 2 : 0	34.14	14.6484	19.12	10.8122	55.28	34.9412	13.76	3.3634	12.04	2.9142
2.	Soil : FYM : Sand 3 : 2 : 1	34.5	14.0448	18.04	6.8184	39.26	12.6544	15.64	3.1164	13.92	3.5172
3.	Soil : FYM : Sand 2 : 1 : 1	33.4	15.0964	22.14	10.4894	36.78	13.1872	17.1	4.1172	14.68	3.2484
4.	Soil : FYM 1 : 1	39.14	15.229	19.84	6.6612	43.56	17.7886	14.86	2.2338	14.26	2.7514
5.	Soil (Magway)	22.92	4.1764	13.5	5.429	22.0	3.7374	6.86	1.083	8.2	1.7112
6.	Soil (Meikhtila)	26.5	11.4462	13.5	4.2872	35.34	13.2558	6.96	2.5446	9.28	1.447
7.	Soil (Myingyan)	21.12	7.9022	10.34	2.5872	29.8	7.6314	5.72	0.774	5.9	0.5148
	F Test	n.s	n.s	**	n.s	**	**	**	n.s	**	**
	CV%	31.507	75.4227	22.8728	77.45	25.1503	50.0437	37.233	88.1119	23.1858	42.0209
	L.S.D 1%	16.8575	15.7328	7.5582	9.2151	19.4289	15.2259	8.8806	3.8403	5.3511	1.9939
	L.S.D 5%	12.4379	11.6098	5.5774	6.8001	14.3373	11.2357	6.5533	2.8339	3.9488	1.4714

Hgt = Height of seedling (inches)

D.wt = Dry matter weight of seedling (gm/plant)

n.s = not significant

\*\* = significant at 1%level

\* = significant at 5%level

FYM = Farm Yard Manure

### 3.3 Experiment III

Plant height and dry matter weight of dryzone species as affected by the soil mixture and different other soil are presented in table 3. The effect of soil mixtures on nursery growth of Sha, Mezail, Bawzaging, Tama and Aurisha are much pronounced as compare to other soils tested. Among the soil mixtures, the nursery growth of seedlings are not statistically different. However (2:1:1) soil mixture is found to be a suitable nursery soil media for sha, Mezali, Tama and Aurisha where as, nursery growth of Bawzagaing highly responded to the soil mixture of (3:2).

## 4. Conclusion

In the Myanmar hard wood species tested, (1:1) soil mixture of soil and FYM is generally found to be a suitable nursery soil media for Padauk, Yinmar and Mahogany. However, soil mixture (2:1:1) of soil, FYM and sand and (3:2) of soil and FYM are observed to be an appropriate nursery soil media for Teak and Yemane. Nevertheless, Pyinkado, on the other hand has a poor response to any source of nursery soil media.

Regarding the dryzone species, (2:1:1) soil mixture of soil, FYM and sand gave better nursery growth for Sha, Mezali, Tama and Aurisha while (3:2) soil mixture is found to be a preferable nursery soil media for Bawzagaing.

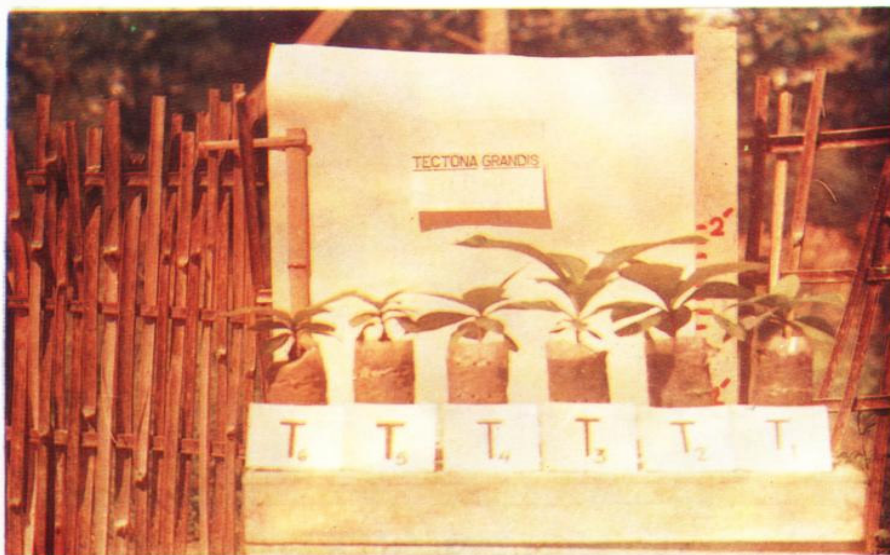


Fig. I. Seedling of Teak (*Tectona grandis*)



Fig. II. Seedling of Yinma (*Chukrasia tabularis*)



Fig. III . Seedling of Mahogany (*Swietenia macrophylla*)



Fig. IV. Seedling of Yemane (*Gmelina arborea*)





Fig. V. Seedling of Pyinkado ( *Xylia dolabriformis* )



Fig. VI. Seedling of Sha (*Acacia catechu*)

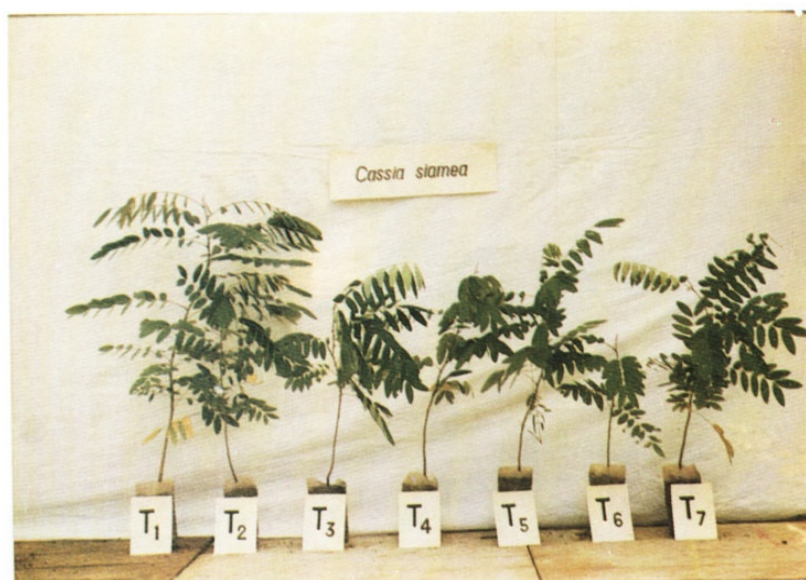


Fig. VII. Seedling of Mezali (*Cassia siamea*)





Fig. VIII . Seedling of Bawzagaing (*Leucaena leucocephala*)



Fig. IX. Seedling of Aurisha (*Acacia auriculiformis*)

# **Appenadix 1.**

## Chemical analysis of soil media used for Experiment I, II, III

No.	Soil media used	P <sup>H</sup>	Total N%	Extractable element				O.M	Sand %	Silt %	Clay %	Textural class
				Ava P%	K%	Ca%	Mg%					
1.	Soil : FYM : Sand 3 : 2 : 0	7.0	0.1666	0.0030	0.0200	0.1560	0.0261	5.10	75	14	6	Sandy Loam
2.	Soil : FYM : Sand 3 : 2 : 1	7.0	0.1310	0.0024	0.0390	0.1150	0.0210	3.10	84	6	6	`
3.	Soil : FYM : Sand 2 : 1 : 1	6.5	0.0969	0.0021	0.0373	0.1050	0.0161	1.95	86	6	4	`
4.	Soil : FYM : Sand 1 : 1 : 0	6.9	0.2771	0.0033	0.0520	0.1890	0.0317	5.40	81	12	4	`
5.	Soil (Myingyan)	8.2	0.0106	Trace	0.0154	0.3800	0.0370	1.30	61	20	16	`
6.	Soil (Magway)	6.4	0.0067	0.0004	0.0201	0.1260	0.0320	0.360	64	14	18	`
7.	Soil (Meikhtila)	7.6	0.0120	Trace	0.0156	0.4100	0.0264	2.090	69	16	12	`
8.	Soil (Hlegu)	7.4	0.0759	0.0002	0.0132	-	-	2.85	40	18	37	Clayey Loam
9.	Soil (Lein tone)	4.7	0.0504	0.0003	0.0145	-	-	2.12	67	12	19	Sandy Loam
10.	Soil (Amatgyikon)	5.3	0.112	0.0004	0.0166	0.0450	0.0281	1.83	56	32	13	Loam
11.	Soil (Moeswe)	7.1	0.1155	0.0012	0.0204	0.154	-	1.42	68	22	7	Sandy Loam
12.	Soil (Hmawbi)	5.3	0.105	0.0004	0.0110	0.024	0.0277	1.91	61	18	19	Sandy Clay Loam

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