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Investigation on the Suitability of some Tropical Pines for Plantation Establishment in the Shan State Area

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ရှမ်းပြည်နယ်၊ ထင်းရှူးစိုက်ခင်းများ တည်ထောင်ရန်အတွက် သင့်လျော်သည့် အပူပိုင်းထင်းရှူးများ စမ်းသပ်ဖော်ထုတ်ခြင်း

ဦးမန်းကိုကိုကြီး၊ B.Sc. (For.) (Rgn.), M.Sc. (ANU) ဌာနမှူး
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ရှမ်ပြည်နယ်တွင် ၁၉၈၀ - ခုနှစ်မှ စတင်၍၊ ထင်းရှူးစိုက်ခင်းများကို ကျယ်ကျယ်ပြန့်ပြန့် တည်ထောင်ခဲ့ပါသည်။ ပြည်တွင်းထင်းရှူးသစ်မျိုးဖြစ်သော *Pinus kesiya* သည် ကြီးထွားနှုန်းနှေးပြီး၊ အပင်ပုံစံအားဖြင့်လည်း ကောင်းမွန်ခြင်းမရှိပါ။ သို့ဖြစ်ပါ၍၊ ကြီးထွားနှုန်းမြန်ဆန်ပြီး အပင်ပုံစံ ပိုမိုကောင်းမွန်မည့် အပူပိုင်းထင်းရှူးဖြင့် အစားထိုး နိုင်ရန်အတွက် ကလောမြို့ နယ်၊ ပင်လောင်းလမ်းခွဲရှိ ကြိုးပြင်တောတွင် ၁၉၈၁- ခုနှစ်၌၊ စမ်းသပ်တည်ထောင်ခဲ့ပါသည်။ ပါဝင်သော စမ်းသပ်သစ်မျိုးများမှာ *Pinus patula* ဒေသ (၃) မျိုးမှ ရရှိထားသည့် *Punus oocarpa* နှင့် ဒေသ(၃)မျိုးမှ ရရှိထားသည့် *Pinus maximinoi* တို့ဖြစ်ပြီး၊ Honduras နိုင်ငံ Dulce Nombre ဒေသမှရရှိသော *Pinus maximinoi* မျိုးသည် ၎င်းဒေသတွင် စိုက်ပျိုးရန် အသင့်တော်ဆုံးဖြစ်ကြောင်း တွေ့ရှိရပါသည်။

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Abstract

An establishment of a large scale pine plantation was initiated in the Shan State since 1980. In order to find a substitute for the indigenous species of Pinus kesiya, which is slow growing and poor form, with a better tropical pine, a species trial was conducted in the Kalaw unclassed forests at Pinlawng Junction, Kalaw Township, in 1981. Pinus patula, three provenances of P. oocarpa and 3 provenances of P. maximinoi were tested. Among these, Pinus maximinoi from Dulce Nombre, Honduras was found to grow best in the area tested.

Contents

1. Introduction

1.1 The Forest Research Institute, Yezin and the East Pegu Yoma Plantation Project have started trails on the introduction of lowland tropical pines to lowland area in Burma since 1980 (Mehm Ko Ko Gyi et. al. 1983). So far no concrete results have been obtained. Most of the results were not very encouraging. However, growth and survival of *Pinus caribaea* var. *hon*. Planted at Yeni in 1983 was quite encouraging. At present, it is too early to draw any conclusion as period of ¼ to ½ of the rotation is needed in any species trial (Burley and Wood, 1976).

1.2 With the dwindling of the natural bamboo resources for long fibre pulp and the difficulty in the extraction of the remaining pine in the hilly regions, the pulp and paper industry is also looking, forward to the success of tropical pines in the lowland area.

1.3 Establishment of pine plantations in the Shan State, which is a natural pine region in Burma, is undoubtedly necessary as, the heavily cut over natural pine area in this hilly region need to be replenished urgently to check erosion and conserve the soil. Secondly, the need for raw material for pulp can also be met as cost of extraction from accessible plantations can be much lower than that from the present inaccessible natural pine forests.

1.4 Accordingly, pines are planted in the form of plantation only in the hilly region of the country where the species grow naturally. Extensive planting of pine in these areas started in 1980. Up till 1984, 10851 acres of pines have been planted in the country (Record from the Forest Department).

1.5 The pine species that were planted were mainly indigenous pine (ie. *Pinus kesiya* Royle ex. Gordon.), with a small acreage of the same species planted with seeds which were imported from abroad.

1.6 However, old plantations of *Punus kesiya* and the majority of the natural stands in the Shan State exhibited very poor form. Height growth is also slower as compared to other fast growing tropical pines.

1.7 In order to support the planting programme to establish more valuable pine plantations with a shorter rotation, a tree improvement programme, or testing and introduction of suitable exotic species are needed. Consequently, the latter was initiated in 1981 starting with three species of available exotic tropical pines.

2. Materials And Methods

This trail was carried out at Kalaw public forests at Pinlaung junction, Kalaw township.

2.1 Site Preparation

The standard site preparation method used in the Shan State was adopted, ie. Felling, burning, kyunkwe and staking. 1' X1' X1' pits were dug at each stake for planting.

2.2 Species

The species and provenances tested were as given below: -

Lot No	Species	Provenance	Latitude
095 (Pa)	*Pinus patula*	Not available	-
102 (Oo)	*Pinus oocarpa*	Nicaragua	12˚ 55' N
106 (Oo)	*Pinus oocarpa*	Honduras	14˚ 54' N
107 (Oo)	*Pinus oocarpa*	Guatemala	15˚ 22' N
108 (Pm)	*Pinus maximinoi*	Nicaragua	13˚ 15' N
109 (Pm)	*Pinus maximinoi*	Honduras	14˚ 48' N
111 (Pm)	*Pinus maximinoi*	Honduras	14˚ 52' N

See Appendix I for detail.

2.3 Spacing

9' X 9' which was the standard spacing at that time was used.

2.4 Site

It is a slopping site, located on the western aspect with shallow clayey (red earth) soil. The parent material is composed of lime stone rock which were partly exposed on the top of the ridge.

2.5 Weeding

Three weeding were carried out in the first year, two in the second and the third year, and one in the fourth year.

2.6 Measurements

Survival % were assessed in the first year. In the second and fourth year height were measured while in the third and fifth year, height and girth at 6" height were measured. Average annual height growth from 1982 to 1986 were also calculated. The height of *P. kesiya* of the same age and planted adjacent to the experimental plot was also measured for comparison. In doing so, 180 trees from the upper slope and 180 trees from the lower slope were assessed.

2.7 Experimental Design

Randomized complete block design was used in conducting this experiment. However, due to the lack of sufficient number of seedlings, the trial was replicated only twice. Once block as situated on the upper slope while the other was situated on the lower slope. Each block contained seven plots and each plot contained 6 x 30 (180 seedlings) of each species and provenances listed above. Statistical F and LSD tests of significance were used in the analysis of data.

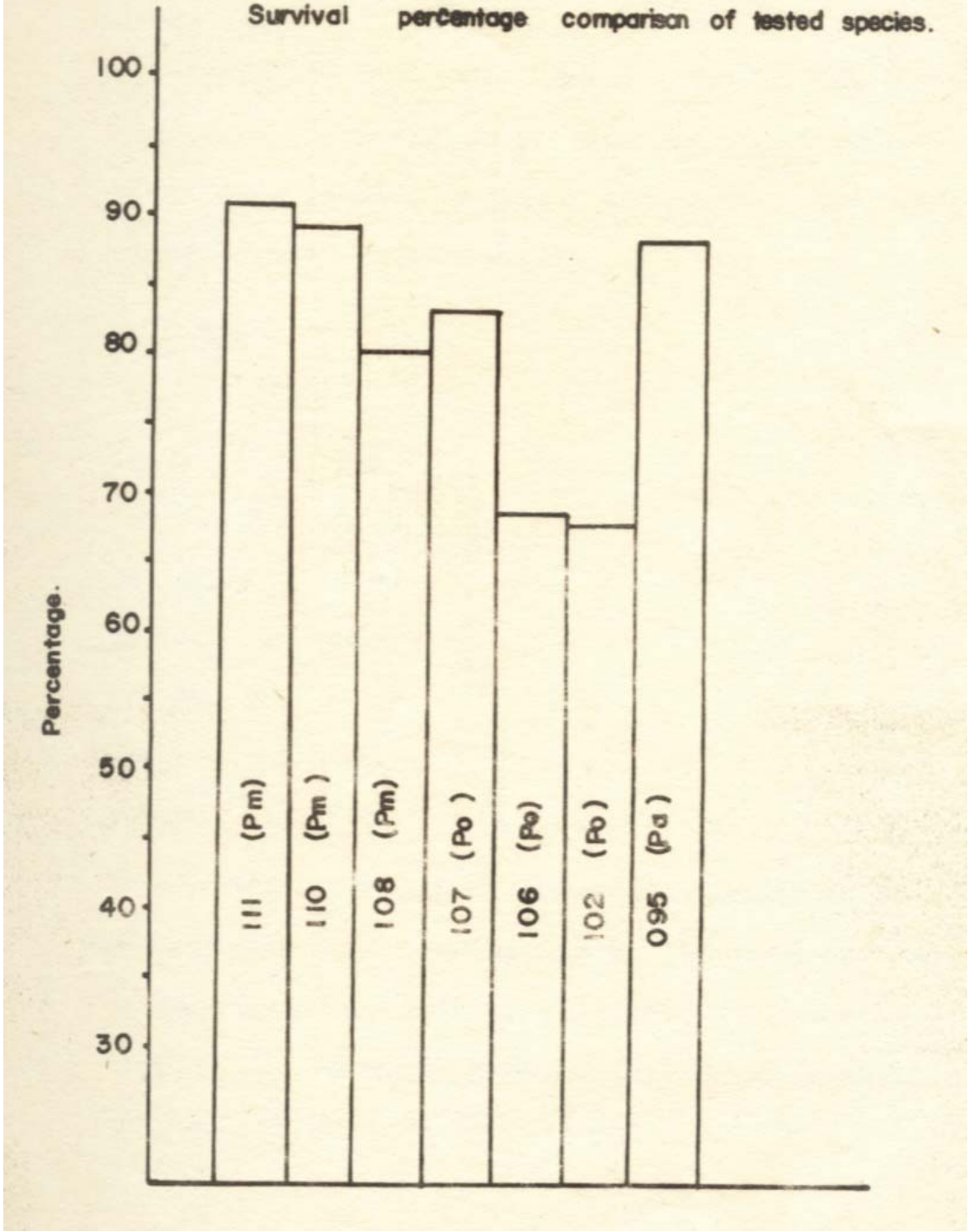
Table 1.

Table 1. Survival percentage of tested species.

Species (Lot No.)	**Survival Percent (%) (Dec / 1981)**
Pinus maximinoi (111)	90.8
Pinus maximinoi (110)	88.9
Pinus maximinoi (108)	80.0
Pinus oocarpa (107)	83.3
Pinus oocarpa (106)	68.5
Pinus oocarpa (102)	67.6
Pinus patula (095)	87.9

FIGURE 1

Survival percentage comparison of tested species.



3. Results

3.1 The results of survival are given in Table 1 and figure 1. The survival assessed in 1981 was significantly different. (See Appendix II.) For simplicity, ranking of species are given below with lines linking those species that were not significantly different.

3.2 Survival

1981

Lot No. 11 (Pm)
Lot No. 110 (Pm)
Lot No. 095 (Pa)
Lot No. 107 (Oo)
Lot No. 108 (Pm)
Lot No. 106 (Oo)
Lot No. 102 (Oo)

Since ranking of survival percent tends to from groups that overlap, it can be said generally that Lot Nos. 111(Pm), 110(Pm), 096 (Pa), 107(Oo) and 108(Pm) gave good survival, while Lot No. 106(Oo) and 102(Oo) gave poor survival.

TABLE 2.

TABLE 2. Height and Average annual height growth of tested species.

Species (Lot No.)	**Ht (ft) (July/1986)**	**Avg. annual Ht. Growth (ft/yrs)**
Pinus maximinoi (111)	14.3	3.55
Pinus maximinoi (110)	12.5	2.96
Pinus maximinoi (108)	11.4	2.70
Pinus oocarpa (107)	9.5	2.29
Pinus oocarpa (106)	9.7	2.39
Pinus oocarpa (102)	12.3	2.98
Pinus patula (095)	12.3	3.02

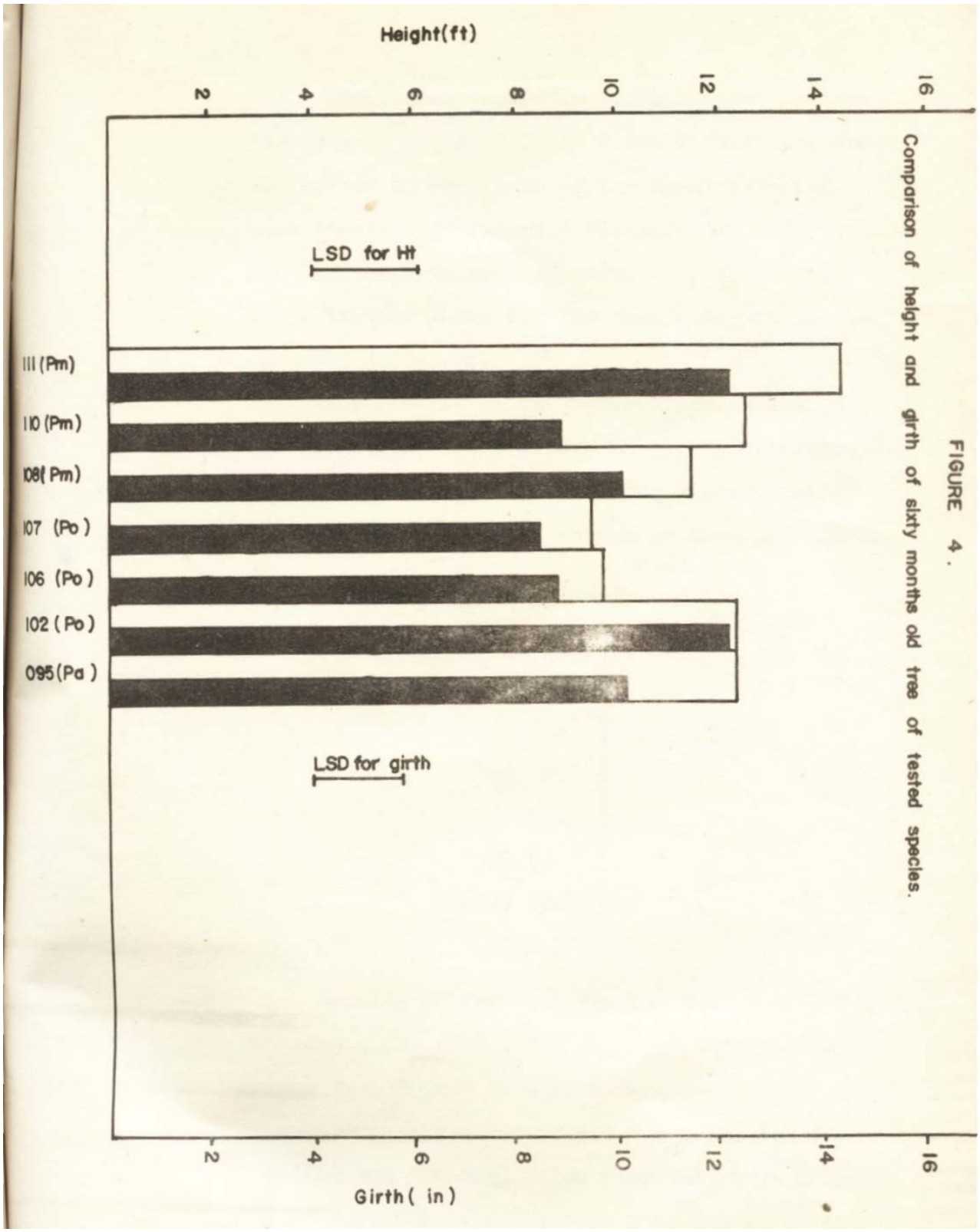
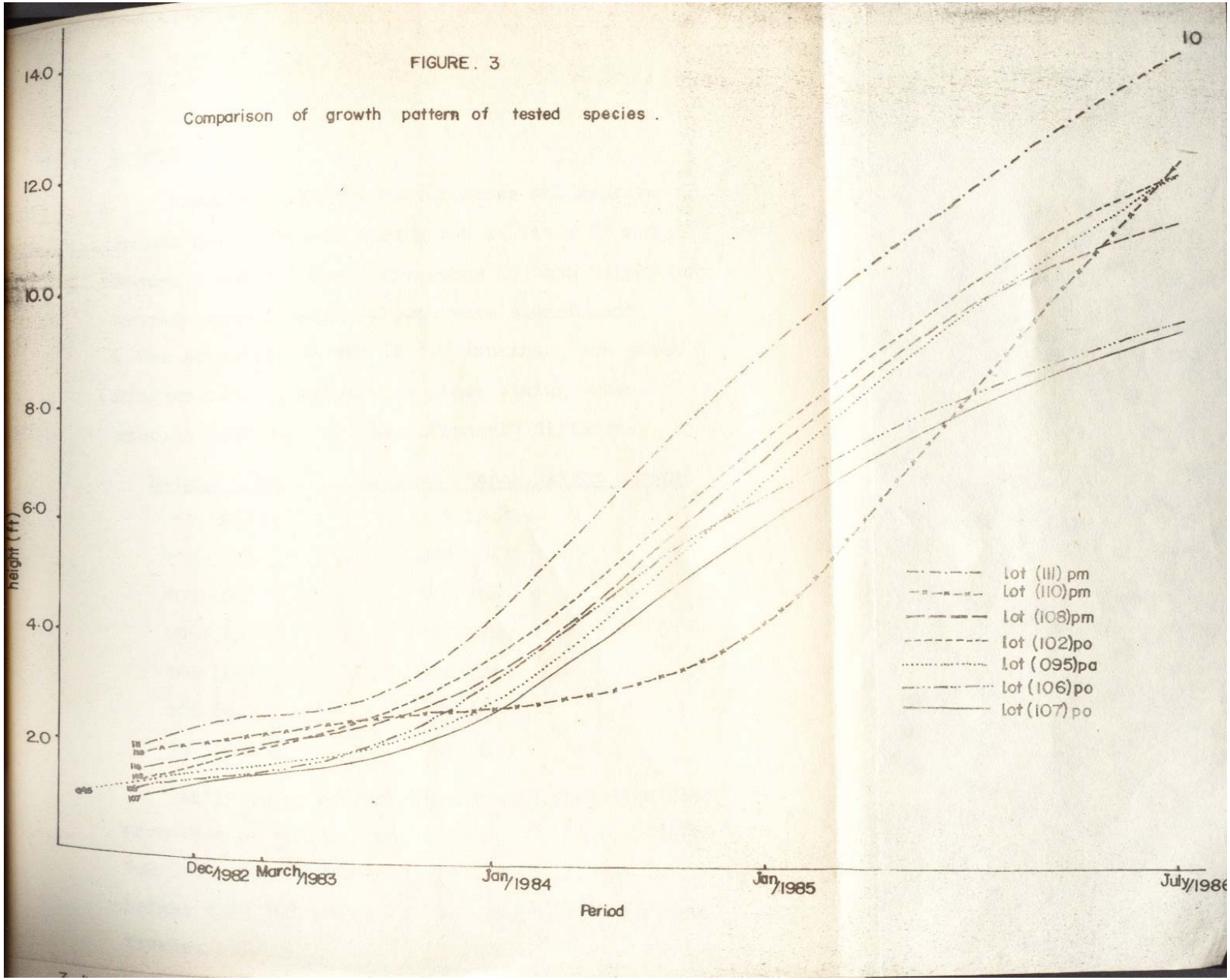


FIGURE 4.
Comparison of height and girth of sixty months old tree of tested species.

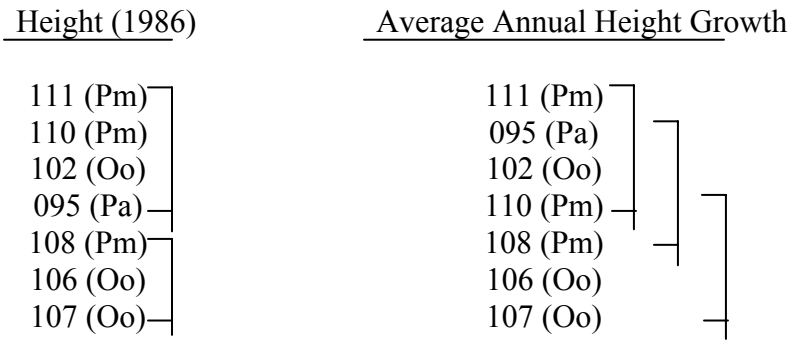
FIGURE . 3

Comparison of growth pattern of tested species .



3.3 Height

Results of height measurements and average annual height growth were given in Table 2 and Figure 2 and 3. The differences in both height and average annual height growth were significant (See Appesndix III and IV). Rankings are given diagrammatically below with lines linking those species that were not significantly different.



Analysis of height measurements indicated the formation of two groups. Lot No. 111 (Pm), 110(Pm), 102 (Oo), 095(Pa) were significantly better in height than 108(Pm), 106 (Oo) and 107(Oo) respectively.

3.4 Average Annual Height Growth

Since linkings in the average annual height growth overlap, it can generally be stated that 111(Pm), 095 (Pa), 102 (Oo) and 110(Pm) were tended to be better in height growth than 108(Pm), 106(Oo) and 107(Oo) respectively.

TABLE 3.

TABLE 3. Girth of tested species.

Species (Lot No.)		Girth (inches) (July/1986)
Pinus maximinoi	(111)	12.2
Pinus maximinoi	(110)	8.9
Pinus maximinoi	(108)	10.1
Pinus oocarpa	(107)	8.5
Pinus oocarpa	(106)	8.8
Pinus oocarpa	(102)	12.1
Pinus patula	(095)	10.2

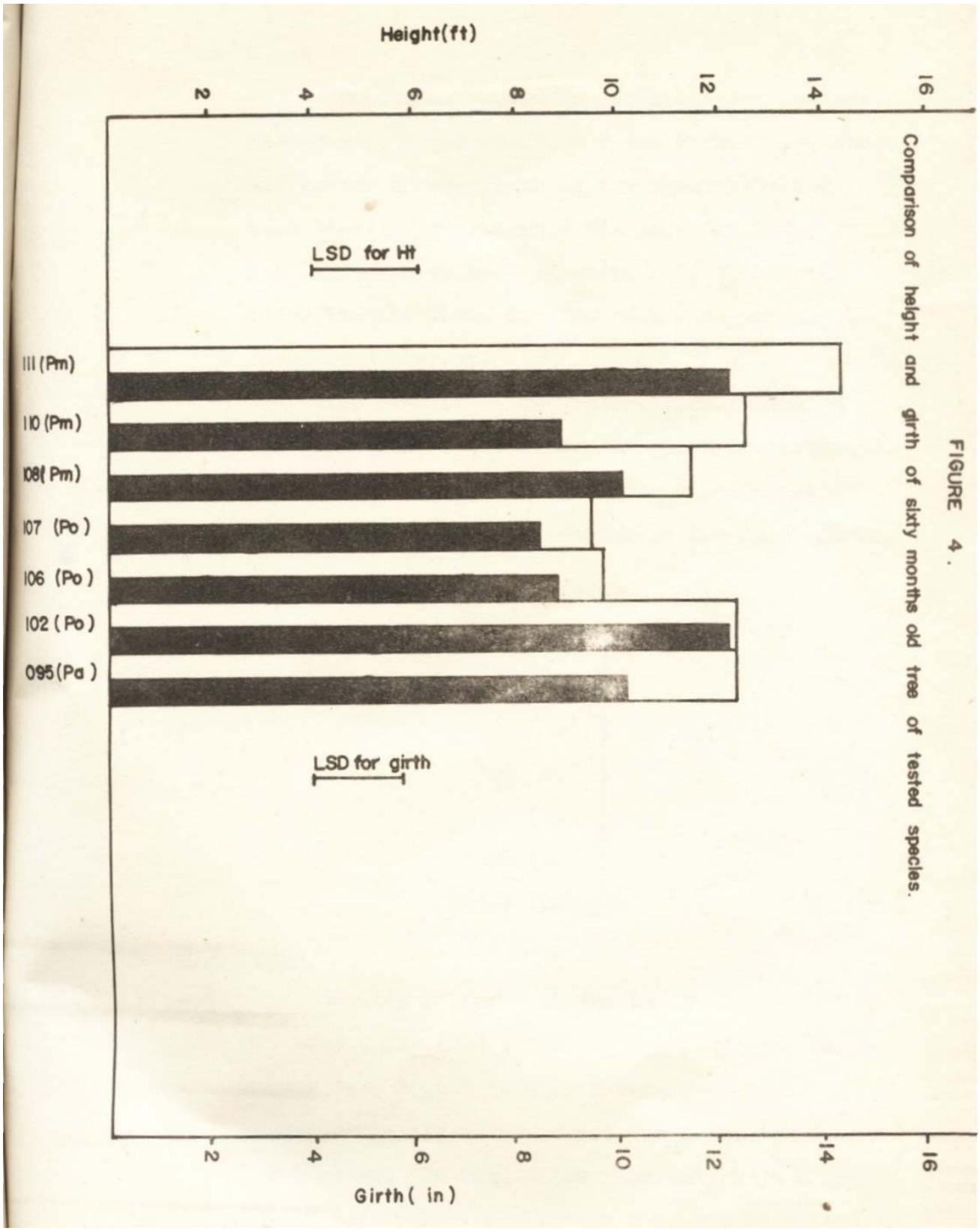


FIGURE 4.
Comparison of height and girth of sixty months old tree of tested species.

3.5 Girth

Results of growth in girth for the specifics tested were given in Table 3 and Figure 4. The difference in the girth of the species tested were highly significant. (See Appendix V). Rankings were given diagrammatically below with lines linking those species that were not significant different.

The results of the observation indicated the formation of two groups in girth measurements. Lot No. 111(Pm) and 102(Oo) were significantly the best while the rest were significantly poorer.

Girth (1986)

111 (Pm)
102 (Oo)

095 (Pa)
108 (Pm)
110 (Pm)
106 (Oo)
107 (Oo)

4. Discussion

4.1 Results of survival for Lot Nos.108(Pm), 107 (Oo), 095(Pa), 110(Pm) and 111(Pm) which ranges from 80.0 % to 90.8% were acceptable according to the standard set for teak. Lot No. 102(Oo) and 106(Oo) which gave only 67.6% and 68.5% survival were slightly poor but is still acceptable.

4.2 The pattern of height growth was found to be very interesting (See figure 3). Some species and provenances which were slow in height growth in the early stages were found to pick up in the later years, ie. 095 (Pa) which was in the fifth position in the early year shootup and latter on attains third position within 3 ½ years. Thus, it is very important not to judge the performance of a species or provenance in the early stages. As was suggested by (1976). Burley & Wood assessment should be made only at ¼ to ½ the rotation. However, from the results and the growth pattern in Figure 3, it is clear that Lot No.111 (Pm) was the best both in survival and heidht growth. It is also the most superior in girth measurement.

4.3 All the parameters assessed indicated that Lot No. 111(Pm) was the most superior among the species and provenances tested.

4.4 Lot No. 102 (Oo) although poor in survival % gave very good performance in both height and growth in the later years. This may be because the planting stock used was too small (ie. 6") for this particular species and provenance. Use of a slightly
bigger planting stock (ie. About 8" - 12") might give a much better survival.

4.5 Although the need to assess stem straightness branch size and branching habit was realized, the trees, at this stage, were considered to be still small for such assessment.
However, *Pinus maximinoi*, in general, appear to have very coarse branches.

5. Conclusion

5.1 Pinus maximinoi from Dulce Nombre, Honduras ie. Lot No. 111 (Pm) was the best both in survival and growth among the species and provenances tested, and is recommended for use in plantation establishment in the Shan States.

5.2 Pinus oocarpa from Pimientilla, Honduras Pepublic ie. Lot No. 106 (Oo) and Pinus oocarpa from Pneble Viejo,Guatemals ie. Lot No. 107 (Oo) are not recommended for use in Plantation in the Shan States.

5.3 The performances of the remaining species and provenances were satisfactory and can be used for plantation establishmesnt in the Shan States.

5.4 More species and provenances should be tested and stem straightness, branch size and branching habit should also be assessed in conjunction with survival and growth.

FIGURE . 5

Pinus maximinoi (lot no. 108).

Pinus maximinoi (lot no. 110)

Pinus maximinoi (lot no. 111)

Pinus oocarpa (lot no. 102)

FIGURE . 6

Pinus oocarpa (lot no. 106)

Pinus oocarpa (lot no. 107)

Pinus patula (lot no. 095)

Pinus kesiya plantation .

APPENDIX I

Lot No.	Country	Latitude	Altitude	Min.temp.	Max.temp.	Rainfall
108	Nicaragua	13˚15' N	4565'-4920' (3386')	7.5˚-8.8˚C	27-28.3˚C	53" (0.9"-3.5") Dry period
110	Honduras	14˚ 48' N	3937'	-	-	55" (April to August) Rain period
111	Honduras	14˚ 52' N	3937'	14.8˚ C	25.5˚ C	65.8" (1"-3.3") Dry period
102	Nicaragua	12˚ 55' N	2953'	-	-	55" (0.4"-2.6") Dry period
106	Honduras	14˚ 54' N	2133'-2789'	-	-	44.6" (0.2"-2.2") Dry period
107	Guatemala	15˚ 22' N	5578'-6234'	15.2˚ C	18.5˚ C	40.8" (0"-9.4") Dry period
095	..... not available					
Planting site	Burma (South Shan State	20˚ 40' N	4330'	Avg.temp.	26.7˚C	40.89"

APPENDIX II

Analysis of variance for survival percentage of tested species.

Source of variation	df	Sums of square	Mean square	F
Block	1	13.02	13.02	
Species	6	1094.37	182.40	5.63*
Error	6	194.54	32.42	
	13			

LSD = 13393

APPENDIX III

Analysis of variance for sixty months old tree Height of tested species.

Source of variation	df	Sums of square	Mean square	F
Block	1	0.44	0.44	
Species	6	34.56	5.76	7.68*
Error	6	4.52	0.75	
	13			

LSD = 2.12

APPENDIX IV

Analysis of variance for average annual height growth of tested species.

Source of variation	df	Sums of square	Mean square	F
Block	1	0.06	0.06	1.25
Species	6	1.75	0.292	6.08*
Error	6	0.29	0.048	
	13			

LSD = 0.54

APPENDIX V

Analysis of variance for sixty months old tree girth of tested species.

Source of variation	df	Sums of square	Mean square	F
Block	1	1.09	1.09	
Species	6	28.49	4.75	9.13**
Error	6	3.09	0.52	
	13			

LSD = 1.76

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5. U.S. Department of agriculture forest service, 1967, Elementary statistical methods for foresters. (Agriculture handbook 317)