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Preliminary Studies on Raising Tropical Pines in the Nursery

U Mehm Ko Ko Gyi & U Aung Khin
Forest Research Institute
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အပူပိုင်းထင်းရှူးမျိုးများကိုပဏာမစစ်းသပ်ပျိုးထောင်ခြင်း

ဦးမင်းကိုကိုကြီး နှင့် ဦးအောင်ခင်
သစ်တောစိုက်ပျိုးပြုစုရေးနှင့်အာနိသင်ဌာနစိတ်
သစ်တောသုတေသနဌာန

စာတမ်းအကျဉ်းချုပ်

ထင်းရှူးပျိုးပင်များသည် မှိုနာကျရောဂါ ဖြစ်လွယ်တတ်သောကြောင့် ဇီဝမူလဒြပ်မပါဟု ယူဆရသော အောက်ခံမြေဆီလွှာကို ၁၉၈၀ခုနှစ်အတွင်း အပူပိုင်းထင်းရှူးများကို ပျိုးထောင်ရာတွင် အသုံးပြုခဲ့ကြပါသည်။ တဖက်မှလည်း ဇီဝမူလဒြပ်ပါဝင်သော အပေါ်ယံမြေဆီလွှာကို အသုံးပြု ပျိုးထောင်ခြင်းဖြင့် မည်ကဲ့သို့အကျိုးသက်ရောက်မည်ကို နှိုင်းယှဉ်သိရှိရန်အတွက် စမ်းသပ်ပျိုးထောင် ခဲ့၍ ထိုပျိုးပင်များ၏အမြင့်တိုင်းခြင်းနှင့် စပ်မြေများနှင့်အပင်တစ်ရှူးများကို ဓာတ်ခွဲခြင်းများ ပြုလုပ် ခဲ့ပါသည်။ စမ်းသပ်မှုရလဒ်အနေဖြင့် ထင်းရှူးပျိုးထောင်ရာတွင် ဇီဝမူလဒြပ်ပါဝင်သော အပေါ်ယံ မြေဆီလွှာ အသုံးပြုစိုက်ပျိုးခြင်းဖြင့် ထင်းရှူးပင်ပိုမိုအောင်မြင်ပုံကို ဆွေးနွေးတင်ပြထားပါသည်။

Preliminary Studies on Raising Tropical Pines in the Nursery

U Mehm Ko Ko Gyi and U Aung Khin
Silviculture and Forest Influences Section
Forest Research Institute

Abstracts

Since pine seedlings are known to be rather susceptable to damping off in the nurseries, the method of using only subsoil, which is supposed to contain no organic matter was adopted in the introduction of tropical pines into Burma in 1980. In order to test the validity of this technique, pine seedlings were sown in mixture containing topsoil as well as in mixture containing subsoil for comparison. Plant heights were measured, soil and plant tissue analyses were carried out and the results were discussed in this paper. Using topsoil in the medium for sowing pine was found to be a better technique, according to this experiment.

Contents

1. Introduction

The increasing demand for the better land to be used for agriculture in the lowland tropics have caused foresters in many countries to look for fast growing tree species in order to meet the increasing timber and pulp-wood needs in their country (Lamb, 1967). Tropical pines, because of their good growth and their wood being more versatile than that of most non-conifers seemed to meet this need (Whitmore and Liezel, 1980). Consequently tropical pines have introduced, studied and planted extensively in the American, Australian, Asian and African tropics and subtropics (Lams, 1967,1973: Whitmore and Liezel, 1980).

Interest in lowland pine plantation by the Forest Department in Burma developed only in 1980. Pine nurseries had to be established with little prior research experience. Seeds of *Pinus caribaea* Mor, *Pinus oocarpa* Shiede, *Pinus elliottii* Engelm. and *Pinus taeda L.* were imported by the East Pegu Yoma Plantation Psroject (EPP) and nurseries were established at Moeswe and Maymyo under the guidance of an international consultant for EPP.

Because pine seedlings are quite susceptable to "damping off " a soil borne fungus disease, precautions were considered necessary to reduce the chances of infection. One such precaution taken was the use of relatively sterile subsoil which is supposed to contain no organic matter as the major component in the potting mixture.

However, organic matter was known to improve soil structure, aid water penetration and retention, act as reservoir of nitrogen and phosphorus, hold nutrients against leaching, and improve buffering action (Davey, 1965). Moreover, it is also needed for the development of mycorrhiza which is of great importance for proper development of pine (Davey, 1965; Russell, 1973; Pritchett , 1979). Thus, the authors felt that it was necessary to study and compare the use of forest topsoil which contains no organic matter in the potting mixture for planting pine.

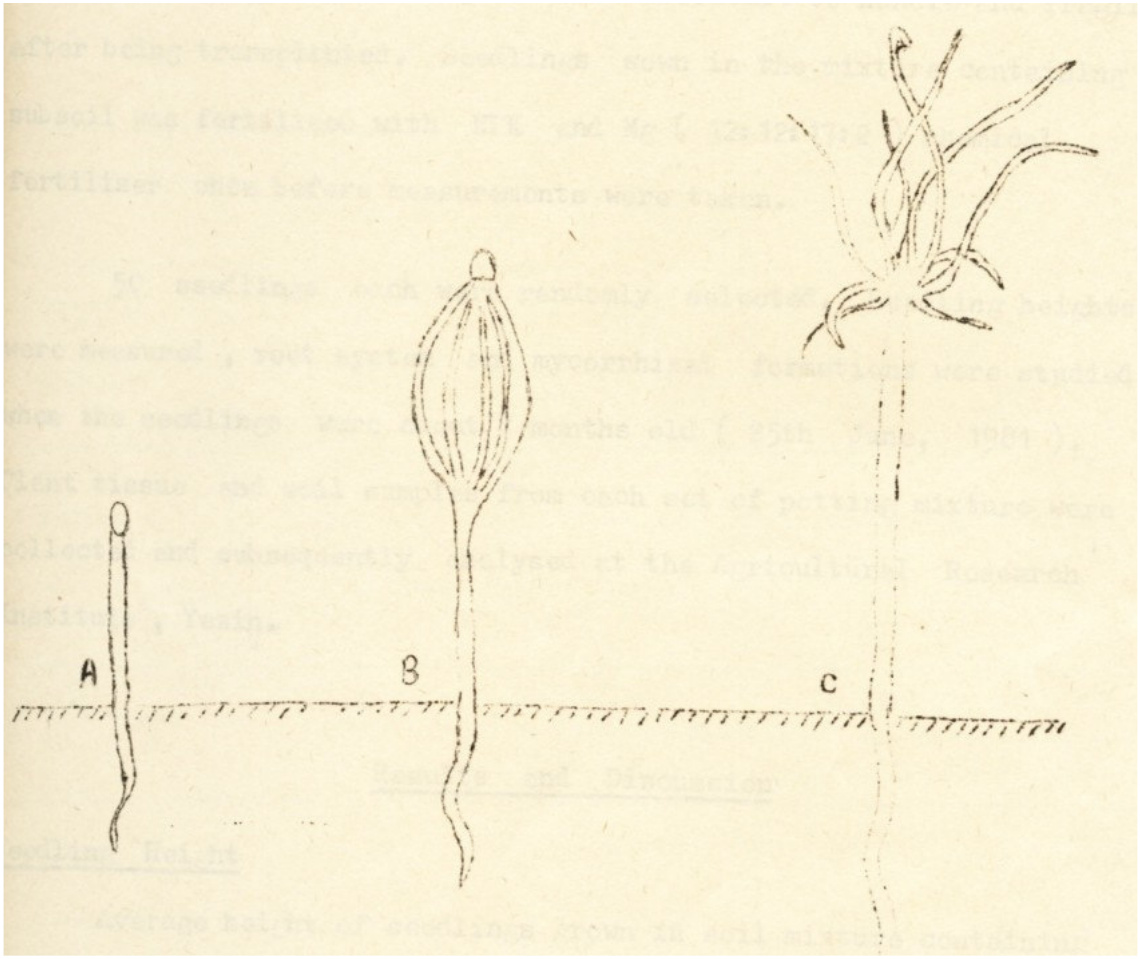
Paul (1972), in his handbook of nursery practice for *Pinus caribaea* var. *hondurensis* and other conifers in wet Malaysia considered that the nursery practice for most tropical pines to be the same. Similarly, in this study, only *Pinus caribaea* Mor. Var. *hondurensis* Barr, and Golf. was used as representative for tropical pines.

Pinus caribaea Mor. occurs naturally in Bahama Island, Western Cuba. Isle of pines, Honduras, Guatemala, Nicaragua and British Honduras (Mirov, 1967, Lamb, 1967; Whitmore and Liezel, 1980). There are three varieties, namely *Pinus caribaea* Mor., *Pinus caribaea* Mor. Var. bahamensis Barr. and *Pinus cahribaea* Mor. Var. *hondurensis* Barr. and Golf (Mirov, 1967). Of the three varieties, *Pinus caribaea* Mor. Var. *hondurensis* Barr. and Golf. is the most production over a wide range of site throughout the tropical (Lamp, 1973; Whitmore and Liezel, 1980).

This report, as stated in the topic, is only a preliminary study, and the results obtained are not as yet complete. However, it is hoped that this interim results of the nursery practice of lowland pines would be useful to Forest Officers who will be faced with the new assignment of planting tropical pines on large scale.

2. Methods

Two potting mixture were tested : namely (1) a sandy subsoil which contained essentially no organic matter mixed with about 2% of topsoil taken from a pines forest in the Shan State, and (2) a soil mixture composed of local topsoil, sand and pine forest topsoil, in the volume ratio of 7:3:1. The pine forest topsoil was used in both mixtures in an effort to insure mycorrhizal infection of the young seedling roots.



2.1 A-matchstick stage.

Seeds were germinated in seed boxes containing clean moist sand and were transplanted into plastic bags containing the above mentioned 2 soil mixtures on 29th November 1980, just before the seed coat was cast. The best size for pricking out was found to be at the matchstick stage, ic. about 3 days after germination. (See illustration above) Care was taken that seedlings were handled only by the seed coat and by the stem. Stage "c" in the illustration is too late for transplanting as it is difficult to handle and fragile after being transplanted . Seedlings sown in the mixture containing subsoil was fertilized with NTK and Mg (12:12:17:2) chemical fertilizer once before measurement were taken.

50 seedlings each were randomly selected. Seedling heights were measured, root system and mycorrhizal formation were studied when the seedlings were about 7 months old 5th June, 1980). Plant tissue and soil samples from each set of potting mixture were collected and subsequently analyzed at the Agricultural Research Institute, Yezin.

3. Results and Discussion

3.1 Seedling Height

Average height of seedlings grown in soil mixture containing forest topsoil (19.6 cm) was found to be significantly superior to that grown in soil mixture containing only subsoil and mycorrhizea incoulum (7.8 cm). The bottom on either of needles of seedlings grown in the subsoil was necrotic and all the seedling were in a very poor state. Moreover, it is generally considered that the plantable size for tropical pines is about 20 cm. (Lamp, 1973), and the seedling that were grown in the subsoil were far beyond this mark.

Table – I Results of soil physical analsyses of soil mixtures containing forest topsoil and subsoil

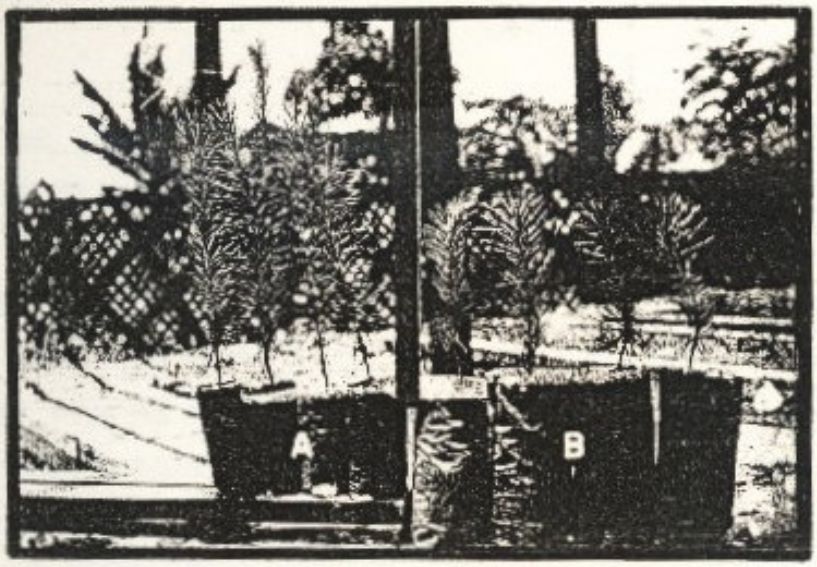
Treatment	Organic Matter(%)	Texture		
		Sand (%)	Silt (%)	Clay (%)
Topsoil	2.20	77.8	7.0	15.0
Subsoil	0.91	89.4	3.0	7.0

Table – II Results of soil chemical analyses of soil mixtures containing forest topsoil and subsoil.

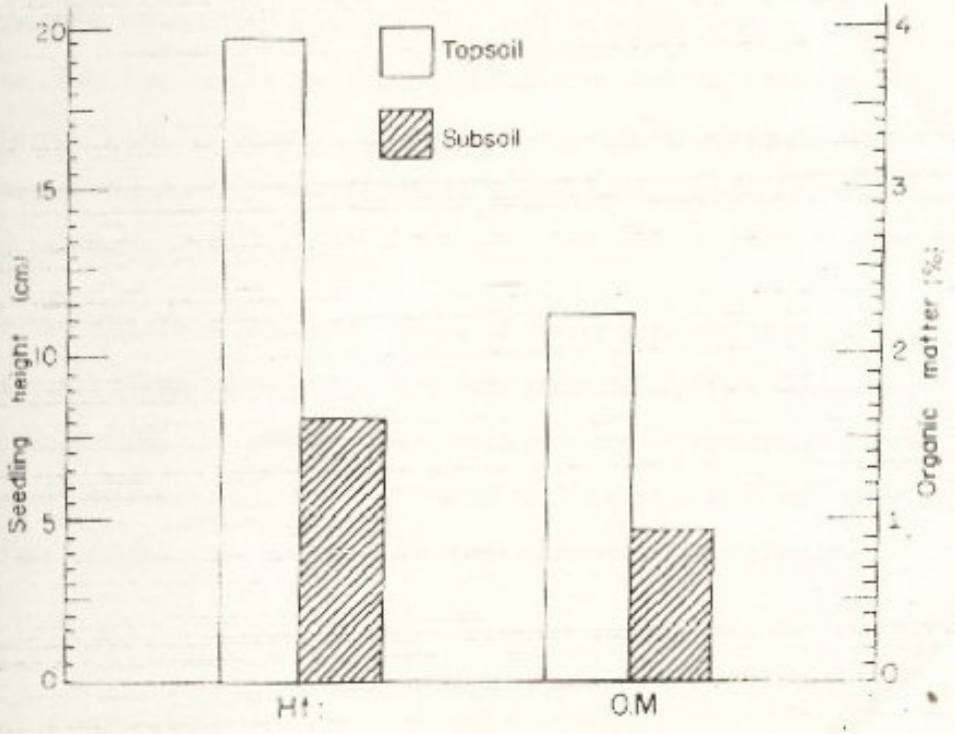
Treatment	p^H	Available		
		N (%)	P_2O_5 (lb/ac)	K(%)
Topsoil	7.7	0.0059	20.5	0.0082
Subsoil	8.3	0.0014	39.5	0.0065

Table – III Results of plant tissue analyses of seedlings grown in soil mixtures containing forest topsoil and subsoil.

Treatment	Total		
	N (%)	P (%)	K (%)
Topsoil	0.7805	0.3121	0.7130
Subsoil	0.7895	0.3881	0.4930



Effect of different soil mixtures on the growth of seven-month old Pinus caribaea var. hondurensis seedlings (A) mixture using forest topsoil, and (B) mixture using subsoil.



Comparison of average seedling heights and organic matter contents of the soil mixtures

3.2 Root Formation

Although the seedling grown in mixture containing forest topsoil have batter root systems, root formation in both cases was poor. Lateral root was found to be very sparse and the primary tap roots were extended and coiled at the bottom of the plastic container. Probably a system of root pruning which was effective on *Pinus radiata* D. Don could have been applied here to improve the formation of the root system (Cameron, 1969; Rook, 1969).

3.3 Mycorrhiza formation and soil p^H

The benefit of mycorrhizae in the growth and development of trees has been ascribed to many factors namely (1) increase in nutrient and water absorption by virtue of an increased absorptive surface area and as provided by mycelia permeating the soil in the vicinity of short roots , (2) increase in nutrient mobilization through biological weathering, and (3) increase in feeder root longevity by providing a biological deterrent to root infection by soil pathogens (Pritchett , 1979; Slankis, 1958).

An appreciable number of clumps of active mycorrhizae was found on the root system of seedlings that were grown in mixture containing the forest topsoil. However, only small evidence of mycorrhizae formation was observed on the root system of the seedlings that were grown in the mixture containing the subsoil. No active mycorrhizae was present. This could be due to the low organic matter content in the mixture containing the subsoil (0.91%) as an appreciable supply of organic matter is needed for the development of mycorrhizae on the roots of conifers (Davey , 1965; Russell , 1973). Moreover, according to Pritchett, (1979); mycorrhizae perfer a slightly acidic soil, but the p^H of the mixture containing the subsoil was very high (8.3). Although still high (7.7), the pH of the mixture containing the forest topsoil must have been marginal for the survival of the mycorrhizae. Further studies will be necessary to confirm the need for closer control on soil acidity.

Initial acidity of the mixture containing the forest topsoil was p^H 6.5. However, it had increased to p^H 7.7 within 7 months. This could be due to the high concentration of calcium in the water plus the low percentage of organic matter in the soil mixture. Organic matter acts as a buffer which slows the p^H change (Davey, 1965; Pritchett, 1979). The percentage of organic matter was much lower and that of sand higher in the mixture containing the subsoil than that containing the forest topsoil. This tends to correlate with the high p^H value of the former (8.3) and slightly lower p^H value of the latter (7.7).

3.4 Soil properties

Paul (1972) considered that the sand and silt/clay ratio of 83:17 be closest to ideal. From the soil analysis data in Table I, the ratio of sand and silt/clay of both the mixture used in this study were quite close to the mark.

The percentage of organic matter in the mixture containing the topsoil was higher (2.20%) than that the mixture containing the subsoil (0.91%). However "damping off" did not occur as severely as was feared in the mixture containing the

topsoil. Although no fungicide was applied as was practised in other countries, only 4.3% was attacked.

Since the mixture containing the forest topsoil has a higher percentage of organic matter, it is evident that the percentages of organic matter, it is evident that the percentages of available nitrogen and potassium would be higher (Table II). However, the fact that it contains a lower percentage of available $P_2 O_5$ was difficult to explain.

3.5 Plant tissue analysis

Plant tissue analysis revealed that there was no significant difference in the nitrogen content. According to Pritchett (personal discussion) the value should be about 1%. Thus, there may have been a slight nitrogen deficiency in both cases. There was also no significant difference in the value of phosphorus. However, they are sufficiently high as the normal value should be between 0.1%- 1.2% Pritchett, personal discussion). The normal value for potassium as specified by Pritchett (personal discussion) is 0.6%. Thus, the seedlings mixture containing the forest subsoil was slightly deficient in potassium (0.4930%), while those grown in mixture containing forest topsoil was adequate (0.7130%).

4. Conclusion

(1) From the results obtained from this study, it is evident that forest topsoil should be used in the soil mixture for transplanting tropical pines in the nursery.

(2) In order to promote proper development of both pine seedling and mycorrhiza, the soil mixture should be acidic. A pH range of 4.8 – 5.7 is recommended (Paul, 1972; Pritchett, 1979).

(3) In order to maintain the pH value and prevent the deficiencies of the required chemical constituents of the soil, use of organic matter in the form of either manure, sawdust or compost in the nursery soil mixture and addition of chemical fertilizer should be considered. However, care should be taken in using chemical fertilizer as overdose can be fatal to the seedlings.

(4) In order to improve the poor root formation observed in this study, further studies on system of root pruning and type and size of container should be carried out.

(5) A minimum of 10% (by volume) mycorrhizal soil should be used in the potting mixture for pine.

(6) Sand and silt /clay ratio of 80:20 is initially recommended for the nursery soil mixture until further information become available from the on – going series of experiments. Coarse sand should be used in order to get the required texture.

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