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อิทธิพลของชนิดของวัสดุชำ และภาชนะชำต่อการเจริญเติบโตของกล้าไม้ประดู่ป่า

EFFECT OF CONTAINER TYPES AND POTTING MEDIA ON THE INITIAL GROWTH OF *PTEROCARPUS MACROCARPUS* SEEDLINGS

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บทคัดย่อ

ทำการทดลองเพื่อหาชนิดของวัสดุชำและภาชนะชำที่เหมาะสมต่อการผลิตกล้าไม้ประดู่ป่า ที่ศูนย์เมล็ดพันธุ์ไม้ป่าอาเซียนแคนาดา ซึ่งดินและน้ำมีความเป็นด่างสูง กล้าไม้ไม่สามารถเจริญเติบโตได้ดีโดยใช้หน้าดินล้วนได้ การทดลองใช้แผนการทดลองแบบ 3 x 3 Factorial in Randomized Complete Block design โดยมีปัจจัยที่ 1 คือ วัสดุชำ ได้แก่ ขุยมะพร้าว, หน้าดินผสมขุยมะพร้าวในอัตรา 1:1, และหน้าดินผสมทรายและขุยมะพร้าวในอัตรา 1:1:1 ปัจจัยที่ 2 คือภาชนะชำ ได้แก่ ถุงพลาสติกดำขนาด 6 x 4 นิ้ว (ปริมาตร 500 มิลลิเมตร) และถาดดำ (Hiko box มีปริมาตร 133 มิลลิเมตร) กล้าไม้ทุกต้นจะใส่ปุ๋ย Osmocote สูตร 13:13:13 ในปริมาณ 0.4 กรัม

ผลการทดลองพบว่าในระยะกล้าไม้ก่อนการย้ายปลูก กล้าไม้ประดู่ป่าจะเจริญเติบโตได้ดีที่สุดในขุยมะพร้าว ตามลำดับ พบว่ากล้าไม้เจริญเติบโตใน ภาชนะชำขนาดใหญ่ได้ดีกว่าในภาชนะขนาดเล็ก อย่างไรก็ตามหลังจากการย้ายปลูกพบว่าวัสดุชำไม่มีผลต่อการเจริญเติบโตของกล้าไม้อย่างเด่นชัด กล้าไม้ที่เพาะชำโดยใช้ Hiko box จะเจริญเติบโตได้ดีที่สุด เนื่องจากเป็นภาชนะชำที่สามารถบังคับรากให้เจริญเติบโตในแนวดิ่ง รากจึงสามารถเจริญแผ่ขยายไปในดินได้อย่างรวดเร็ว

ABSTRACT

In tropical nurseries it is often difficult to grow seedlings because of soil conditions such as a high pH. This paper reports on an experiment at the ASEAN-Canada Forest Tree Seed Centre in Thailand to identify the most suitable container type and growing medium for producing seedlings of *Pterocarpus macrocarpus*. Three container types and three medium types were tested, using a 3 x 3 factorial experiment in a Randomized Complete Block design. Container types were 6 x 8 inch (1,000 ml/cavity), 6x4 inch (500 ml/cavity), and Hiko box (133 ml/cavity). Media were coconut husk, mixture of topsoil and coconut husk (1:1:1). Results showed that in the nursery stage seedlings grew best in coconut husk. Seedlings grown in the mixture of topsoil and coconut husk grew better than seedlings grown in the mixture of topsoil, sand. and coconut husk. Seedlings grown in bigger container showed better growth. However, after out-planting, seedlings grown in the Hiko box showed the best result, while medium type had no significant effect on seedling growth.

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INTRODUCTION

When seedlings are planted in containers they do not have as much growing medium available as when they are planted bare rooted. The root environment is also significantly affected by the physical and chemical composition of the medium, the size and shape of the container, the surface upon which it is placed to grow, and the ambient atmosphere of the containers (Davison and Mecklenburg, 1981).

The growing medium in the containers serves the same function for seedlings as soil does in the field (Tinus and McDonald, 1979).

Many natural materials can be used as growing media, such as sand, compost, peat, sphagnum moss, vermiculite, and topsoil. There are also synthetic materials available. In North America a peat-vermiculite mixture is often used to grow seedlings (Tinus and McDonald 1979). However, topsoil tends to be used in developing countries. But wherever nurseries are located appropriate potting mixtures are important because nurseries are often sited on degraded forest lands where little topsoil is left.

The function of containers is to pack seedlings into a standard size and shape for ease of handling during nursery operations, shipping, and outplanting. From the literature reviewed, it is apparent that the larger the container size, the more positive the seedling growth (Houston and Heiligmann, 1985; Hendromono and Suhaendi, 1986; Cunningham and Geary, 1989; Mindawati and Rostiwati, 1989). However, it is also true that handling becomes more difficult and expensive as container size increases. Using polyethylene bags has been popular in developing countries because of the low cost. However, it causes permits root circling (Tinus, 1984).

Kajornsrichon (1992) grew seedlings of various tree species in different types of container and media at the nursery of the ASEAN-Canada Forest Tree Seed Centre (ACFTSC) where the soil is sandy clay loam with poor drainage and very hard when dry. Soil and water pH was high (approximately 8.0). It was found that in this condition forest tree seedlings can not grow well in local topsoil. *Pterocarpus macrocarpus*, *Dalbergia cochinchinensis*, *Pinus caribaea*, and *Parasenanthes falcataria* grew best in topsoil mixed with sand. Container size was positively correlated with seedling growth only in the case of fertile media.

The experiment reported here was conducted at the ACFTSC, Saraburi, Thailand, where the average meteorological features are as shown in Table 1. In these alkaline conditions, some seedling species seem to grow well only in coconut husk, but the initial cost of husk preparartion is still expensive for a small scale nursery. The objective of the experiment was to try to reduce the volume of coconut husk as potting medium to other media with suitable container type.

MATERIAL AND METHODS

Pterocarpus macrocarpus seeds were sown in early March 1992. After 2 weeks seedlings were transplanted and grown in different container types and potting media. There were 3 container types : 5 x 8 inch Hiko Box (133 ml/cavity), 6 x 4 inch black plastic bags (500 ml), and 6 x 8 inch black plastic bags (1,000 ml), and 3 medium types : pure coconut husk, mixture of topsoil and coconut husk (1:1), and mixture of topsoil, sand, and coconut husk (1:1:1).

Each seedling was fertilized with 0.4 gm of slow release Osmocote fertilizer (13:13:13). A 3 x 3 factorial Randomized Complete Block design with 24 seedlings/experimental unit was used. Seedling height and diameter were measured periodically. Shoot/root ratio, total dry weight, and survival rate measurements were taken before out-planting. Four-

Table 1. Average meteorological data for the ASEAN-Canada Forest Tree Seed Centre, Muaklek, Saraburi.

Month	Rainfall (mm)	Temperature		Relative humidity (%)
		Max.	Min.	
January	18.75	34.22	12.97	84.09
Febuary	9.30	35.55	14.05	79.57
March	47.25	36.88	17.72	78.69
April	27.85	38.45	19.50	78.69
May	124.52	37.92	21.05	77.14
June	135.55	34.78	21.32	78.36
July	108.27	34.75	21.12	79.67
August	196.62	33.28	21.65	82.90
September	166.94	33.22	20.17	85.51
October	208.84	35.53	15.73	84.74
November	38.00	32.66	12.20	79.93
December	19.20	33.93	11.17	76.06
Total	1,101.10			958.47
Average	91.75	35.09	17.39	79.87

month-old seedlings were planted in late July 1992. The experiment was finished in March 1993.

Data were subjected to analysis of variance according to the following model :

$$X_{ijk} = \mu + M_i + C_j + MC_{ij} + e_{ijk}$$

Where X_{ijk} = growth parameter for the k^{th} seedlings in the i^{th} medium and the j^{th} container.

μ = overall experimental mean

M_i = effect of i^{th} medium

C_j = effect of j^{th} container

MC_{ij} = effect of interaction between i^{th} medium and j^{th} container

e_{ijk} = random error term

The F-test was used for comparing among treatments. The Multiple Range Test - Scheffe Method - at 95% confidence level was used for comparing the means.

RESULTS AND DISCUSSION

The results showed that in the nursery stage both container type and potting medium greatly affected diameter and height of *P. macrocarpus* seedlings. There was significant interaction between container type and potting medium only in height growth. Seedlings grew best in coconut husk and 6 x 8 inch plastic bags. However, after out-planting, there was no effect from the medium. Seedlings produced in Hiko boxes and a mixture of topsoil, sand, and coconut husk showed good performance in the field. After planting, diameter growth of seedling seems to increase faster than height growth. The effect of container type and potting medium is shown in Tables 2 and 3, and illustrated in Figures 1 - 4.

The interaction of container type and potting medium on average height and diameter in the nursery is shown in Table 4. Seedlings grew best in 6 x 8 inch bags. Seedlings grown in 6 x 4 inch bags were bigger than those grown in Hiko boxes. For every container type, seedlings grew best in coconut husk, followed by those grown in the mixture of topsoil and coconut husk, and the mixture of top soil, sand, and coconut husk, respectively.

The growth parameters of seedlings before out-planting were shown in Table 5. Height, diameter and dry weight increased with container size, while shoot / root ratio

Table 2. Average heights (cm) of *Pterocarpus macrocarpus* seedlings in different container types and potting media before and after planting

Seedling age (week)	Medium type			Significant level of medium	Container type			Significant level of container	Significant level of in interaction
	Coconut husk	Soil + Sand + Coconut Husk	Soil + Coconut husk		6 x 8" bag	6 x 4" bag	Hiko box		
10	21.51a	18.60b	19.32b	**	21.20a	20.19a	18.04b	**	**
12	24.30a	20.81b	22.10b	**	25.37a	22.64b	19.20c	**	**
14	27.12a	22.80b	24.72b	**	29.11a	24.40b	21.12c	**	**
16	28.55a	24.05b	26.94a	**	31.61a	26.76b	21.13c	**	**
22	29.22	27.39	28.86	ns	30.58	25.17	29.72	*	ns
25	28.03	28.78	30.60	ns	30.97	25.91	30.39	ns	ns
30	30.17	31.19	30.86	ns	31.78ab	26.44b	34.11a	*	ns
34	29.75	31.67	30.83	ns	31.73	26.00	34.51	ns	ns
38	30.67	31.96	29.56	ns	32.13ab	25.99b	34.15a	*	ns
42	30.48	32.04	30.91	ns	32.43	27.08	34.03	*	ns
46	29.42	31.22	29.68	ns	31.34	26.03	33.05	ns	ns

Note: Seedlings were planted at 16 week-old; ** = significant at $p \leq 0.05$; * = significant at $p \leq 0.01$; ns = non significant

Table 3. Average diameter (mm) of *Pterocarpus macrocarpus* seedlings in different container types and potting media before and after planting

Seedling age (week)	Medium type			Significant level of media	Container type			Significant level of container	Significant level of in interaction
	Coconut husk	Soil + Sand + Coconut Husk	Soil + Coconut husk		6 x 8" bag	6 x 4" bag	Hiko box		
10	3.69	3.74	19.32b	**	21.20a	20.19a	18.04b	**	ns
12	5.05	4.91	22.10b	**	25.37a	22.64b	19.20c	**	ns
14	5.65	5.47	24.72b	**	29.11a	24.40b	21.12c	**	ns
16	6.31	6.14	26.94a	**	31.61a	26.76b	21.13c	**	ns
22	7.22	7.27	28.86	ns	30.58	25.17	29.72	ns	ns
25	7.29	7.62	30.60	ns	30.97	25.91	30.39	ns	ns
30	9.84	9.91	30.86	ns	31.78ab	26.44b	34.11a	**	ns
34	9.79	10.00	30.83	ns	31.73	26.00	34.51	**	ns
38	9.56	9.90	29.56	ns	32.13ab	25.99b	34.15a	ns	ns
42	9.18	10.11	30.91	ns	32.43	27.08	34.03	**	ns
46	8.85	9.64	29.68	ns	31.34	26.03	33.05	**	ns

Note: Seedlings were planted at 16 week-old; ** = significant at $p \leq 0.05$; * = significant at $p \leq 0.01$; ns = non significant

decreased. Seedlings grown in better media showed better shoot/ root ratio.

Barnett (1984) reported that large seedlings consistently grew better after out-planting than small ones. This solution can not be used with this experiment because seedlings growing well in one kind of medium may not show good performance in the field. He also found that, in planting spruce and pine, much higher shoot/root ratios may be better for container grown seedlings. This solution can be used with the container effect but not with the media effect in this experiment.

The Hiko box was a kind of root trainer that not only gave the highest shoot/root ratio for seedling in this experiment, but also prevented root circling and encouraged roots to grow quickly into the surrounding soil (Josiah and Jones, 1992). It also made the seedlings grow faster after planting.

From this experiment, it was found that in producing *P. macrocarpus*, the container type should be changed from a plastic bag to a Hiko box (root trainer) because it requires a small volume of medium, is easy to handle, and makes seedlings grow fast after planting. All of the media (pure coconut husk, mixture of topsoil and sand, and mixture of topsoil, sand and coconut husk) can be used because there was no significance difference after transplanting.

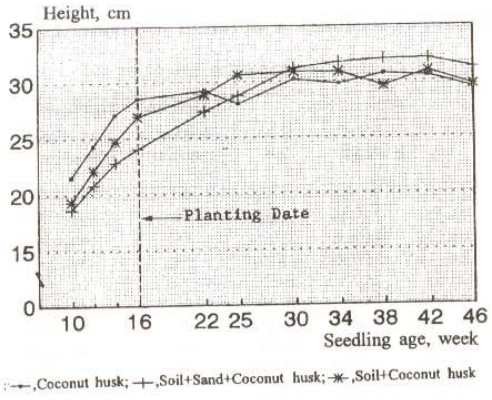

Figure 1. Effect of potting media on the height growth of *Pterocarpus macrocarpus* seedlings before and after planting.

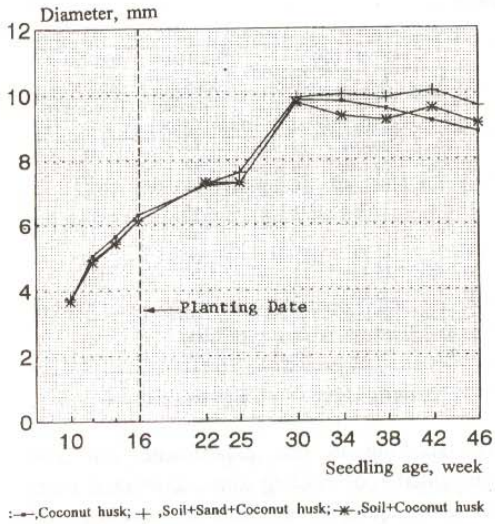

Figure 2. Effect of potting media on the diameter growth of *Pterocarpus macro carpus* seedlings before and after planting.

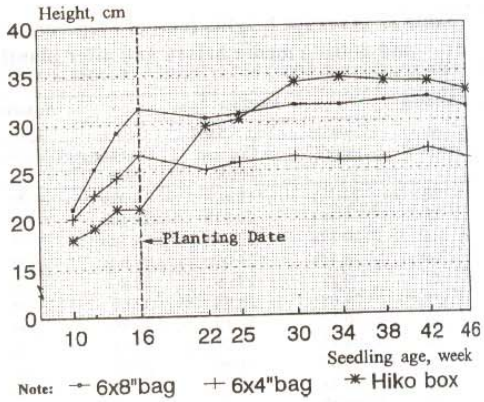

Figure 3. Effect of container types on the height growth of *Pterocarpus macrocarpus* seedlings before and after planting.

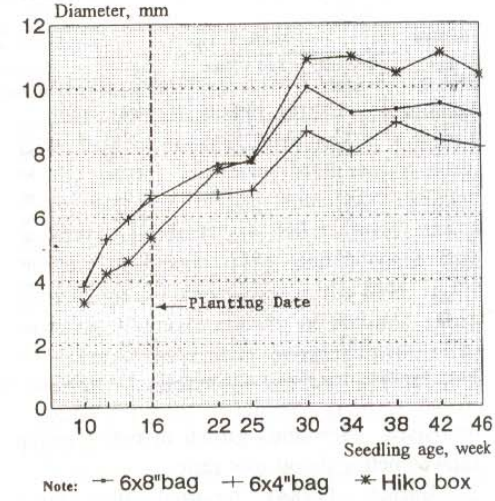

Figure 4. Effect of cntainer types on the diameter growth of *Pterocarpus macro carpus* seedlings before and after planting.

CONCLUSION

There was evidence that different types of growing medium and container play a role in determining growth of *P. macrocarpus* seedlings. In producing *P. macrocarpus* containerised seedlings, the container type should be changed from a plastic bag to a Hiko box (root trainer) because it requires a small volume of medium, is easy to handle, and makes seedlings grow fast after planting. All of the media (pure coconut husk, mixture of topsoil and sand, and mixture of topsoil, sand and coconut husk) can be used because they had significant differences only in the nursery not after planting.

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