



**UNIVERSITI PUTRA MALAYSIA**

**EFFECTS OF SOME NURSERY PRACTICES ON THE GROWTH OF  
ENDOSPERMUM CHINENSE BENTH SEEDLINGS**

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**EFFECTS OF SOME NURSERY PRACTICES ON THE GROWTH OF  
*ENDOSPERMUM CHINENSE* BENTH SEEDLINGS**

**By**

**DANG THINH TRIEU**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,  
in Fulfilment of the Requirement for the degree of Master of Science**

**March 2003**



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**Chairman: Mohd Zaki Hamzah, Ph.D**

**Faculty: Forestry**

An investigation was undertaken in *Endospermum chinense* Benth species to assess the growth of seedlings under some nursery practices.

Factorial experiments were conducted to study the effects of pot sizes, potting media and fertilizers on the growth of seedlings. Pot sizes were applied at two levels, i.e. 5.1 cm x 11.0 cm and 6.3 cm x 14.0 cm. The forest top-soil and river alluvial soil were tested as potting media. In addition, four levels of commercial fertilizer NPK at 0%, 0.5%, 1.0% and 1.5% and three levels of organic fertilizer such as 0%, 10% and 20% by weight of pot were used as fertilization. After 24 weeks of treatment, maximum growth, nutrient, and chlorophyll concentrations were recorded in treatments with highest inorganic and organic fertilizers. The inorganic fertilizer gave better seedling morphology and physiology. The use of larger pot size filled with forest top-soil medium also stimulated growth of seedlings as well as nutrient, and chlorophyll concentrations. Seedlings with a lower rate of growth were found to record a higher plant total carbohydrate concentration. Pot size, fertilizer and potting medium significantly influenced the morphology and physiology of *E. chinense*



seedlings in a decreasing order of importance. The factors interact additively to influence growth. The lack of one factor can be compensated by the excess of another.

An experiment was conducted to estimate the growth of seedlings under different light intensities: four levels of light regimes, 100%, 80%, 50% and 20% were used. The results showed that 80% of light intensity was optimal for growth of seedlings. The N, P and starch concentrations of seedlings were not affected by treatment. The K and chlorophyll concentrations were highest in 20% light intensity, but Ca concentration was highest in 100% light intensity.

Four levels of watering regime such as 100%, 75%, 50% and 25% were carried out to study the effects of water deficit on the growth of seedlings. Results suggested that *E. chinense* seedlings need unrestricted water for best growth in the nursery.

A field trial was conducted to assess the effect of nursery cultural practices on the growth and survival of the seedlings when they were out planted in the field. High quality *E. chinense* seedlings with best morphological and physiological condition can be produced when grown under optimum nursery conditions. Such plants will also perform better when out planted.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia bagi memenuhi keperluan untuk ijazah Master Sains

**KESAN BEBERAPA PRAKTIS NURSERI KE ATAS TUMBESARAN ANAK BENIH *ENDOSPERMUM CHINENSE* BENTH**

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Satu penyelidikan telah dilaksanakan untuk menilai kesan beberapa amalan nurseri ke atas tumbesaran anak benih *Endospermum chinense* Benth.

Ujikaji faktorial telah dijalankan untuk mengkaji kesan saiz tabung, media tabungon dan baja ke atas tumbesaran anak benih. Dua jenis saiz tabung digunakan, iaitu 5.1 cm x 11.0 cm dan 6.3 cm x 14.0 cm. Tanah atasan hutan dan tanah alluvial sungai telah diuji sebagai media tabung. Disamping itu empat jenis baja komersial, 0%, 0.5%, 1.0% dan 1.5% NPK, dan tiga peringkat baja organik iaitu 0%, 10% dan 20% berdasarkan berat tabung telah digunakan untuk pembajaan. Selepas rawatan selama 24 minggu, tumbesaran, nutrien, dan konsentrasi klorofil yang maksima telah dicatatkan oleh tabung bersaiz lebih besar, tanah atasan hutan, dan baja organik dan bukan-organik yang tinggi. Anak benih yang mempunyai kadar tumbesaran terendah didapati mengandungi jumlah konsentrasi karbohidrat yang paling tinggi. Saiz tabung, baja dan media tabung menunjukkan kesan yang bererti ke atas kualiti anak benih *E. chinense* mengikut Faktor-faktor



tersebut mempengaruhi tumbesaran melalui interaksi secara tambahan. Kekurangan satu faktor akan digantikan oleh peningkatan faktor lain.

Satu ujikaji telah dijalankan untuk menganggar tumbesaran anak-anak benih di bawah intensiti cahaya yang berlainan, empat peringkat intensiti cahaya iaitu 100%, 80%, 50% dan 20% telah digunakan. Keputusan kajian menunjukkan 80% intensiti cahaya adalah optima untuk tumbesaran anak-anak benih. Konsentrasi N, P dan kanji anak-anak benih tidak dipengaruhi oleh rawatan di atas. Konsentrasi K dan klorofil adalah tertinggi pada 20% intensiti cahaya, manakala konsentrasi Ca adalah maksima pada 100% intensiti cahaya.

Empat peringkat penyiraman, iaitu 100%, 75%, 50% dan 25% telah dijalankan untuk mengkaji kesan kekurangan air ke atas tumbesaran anak-anak benih. Keputusan menunjukkan bahawa anak-anak benih *E. chinense* memerlukan jumlah air yang tidak terhad untuk mencapai tumbesaran yang terbaik dalam nurseri.

Satu percubaan lapangan telah dijalankan untuk mengkaji kesan amalan kultur nurseri ke atas tumbesaran dan kadar hidupan anak-anak benih apabila ditanam di lapangan luar. Anak-anak benih *E. chinense* yang bermutu tinggi dari segi keadaan morfologi dan fizikal boleh dihasilkan apabila ditanam di bawah keadaan nurseri yang optima. Anak-anak benih tersebut juga menunjukkan prestasi yang lebih baik apabila ditanam di lapangan luar.

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I certify that an Examination Committee met on 5<sup>th</sup> March 2003 to conduct the final examination of Dang Thinh Trieu on his Master of science thesis entitled “Effects of Some Nursery Practices on the Growth of *Endospermum chinense* Benth Seedlings” in accordance with Universiti Pertanian Malaysia (higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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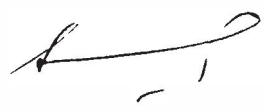
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## DECLARATION

I hereby declare that the thesis is based on original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.



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Date: 7 MAR 2008

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## LIST OF ABBREVIATIONS

%	percent
µg	microgram
ANOVA	Analysis of Variance
C	carbon
Ca	calcium
cm	centimeter
D	diameter
DLW	dry leaf weight
DRW	dry root weight
DSW	dry stem weight
F	fertilizer
g	gram
H	height
K	potassium
Kg	kilogram
LA	leaf area
M	manure
m	meter
MARD	Ministry of Agriculture and Rural Development
meq	milliequivalent
Mg	magnesium
N	nitrogen
P	phosphorus
ppm	parts per million
Rs	river alluvial soil
SAS	statistical analysis system
Ts	forest top-soil



# CHAPTER I

## INTRODUCTION

As a consequence of long wars, shifting cultivation practices and over-exploitation, Vietnam's forest area has been reduced considerably, from 43% of the country's land area in 1943 to 28% in 1995 (MARD, 1999). However, during the last decades, there has been an increasing recognition of the many diverse roles that forests and trees can play in helping to secure a stable rural development. It is realized that forestry should help to meet both basic needs of rural people and commercial needs of industry, to improve rural incomes and to combat environment decline.

Vietnam's demand for industrial wood is predicted to be at 9.35 million m<sup>3</sup> by 2010. While due to the policy of banning of natural forest exploitation, the wood that can be logged from natural forest in this period will be 300.000 m<sup>3</sup>/year (MARD, 1999). The balance will be met by forest plantations or imports from oversea countries. In order to meet these demands and to increase the forest cover in the whole country to 43%, a reforestation program involving 5 million hectares of forest by 2010 has been planted. It is necessary to increase the production of timber by intensive management of the forest resources.

In the last decades, some exotic trees such as Eucalyptus and Acacia became attractive plantation species in Vietnam. However, some native trees which have been planted in large scale are *Styrax tonkinensis*, *Manglietia glauca*, *Chucrasia tabularis*, *Pinus massoniana*, *Dendrocalamus membranaceus*, *Ramnoneuron balansae* and others. Some important biological advantages



indigenous species. It is possible to predict their performance in plantation based on their performance in natural stands; the species fills an existing ecological niche, it may therefore be less susceptible to diseases and pests, and the timber is well known to local industries. Therefore, the trend in forest plantation establishment for raw material supply in recent years concentrated in both exotic and indigenous fast growing species.

Reforestation success is highly dependent on the planting of high quality forest tree seedlings. (Duryea and McClain, 1984). The seedling quality is defined mainly by their morphological characteristics and physical appearance. However, field performance is also related to the seedling's physiological condition and interaction with the environment of the planting site. For this reason, there has been an increasing trend toward physiological characterization of planting stock (Burdett, 1983; Sutton 1979). Poor performance after planting has been linked to physiologically dependent response such as inability to regenerate new roots, poor nutrient status or impaired water uptake. Silviculturists have recognized the need for a greater understanding of those aspects of seedling physiology that are critical to optimal field performance.

*Endospermum chinense* Benth is indigenous, pioneer fast growing tree in Vietnam. It is distributed widely from North to Central highland provinces. The timber is favoured for the manufacture of match splints and boxes. It is also suitable for pattern making, plywood, pulp and paper productions. The establishment trials of *Endospermum chinense* Benth were preliminarily successful and the results showed that *E. chinense* is one of the promising indigenous species for reforestation (Nguyen

Ba Chat 2001). However, studies in *Endospermum* on nursery practices in general are sporadic (Soerianegara and Lemmens, 1994), so that there is no standard technique commonly adopted by all nurseries for producing planting stocks.

The present study consists of light, fertilizer and water regimes to evaluate the effects of those factors in nursery conditions on the growth and initial establishment of *Endospermum chinense* seedlings. The following specific objectives of the studies are:

- 1) To study the influences of fertilizer, pot size, and potting medium on the growth of *Endospermum chinense* Benth seedlings
- 2) To evaluate the effects of light regime on the growth of *Endospermum chinense* Benth seedlings
- 3) To assess dry matter partitioning and vegetative growth of seedlings under water stress
- 4) To determine the effects of fertilizer, pot size and potting medium in the nursery on the survival and growth of seedling after outplanting

## CHAPTER II

### LITERATURE REVIEW

#### *Endospermum chinense* Benth – A Profile

##### **Distribution**

*Endospermum chinense* Benth (*Euphorbiaceae*) is found from Assam (India) through Southern China towards Vietnam, Laos, Cambodia and Thailand. In Vietnam, *E. chinense* Benth is found from Northern to Central Highland provinces (FIPI, 1985).

##### **Ecology**

*Endospermum chinense* Benth occurs both in primary and secondary forests. It is often found in association with other species such as *Cinnamomum spp*, *Pygeum arboreum*, *Canarium album* Raeusch, *Machilu spp*, and *Engelhardtia chysolepip* Hance. (Nguyen Ba Chat, 2001). *E. chinense* is known as an opportunist species which occurs and dominates the gaps in the forests and are also common in areas with shifting cultivation (Vu KHCN, 1994). *Endospermum chinense* generally grows on low, flat to undulating country or sometime on hill-sites up to 800 m altitude with annual rainfall of between 1,300-2,500 mm, the mean annual temperature is 20-23°C, and the mean humidity is 80-85% (Nguyen Ba Chat, 2001). This species prefers moist, deep, well-drained soils with the pH of 4.6 to 6.0 (Vu KHCN, 1994).



## Silviculture Aspects

Fruiting of the species appears to be annual, and the fruits are heavily predated by insects. The fruits can be collected either by picking them off the tree or gathering them on the ground. A kilogram of fruit contains about 12,000 to 14,000 fresh seeds. The seeds should not be stored for more than 1 month due to of fast reduction germination capacity. In Vietnam, *Endospermum chinense* is mainly propagated by seeds. The fruits are soaked in water for 24 hours to allow macerate then separate the seeds. The seeds are soaked in water overnight before broadcasting in raised seedbeds. After sowing, the seeds are covered with about 0.5-1.0 cm of soil. The seedbed is mulched with dry grass, and subsequently watered. The seeds start to germinate after about seven days. The germination of fresh seeds is about more than 80%. (Cty Giong va Phuc vu trong rung, 1995; Vu KHCN 1994; and Nguyen Ba Chat, 2001).

## Property and Use

*Endospermum chinense* is classified as a light hard wood timber with average density about  $500 \text{ kg/m}^3$  at 15% moisture content. The wood is bright yellow and difficult to differentiated between sapwood and heartwood. The timber is easy to saw by hand and machine tool. It is suitable for a wide range of general utility purposes such as for making match boxes, match splints, drawing board, block boards and toys. It is also reported to be one of the favorite timber of making clogs, pattern making, trays, furniture part, plywood chest, and disposable chopsticks (Nguyen Ba Chat, 2001; and Soerianegara and Lemmens, 1994).