

PROPAGATING NATIVE TREES TO RESTORE DEGRADED FOREST ECOSYSTEMS IN NORTHERN THAILAND

Cherdsak Kuarak¹, Stephen Elliott¹, David Blakesley², Puttipong Navakitbumrung¹, Sudarat Zangkum¹ and Vilaiwan Anusarnsunthorn¹

ABSTRACT

Producing a wide range of native forest tree species to restore forest ecosystems for conservation of biodiversity is beset with nursery scheduling problems. Different species produce seeds at different times of the year and they have different growth rates, yet all seedlings must reach a plantable size at the same time of the year. A research programme was begun in 1997, to formulate production schedules for various forest tree species indigenous to northern Thailand and to determine optimum propagation methods. Basic data were collected on performance in the nursery from seed collection to planting out. In this short report, we present detailed results for four tree species suitable for forest restoration plantings (*Bischofia javanica*, *Castanopsis tribuloides*, *Ficus semicordata* and *Dalbergia rimosa*) and a summary production schedule for 35 species. Of these, 12, 22 and 1 species respectively reached plantable sizes by the 1st, 2nd and 3rd planting season after seed collection. The amount of nursery time required ranged from 6 to 25 months.

Key words: seedling production or propagation, forest restoration, tropical tree nursery methods, Thailand

INTRODUCTION

Deforestation is one of the most serious environmental problems in Thailand today, causing rural poverty, watershed degradation and loss of biodiversity. In the past, efforts to solve the problem usually meant establishing single-species plantations, which are of little value for wildlife conservation and watershed protection. Recently, however, the idea of restoring original forest ecosystems has rapidly gained ground. Some senior Royal Forest Department officials are actively promoting "enrichment planting", using a wide range of native tree species and a random planting pattern (CHATWIROON, 1997).

In 1993 a nation-wide project, involving the government, NGO's and the private sector, was launched to replant 8,273 km² of deforested land, to celebrate His Majesty King Bhumibol Adulyadej's Golden Jubilee. The project stipulates use of a wide range of native forest tree species. Consequently, tree-planting programs, using mixtures of several native

¹ Forest Restoration Research Unit, Biology Department, Faculty of Science, Chiang Mai University, Chiang Mai 50200, Thailand.

² Horticulture Research International, East Malling, West Malling, Kent ME19 6BJ, UK

forest tree species, have become very popular in Thailand. However, the results of such tree-planting programs are often disappointing. Their success depends on selecting suitable tree species and on the size and the quality of the trees planted. In the past, most tree nurseries grew very few, mostly commercially valuable species such as teak (*Tectona grandis* L. f. (Verbenaceae)) and *Eucalyptus* spp. (Myrtaceae). Now, to satisfy the growing interest in restoring forest ecosystems for wildlife conservation, there is an urgent need to propagate a much wider range of native forest trees in nurseries.

Growing a wider range of tree species, however, is beset with scheduling problems. Different tree species produce seeds at different times of the year and their seedlings grow at different rates, yet they must all reach a plantable size (40-60 cm tall) at the same time of the year, i.e. the beginning of the rainy season, May-June, in northern Thailand. The vast majority of the approximately 1,200 tree species indigenous to northern Thailand have never been propagated in nurseries. Lack of information about how to grow them has limited their use in forest restoration programmes.

In 1997, staff at the Forest Restoration Research Unit (FORRU) began collecting data on the performance of a wide range of native trees in the nursery. FORRU is a joint initiative between Chiang Mai University and the Headquarters of Doi Suthep-Pui National Park (under the Royal Forest Department). Its aim is to develop suitable techniques to restore forest ecosystems for wildlife habitat in conservation areas in northern Thailand (FOREST RESTORATION RESEARCH UNIT, 1998). This preliminary report presents the results of four species, which were part of larger experiments to propagate a wide range of native forest tree species. The objective was to prepare production schedules to raise trees to a plantable size from seed and to determine optimum propagation methods.

METHODS

Seeds of *Bischofia javanica*, *Castanopsis tribuloides*, *Ficus semicordata* and *Dalbergia ramosa* were collected and sown in baskets in a germination medium of forest soil and coconut husk mixed in the ratio 1:1. All seedlings were pricked out of the germination trays when they had the first pair of leaves and transplanted into black plastic bags 2.5 inches in diameter by 9 inches in depth. The potting mix consisted of forest soil, peanut husk and coconut husk mixed in the ratio of 2:1:1. Seedlings were shaded inside the nursery under a plastic roof (approximately 20% full sunlight), for about 2 weeks. During this time, they were given nitrogen fertiliser (45-0-0) every 2 days. Approximately 20 g of fertiliser was mixed with 10 litres of water and applied to the seedlings using a watering can. After two weeks, the seedlings were moved out of the nursery and placed under black shade netting (approximately 50% of full sunlight).

Fifteen seedlings of each species were randomly selected for monitoring of health and measurement of relative growth rate (RGR) of height and root collar diameter. These measurements were repeated every 45 days. Ten granules of Osmocote slow-release fertiliser (15-15-15) were applied to selected species every 3 months. Weeds, pests and diseases were controlled, as necessary for each species. Growth rate measurements ceased when the seedlings were ready for planting out, i.e. when they had grown at least 40-60 cm

tall (30 cm for the fastest-growing species) and appeared healthy and vigorous. Seedlings were hardened off in full sunlight for 4 weeks in May and dispatched for planting in June each year.

RESULTS AND DISCUSSION

Here, the results of the four species that typify three of the main types of production schedule (Table 1) are presented. Details for more species are summarised in Table 2.

Table 1. Three main types of production schedule.

Seed Collection	Ready for Planting	Time in Nursery (months)	Examples
Late rainy season	1 st planting season after seed collection	7-9	<i>Bischofia javanica</i>
Late rainy season	2 nd planting season after seed collection	19-21	<i>Ficus semicordata</i> <i>Castanopsis tribuloides</i>
Late dry – early rainy season	2 nd planting season after seed collection	14-16	<i>Dalbergia rimosa</i>

Bischofia javanica Bl. (Euphorbiaceae)

Seeds were collected from the ground beneath a parent tree on 19th October 1997 and sown on 21st October. Germination commenced after 13 days. Of 1,500 seeds sown, 1,270 germinated (a germination rate of 85%) by 30th December (70 days after sowing). However, damping off killed many seedlings, such that only 312 were suitable for pricking out and potting on 30th December. Of these 250 (80%) grew into plantable saplings. Plants received Osmocote fertiliser in January and April. No pruning was carried out. The mean annual RGR was 861% for height and 437% for root collar diameter. Potted seedlings grew to a mean height of 36.4 cm by mid-June 1998. Because this species is fast growing, it can be planted out when 30 cm or taller. Therefore, most seedlings were ready for planting at the beginning of the first planting season following seed collection, i.e. after about 8 months in the nursery. RGR was slow during the cool season and accelerated during the hot season. Several potted plants suffered from a disease that caused leaf curling, but otherwise they remained in good health.

Recommendations for further research: treatments to prevent damping off of germinating seedlings; treatment of leaf curling disease in larger seedlings.

Castanopsis tribuloides (Sm.) A. DC. (Fagaceae)

Seeds were collected from the ground beneath a parent tree on 20th November 1997 and sown on 22nd November. Of 1,500 seeds sown, 814 germinated (a germination rate of

54.3%) by 13th February 1999 (85 days after sowing). Germination was very asynchronous, with a long taproot developing before the shoot appears. Seven hundred and two seedlings were suitable for pricking out and potting on 13th February. Of these 631 (89.9%) grew into plantable saplings. Application of Osmocote fertiliser and pruning were not considered necessary for this species and were not carried out. The mean annual RGR was 213.4% for height and 164.4% for root collar diameter. Potted seedlings grew to an average height of only 6.8 cm by May 1998 and were therefore not ready for planting. By May 14th 1999, the seedlings had grown to a mean height of 50.2 cm and were therefore ready for planting in the second planting season after seed collection (i.e. after 19 months in the nursery). RGR was fairly constant throughout the year, except for a slowing of growth during the cool season. Seedlings remained in good health throughout their growth in the nursery.

Recommendations for further research: although seeds are available from August to November, the experiment above was performed on seeds collected in November. Experiments should be carried out with seeds collected earlier, using fertiliser to see if it is possible to grow the trees to a plantable size by the first planting season after seed collection (i.e. after about 10 months of growth in the nursery).

***Dalbergia rimosa* Roxb. var. *rimosa* (Leguminosae, Papilionoideae)**

Seeds were collected from the parent tree on 15th May 1998 and sown on 20th May. Germination commenced after 5 days. Of 1,500 seeds sown, 591 germinated (a germination rate of 39%) by 15th June (26 days after sowing). Five hundred and sixteen seedlings were suitable for pricking out and potting on 15th June. Of these 452 (87.6%) grew into plantable saplings. Plants received Osmocote fertiliser in October, January and April. No pruning was carried out. The mean annual RGR was 173.1% for height and 160.9% for root collar diameter. Seedlings grew to a mean height of 55.2 cm by May 31st 1999. Most seedlings were therefore ready for planting at the beginning of the second planting season following seed collection (i.e. after 14 months in the nursery). Growth was mostly constant throughout the year, but slightly higher than average at the end of the rainy season. Seedlings remained in good health throughout their growth in the nursery.

Recommendations for further research: investigate treatments to improve germination rate.

***Ficus semicordata* B.-H. ex J.E. Sm. var. *semicordata* (Moraceae)**

Seeds were collected from the parent tree on December 15th 1997 and sown on December 16th. Germination commenced after 31 days. Of 1,500 seeds sown, 770 germinated (a germination rate of 51.3%) by 13th July 1998 (210 days after sowing). However, damping off killed many seedlings, such that only 120 were suitable for pricking out and potting on 13th July 1998. Of these 72 (60%) grew into plantable saplings. Plants received Osmocote fertiliser in January and April. No pruning was carried out. The mean annual RGR was 284.1% for height and 190.3% for root collar diameter. Potted seedlings grew to a mean height of 53.5cm by June 10th 1999 and were therefore ready for planting in

the second planting season after seed collection (i.e. after 19 months in the nursery). RGR was fairly constant throughout the year, but slightly higher during the rainy season.

Recommendations for further research: treatments to prevent damping off of germinating seedlings.

A provisional production schedule has been compiled for 35 potential framework species, based on data collected in the FORRU nursery (Table 2). The amount of time required to grow seedlings to a plantable size ranged from 6 months for *Melia toosendan* Sieb. & Zucc. to 25 months for *Eurya acumminata* DC. var. *wallichiana* Dyer. Only 12 species reached a plantable size by the beginning of the first planting season after seed collection. Most of these species fruited in the mid- to late rainy season and exhibited rapid growth in the nursery. Twenty-two and 1 species reached plantable sizes by the 2nd and 3rd planting seasons after seed collection respectively. These species fruited at all times of the year, except June-July.

REFERENCES

- CHATWIROON, P., 1997. Forest situation and some responses in Thailand. Paper presented at the workshop "*From Reforestation to Rehabilitation*", Kuranda, Queensland, Australia.
- FOREST RESTORATION RESEARCH UNIT, 1998. *Forests for the future: growing and planting native trees for restoring forest ecosystems*. (Eds Elliott S, Anusarnsunthorn V and Blakesley D). Biology Department, Science Faculty, Chiang Mai University, Thailand. ISBN 974-656-217-7. 60 pp.

