ITTO PROJECT PD 386/05 Rev.1(F)
TECHNOLOGICAL DEVELOPMENT FOR THE PRODUCTION OF PLANTING MATERIALS TO SUPPORT SUSTAINABLE PLANTATION OF BALI INDIGENOUS SPECIES THROUGH COMMUNITY PARTICIPATION

Seed Collection and Handling

Pulai

Alstonia scholaris (L.) R.Br.

BALI PROVINCIAL FORESTRY SERVICE
AND
REGIONAL TREE SEED CENTER FOR BALI AND NUSA TENGGARA
AND
INTERNATIONAL TROPICAL TIMBER ORGANIZATION (ITTO)

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Eko B. Hardiyanto

BALI PROVINCIAL FORESTRY SERVICE AND
REGIONAL TREE SEED CENTER FOR BALI AND NUSA TENGGARA AND
INTERNATIONAL TROPICAL TIMBER ORGANIZATION (ITTO)
2008

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PREFACE

Bali Province has large degraded forest and land. Around 55.313 ha of land are classified as degraded and critical. In the mean time the demand on wood in Bali, particularly wood for handicraft industry has been increasing and the local wood production is not able to meet the wood demand. Wood-based local handicraft industry is an integral part of the tourism industry of Bali, taking up around 35% of wood consumption and providing a lot of job opportunities. Concern about the sustainability of the industry due to the deterioration of the resources has been growing.

The Provincial Government of Bali has addressed the above problems by embarking on the rehabilitation program of degraded forest and land by planting trees of indigenous species. The objectives are to empower local economy and improve environmental conditions, and to meet the ever-increasing demand of wood for local handicraft industry. Six indigenous species have been identified and selected in the planting program, and included in the International Tropical Timber Organization (ITTO) Project No: 386/05 Rev.1 (F) titled "Technological Development for the Production of Planting Materials to Support Sustainable Plantation of Bali Indigenous Species through Community Participation".

The availability of good quality of seeds and planting stocks as well as proper planting techniques have been identified as some of the many factors crucial for the success of planting program. This guideline is intended to provide information on seed collection and handling of *Alstonia scholaris*. The preparation of the guideline is part of the above ITTO Project and therefore the guideline is written heavily based upon the research findings generated from the same project and other experiences relevant to the subject.

The author hopes that the guideline will be useful for and benefit organizations or farmers involved in tree planting.

In this opportunity I would like to acknowledge the following individuals for their invaluable contribution to the preparation of the guideline:

- Ir. Made Sulendra, the Head of Bali Provincial Forestry Service;
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Eko Bhakti Hardiyanto
Tree Breeder and Silviculturist

Alstonia scholaris (L.) R. Br.
Seed collection and handling

Taxonomy and Nomenclature
Family : Apocynaceae
Vernacular/common names : pulai, pule

Natural Distribution and Habitat
A. scholaris has very wide natural distribution in the Asia Pacific region, starting from India and Sri Lanka to Southeast Asia and Southern China, Malaysia to Northern Australia and Solomon Islands. The species is tolerant to a wide range of soil types and habitats. It is found at lowlands with mean annual rainfall in the range of 1,100 – 3,800 mm. It is also found at high elevation above 1,000 m, but will not survive when the temperature below 8°C. The species can grow on shallow soil.

Uses
The wood is not sufficiently durable, only for internal-light construction, pulp and paper. In Sri Lanka *A. scholaris* is used for firewood and managed for a short rotation plantation of 6-8 years, but it is poor for charcoal making. Its stem bark contains alkaloid for medicine. The wood is often used for making black board in the school, that is why the species is called as scholaris (blackboard tree).

Botanical Features
Tree can achieve up to 40 m in height and 40-60 cm in bole diameter, has straight stem, with corky grey or grey-white bark. The bole of larger tree is fluted up to 10 m, tapering and slightly twisted. The outer blaze is creamy to yellowish and contains a lot of latex. The leaves are in whorls of 4-9 leaflets, the lamina obovate to elliptical with slightly pointed or rounded at the tip. The upper leaf surface is green, glossy, while the lower one pale-white. The leaf lamina is 10-25 cm long and 2.0-7.5 cm wide.

Young tree of *Alstonia scholaris*

Mature tree of *Alstonia scholaris*

Phenology

A. scholaris is evergreen species. The inflorescence is a much-branched terminal panicle and long. The flowers are clear white to cream, every flower can bear two fruits. Fruiting periods is October – November.

Fruit and seed

The fruit is a pendulous, dehiscent dry follicle, spindle shaped, 30-40 cm long, 4-5 cm wide, slightly woody, each containing numerous seeds. Mature follicle is yellowish green. Seed is flat, oblong brown , 4-5 mm long, with a tuft of hairs at each end.
Seed is dispersed by wind. There are 37,000-87,000 seeds per kg.

Seed collection

Seed collection should be done just before the seed is released, delay will cause seed loss due to dehiscence. Fruit may be collected by climbing the tree and taking the fruit directly or by shaking the branches and collecting the fallen fruit on the ground. The best time for seed collection is from October to November.

Fruits of *Alstonia scholaris*

Seeds of *Alstonia scholaris*

Seed handling

Collected fruits should be immediately dried under shade in a container with good air circulation to make the follicle dehisces and releases seed, normally it takes about one week of drying. The hairs of seed should be removed.

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Nursery and Planting

Pulai

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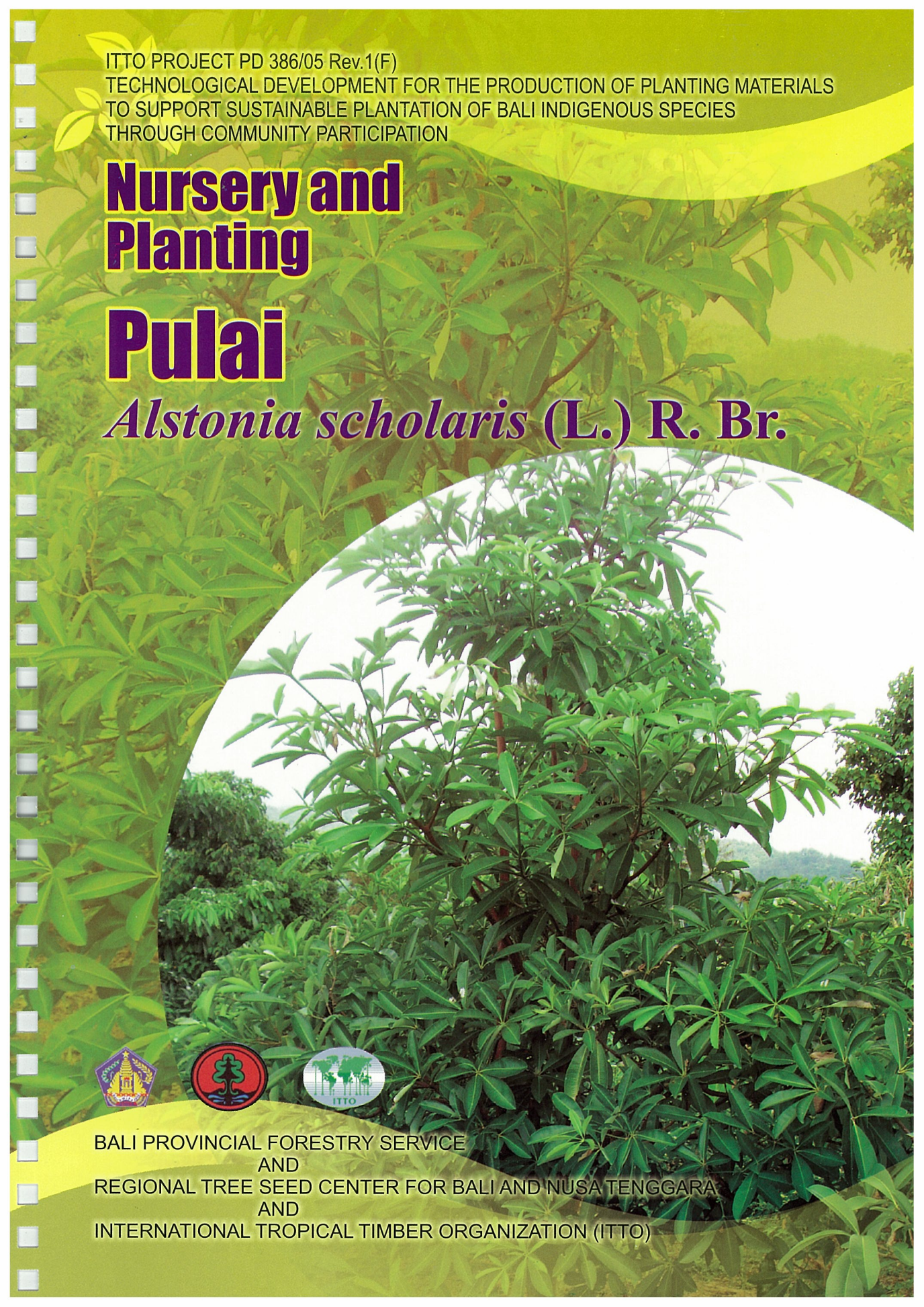

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The availability of good quality of seeds and planting stocks as well as proper planting techniques have been identified as some of the many factors crucial for the success of tree planting program. This guideline is intended to provide information on nursery and planting *Alstonia scholaris*. The preparation of the guideline is part of the above ITTO Project and therefore the guideline is written heavily based upon the research findings generated from the same project and other experiences relevant to the subject.

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Nursery and Planting

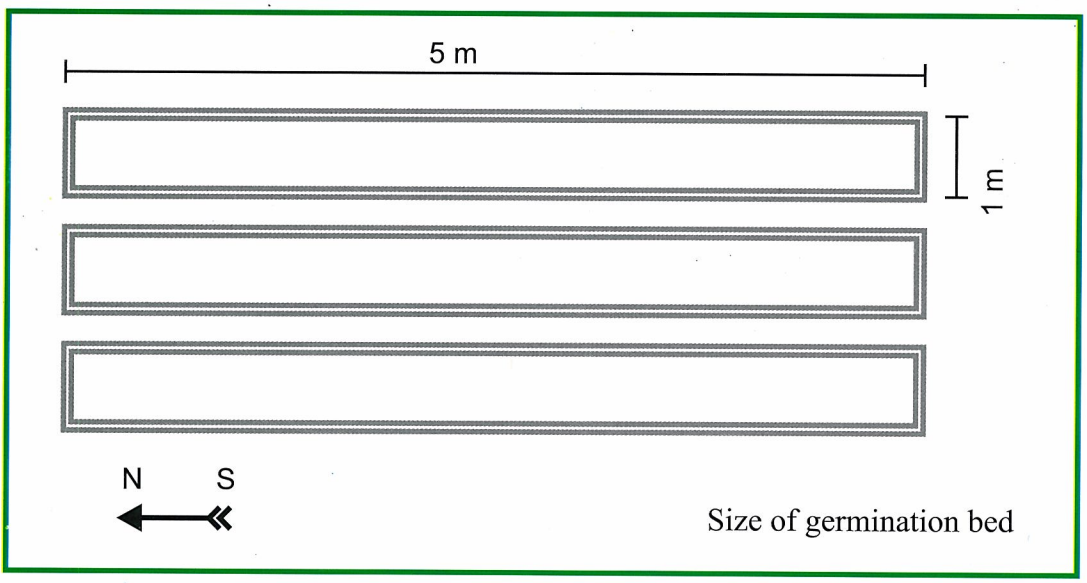
Site Selection of Nursery

The nursery site should be selected based on the followings:

a. Near the planting area to improve survival due to less damage during transport between the nursery and field.
b. Good accessibility to and within nursery.
c. Good topography (flat or gently slope) to make easy work. Low areas should be avoided as these will collect water at the low point and inhibit proper growth.
d. Ample, reliable and consistent water sources must be located nearby.
e. Workable soil.
f. Sufficient size to accommodate the number of seedlings needed to be raised.
g. Relatively easy to find workers.

Germination Bed

Germination bed with the size of 1 x 5 m may be prepared using brick, piece of wood or bamboo at the edge of the bed. Sowing media consist of fine sand. The media are put in the seed bed to a depth of about 15 cm. The surface of the media is leveled off to make easy for pricking and to prevent the root of seedling from damage during pricking. To reduce sun light the seed bed is put under shade using nylon net or coconut leaf (light intensity of 50 %).



Size of germination bed

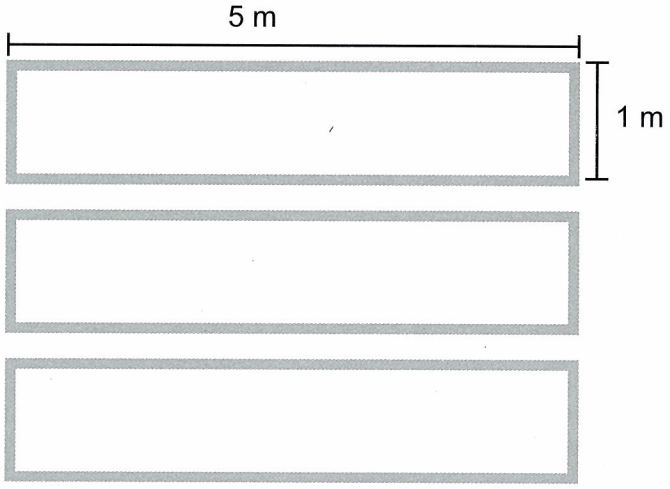
Seed Sowing

Pre-sowing treatment is not needed. Due to small seed size, seed should be mixed with fine sand , ash or fine soil with a proportion of 1 seed: 3 fine sand, ash or fine soil in volume. The mixture is sown on the germination bed and then covered with a 1 cm layer of fine sand, ash or soil. The germination bed should be watered every day to maintain its moisture. Normally seed starts germinating at the second week after sowing.

Seed growing
on the germination bed

Nursery Bed

Nursery bed is usually 1 m wide to facilitate hand tending and the length of bed is 5 m or depending on available space (arranged in north-south direction). To prevent container from falling, the edge of bed should be supported with piece of wood, bamboo or brick. The polybag previously filled with media is then put in the nursery bed. To reduce sun light the nursery is put under shade using nylon net or coconut leaf (light intensity of 50 %).



Size of nursery bed

Potting Media

Potting media consisting of a mixture of top soil and compost/ manure with a ratio of 8:2. The media should be mixed thoroughly before being filled into polybag. The potting media are filled manually by hand into the polybag with adequate density so that the filled polybag can be raised firmly. The polybags that already filled with media are placed in the nursery bed.

Filling the potting media into polybag

Pricking Out

Generally germination starts at the second week after sowing. Pricking will start when the seedling has developed two pairs of leaves, and a height of about 10 cm. Pricking should be done in the morning or late afternoon. The seedlings are pulled gently to prevent from damage and their roots are then slightly soaked in the water in a plastic box.

A vertical hole is made in the potting media to which the seedling will be planted using a bamboo stick. The root is then placed carefully into the hole so that it is not twisted. The seedlings are placed under partial shade (50 % light intensity) made of nylon net.

Seedlings in the nursery beds

Maintenance

Seedling maintenance includes weed control, pest and disease control and watering. Watering is regularly done, 1-2 times a day. Dead seedling should be replaced immediately. At 15 days old seedlings are fertilized using leaf fertilizer such as gandasil. In addition they are fertilized with NPK (15:15:15) at a rate of 10 g/l of water/m^2 of nursery bed given every week up to age of 2.5 months. Afterwards, seedling needs hardening off to make the stem lignified. During hardening off phase the frequency of watering is reduced, and fertilizer is no longer applied. Seedlings with lignified stem will be more robust to be transported and planted in the field. At 1 month of age the shade is progressively open as *A. scholaris* seedling grows better under full sun light.

Weed control

Watering

Seedling transportation

Seedling transportation

Transportation

Seedling transportation should be carried out carefully as the young seedlings are delicate and prone to damage. To have high survival and optimal growth the following procedures should be taken:

a. Ideally seedling should be planted in the same day as it is transported from the nursery;
b. During transport extra care to the seedling should be taken, avoiding damage and direct exposure to sunlight;
c. If delay of planting is likely special treatment is required as follows:
   - store the seedling in a cool place and out of the direct sun at all times;
   - never let the root dry out, sprinkle them with water when necessary.

Planting Site

A. scholaris generally grows at altitudes from 0 to 1,000 m with an optimum mean annual rainfall ranging between 1,850 and 2,500 mm and 2-5 months of dry period. The species grows on various soils: alluvial, latosol and vulkanic soil. It prefers light texture and well-drained soil.

Planting

Normally seedlings are ready to be planted in the field when they age 6 months, 30-40 cm in height, more than 4 mm in root collar diameter and have 5 pairs of leaf. *A. scholaris* may be planted in forest and farm lands or wood yard. The initial spacing varies depending on the planting objectives: 3 x 3 m, 3 x 4 m, 3 x 5 m or 4 x 5 m. In an agroforestry system trees may be spaced accordingly based upon the available space, or trees may be planted in the form of fence planting. In this regard trees can be spaced 3-4 m apart.

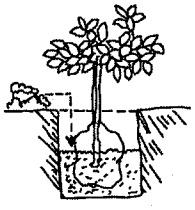
a. Site preparation

Site should be prepared accordingly to achieve a reasonable success in terms of survival and growth. Site preparation includes the followings:

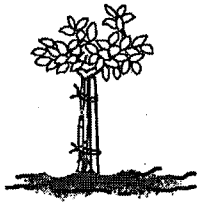
- Clearing weed and other unwanted vegetation;
- Improving physical soil properties;
- Marking out the planting spots with sticks and preparing the planting holes (40 x 40 x 40 cm). It is recommended to fill the planting hole with decomposed manure or organic compost at a rate of 3 kg per hole;
- Transporting seedling to the planting spots.

Planting procedures

Prepare planting hole (40x40x40 cm)



Tear the polybag and plant carefully



Provide a stick for support

b. Planting

The following planting procedures should be undertaken:

- Tear the polybag carefully, make sure that the soil media are not broken. When there are cracks in the polybag, press the polybag with hand slowly so as to remake the soil media firm. Avoid root twisted when planting since this will reduce tree growth or cause tree death in later years.
- Place seedling root down to the bottom of the planting hole carefully and hold the stem, push the soil into the planting hole until it is well filled up to the root collar.
- Pack the soils tightly around the tree roots with sole of the boots so that no air pockets are left near the tree roots. The air pocket may be filled with water which can cause seedling death due to lack of air for root.
- Carry out planting at the early rainy season if possible when the soil has enough moisture.
- Prepare additional seedling (about 10 % of the total seedling planted) for blanking. Replace the death trees with new seedlings immediately soon after planting.

Maintenance

Trees are fertilized using Urea (30-50 g/tree), applied one months after planting. The fertilizer is placed at furrow or holes at a depth of 10 cm, about 15 cm from the tree. The second fertilizer application is done at 4-6 months old with Urea at a rate of 100 g/tree.

Weed control is carried out by clearing weed around the trees. It is done until the trees are capable of competing and suppressing the weed.

Trees may have multiple stems, or forked branches starting at very low part of the stem. Multiple stems should be reduced to only single stem to improve stem form and quality. This operation is called singling. Singling is done by removing poor stems and leaving only one best stem. Singling should be done at early growth phase of trees when trees start showing multiple stems.

To increase wood quality, pruning needs also be carried out. Big branches not easily self-pruned should be pruned, otherwise the log quality will be poor.

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