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

Bentawas

Wrightia pubescens 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
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INTERNATIONAL TROPICAL TIMBER ORGANIZATION (ITTO)
2008

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CONTENTS

FIGURES

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 *Wrightia pubescens*. 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:

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Eko Bhakti Hardiyanto
Tree Breeder and Silviculturist

Wrightia pubescens R. Br.
Seed Collection and Handling

Taxonomy and Nomenclature
Family: Apocynaceae
Vernacular/common names: mentaos (Java), bintaos (Sunda, Madura), benteli lalaki (Sunda), bentawas, tawas (Bali), dediteh (Timor).

Natural Distribution And Habitat
W. pubescens is native to southern China, Cambodia, Vietnam, Thailand and Peninsular Malaysia (may not grow naturally in Kalimantan), Sumatra, Java, Sulawesi, Maluku, Solomon Islands and northern Australia. The species grows in monsoonal forest, shrubs and savanna at an altitude up to 1,000 m with the mean annual rainfall ranges of 875-4,000 mm. In Bali, it is found in farm land, wood yard and road side.

Uses
The wood is used for construction, pencil, musical instruments, carvings, puppet and 'keris' sheath. The wood density is around 0.54 with durability class of IV-V. In Bali the wood is used widely for carving and furniture. The wood is white, soft-fine textured, easy to work and not easily cracked. The white latex contained in bark can be used for treating desentry, while its leaf can be used for anti inflammation in eyes. In Indonesia the stem bark is used as a coagulant in local cheese industry.

Wrightia pubescens tree

Botanical Features
W. pubescens is a medium- size tree up to 35 m in height and 50 cm in bole diameter. The stem bark is light grey to brownish yellow with deep longitudinal furrows. The young branches have smooth bark or fine pubescent. The leaf is compound, alternate, ovate or oblong , 5-15 cm long and 2-7 cm wide; 8-15 pairs of leaf vein without stipulate. The flowers are bisexual, yellowish white or light to dark red, composed as inflorescence at the twig terminal. The flowers produce unique-sweet fragrance, have two carpels, arranged closely along the stylus.

Phenology
In Bali the majority of *W. pubescens* bear flowers in March – April and fruits in July-October.

Fruit and Seed

The fruit comprises of two follicles attached each other, dark green to blackish green, dense, slightly woody, pointed at the base and tip, slightly widen at the middle. The pod surface has rough-yellow spots, 15-30 cm long, 1.5 cm wide, and 1 cm thick. One pod contains more than 100 seeds.

The seed is yellowish green to yellow, long-tube shaped, winged at the bottom and pointed at the tip, 12 mm in length and 2 mm in diameter. The seed weight is 27-30 g per 1,000 seeds. There are 33,000 seeds per kg.

Fruit and seed of *Wrightia pubescens*

Seed Collection

It is hard to identify mature fruits by color. The best method to identify the ripe fruit is by breaking the fruit and releasing the seed with finger; if the seed looks fully filled and hard, it indicates that the seed is mature. Another method is to look at the tree crown; fruit maturity coincides with the time of trees to shed their foliage. Mature fruits should be harvested timely and not allowed to desiccate. Fruits can be harvested directly from the tree.

Fruits of *Wrightia pubescens*

Seed Handling

Collected fruits are put in cotton bag, gunny or plastic tray. To make seed extraction easier, latex in the fruit should be removed by cutting the bottom and top of fruit and let the latex comes out. Fruits are dried out under sun for 5-6 hours and then their pods are peeled off, leaving the hardest part. Seeds are extracted by twisting the fruit to separate two tight loci. For each locus seed is released from fruit flesh and the seed wings are removed.

Clean seed is not allowed to be exposed to open air as it can reduce their moisture content rapidly. Due to recalcitrant nature, seeds should not be stored and must be sown immediately after harvesting. Fruits may be stored in cotton bag in an air conditioned room or refrigerator. This storage condition can maintain more than 60 % seed viability for three weeks.

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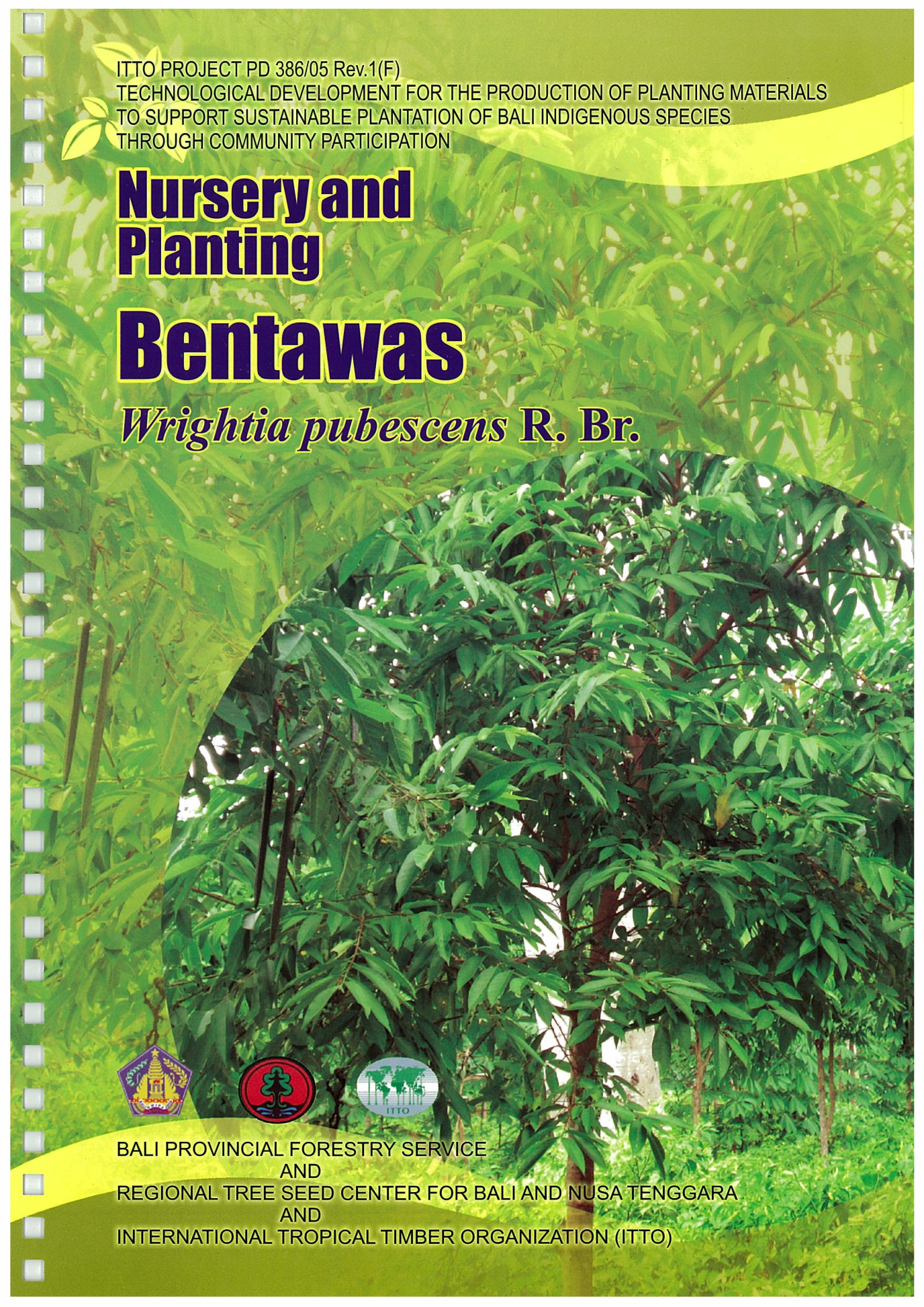
THROUGH COMMUNITY PARTICIPATION

Nursery and Planting

Bentawas

Wrightia pubescens R. Br.



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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 of *Wrightia pubescens*. 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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Eko Bhakti Hardiyanto
Tree Breeder and Silviculturist

Wrightia pubescens R. Br.
Nursery and Planting

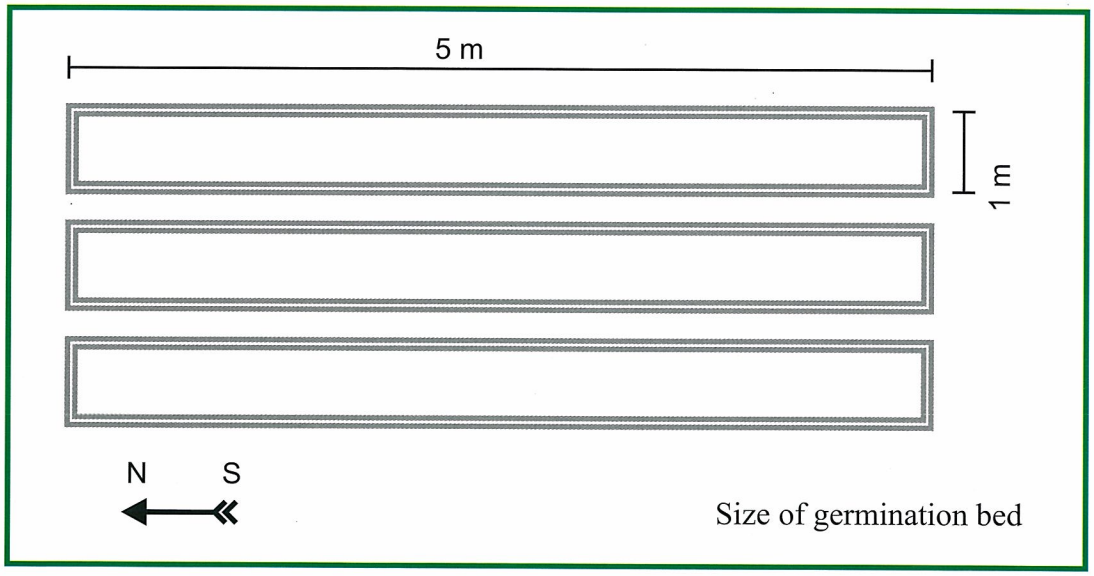
Site Selection of Nursery

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

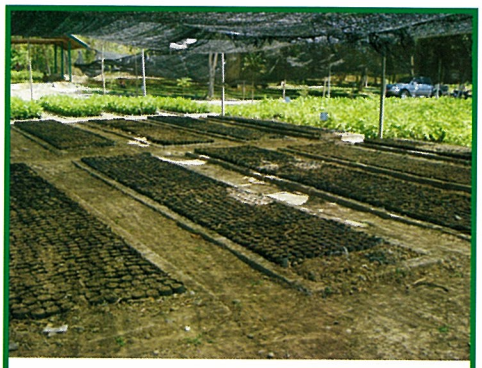
The seed germination type of *W. pubescens* is classified as epigeous. Pre-sowing treatment is not needed. The seed is sown in the germination bed and covered with a 1 cm layer of fine sand, ash or fine soil. The germination bed should be watered every day to maintain its moisture. Normally seed starts germinating 5 days after sowing.

Germination beds

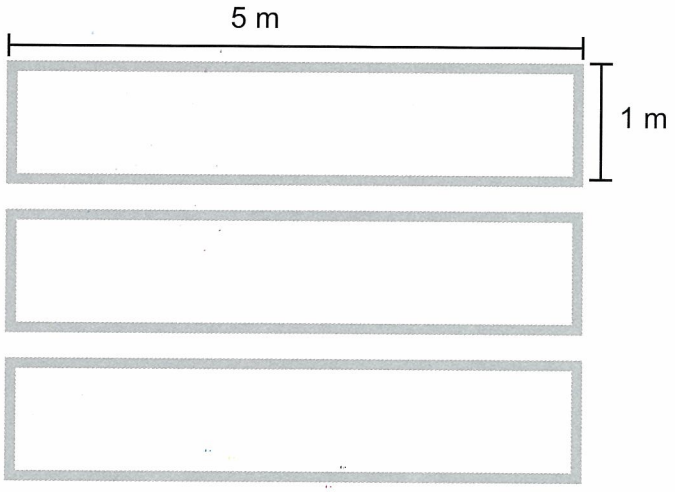
Seedlings of *Wrightia pubescens* in the germination bed

Nursery Bed

Nursery bed is made of concrete, brick or bamboo (arranged at north-south direction) with a size of 1 x 5 m. 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 %).



Nursery beds



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.

Pulling out the seedlings from germination bed

Filling the potting media into polybag

Pricking Out

Generally germination starts 5 days after sowing. Pricking will start when the seedling has developed 4 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 into 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.

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. To obtain high quality seedlings, 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 4.0 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 woody stem will be more robust to be transported and planted in the field. At 2 months of age the shade is progressively open as *W. pubescens* seedlings grow better under full sun light.

Watering and weeding in the nursery

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

Normally seedlings are ready to be planted out when they age 5 months, 30-40 cm in height, more than 4 mm in root collar diameter and have 8 leaves. *W. pubescens* 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.

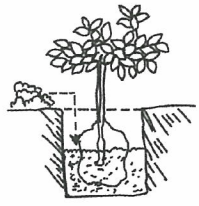
b. Planting

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.

Planting procedures

Prepare planting hole (40x40x40 cm)



Tear the polybag and plant carefully

Provide a stick for support

Planting in the field

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. 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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