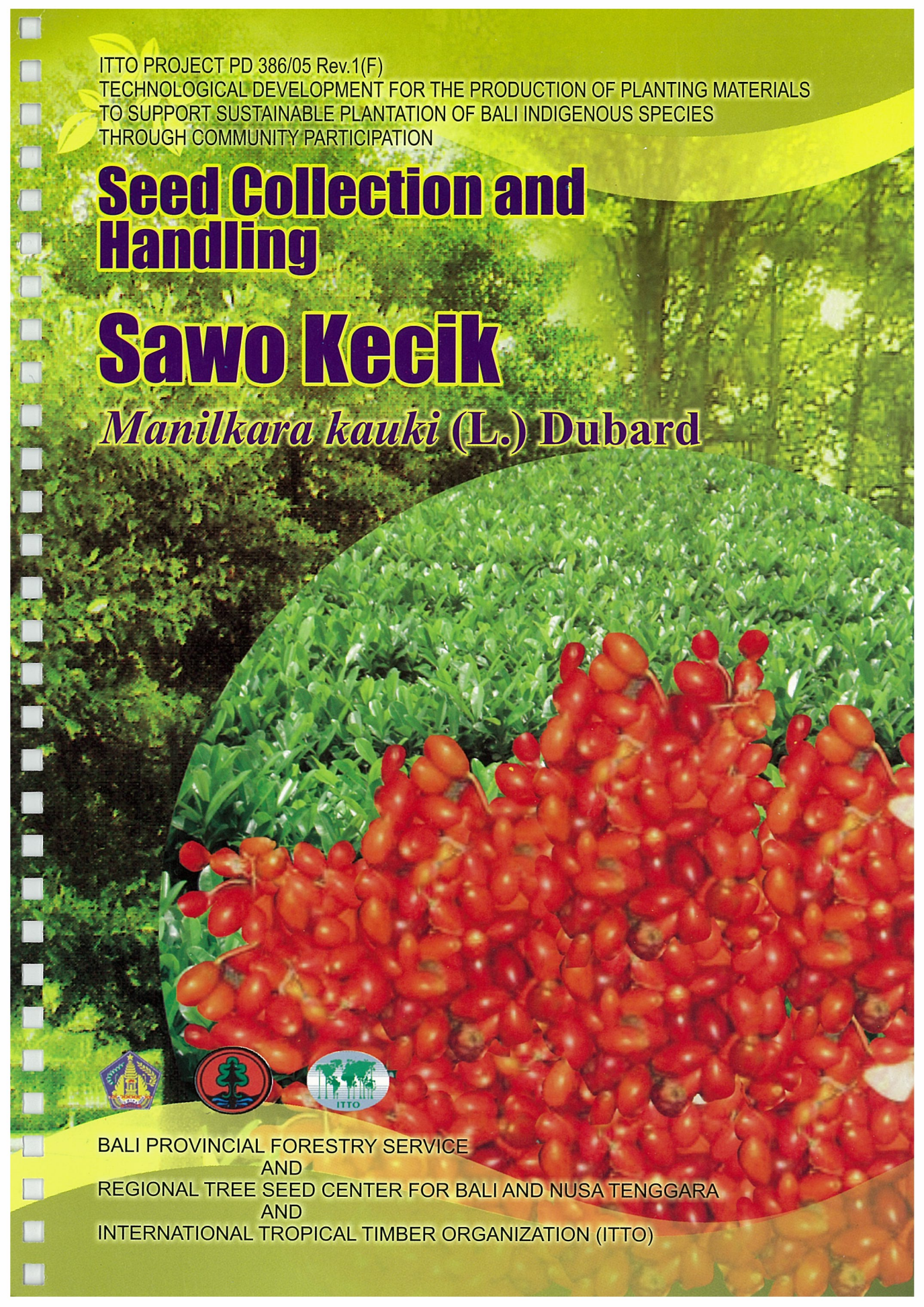
ITTO PROJECT PD 386/05 Rev.1(F)
TECHNOLOGICAL DEVELOPMENT FOR THE PRODUCTION OF PLANTING MATERIALS TO SUPPORT SUSTAINABLE PLANTATION OF BALI INDIGENOUS SPECIES THROUGH COMMUNITY PARTICIPATION

Seed Collection and Handling

Sawo Kecik

Manilkara kauki (L.) Dubard



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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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 *Manilkara kauki* (L.) Dubard. 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

Manilkara kauki (L.) Dubard
Seed Collection and Handling

Taxonomy and Nomenclature
Family : Sapotaceae
Vernacular/common names : sawo kecik (Java, Bali), kayu sawo (Java), sabo (Bali).

Natural Distribution and Habitat
The natural occurrence of *M. kauki* is in Asia Pacific region and Australia. The species is widely distributed in southeast Asia, including Myanmar, Thailand, Indochina, Peninsular Malaysia and Indonesia (except Kalimantan), and Papua New Guinea. In Indonesia the species is found in We Isle (Sumatra), southern Banyuwangi (Java), Karimun Islands, Kangean Islands, Bali, Nusa Tenggara, Buton, Sulawesi, Maluku, and Papua.

M. kauki grows in coastal regions up to 500 m altitude, with a mean annual rainfall ranging between 1,500 to 3,600 mm, and 0-6 months of dry period. It is found in a wide variety of soil types, but prefers to grow on soil with light texture and free drainage.

Seed stand of *Manilkara kauki*

Uses
The wood is heavy and hard, used for heavy constructions (house post, bridge, railroad sleeper, telephone pole), furniture, flooring, and carving. The timber can be worked easily, leaving a fine, smooth polish due to its structure; this combination of unusual wood pattern and color makes it very attractive for fine carvings. The heart wood is brown, dark brown or brownish red, sometimes with reddish lines. The fruit is edible, while flower and seed are used as local medicines.

Tree of *Manilkara kauki*

Botanical Features
M. kauki is a medium-size tree up to 25 m in height and 100 cm in diameter, has many branches, thick and rounded crown. The bole is often gnarled. Leaves are arranged in whorl at the twig terminal, the leaflet is glossy, dark green. The young flowers are hard, ovate. The carpel is yellowish white with pink spots, 7 mm long.

Fruit and Seed

The fruit is ovate, 3 cm in length and 2 cm in diameter, belongs to berry (fleshy simple fruit with a soft skin). Ripe fruits are glossy-brownish red, contain 1-6 seeds. The seed is glossy-brown, oblong or ovate, with a size of 2 x 1 x 0.75 cm. The seed testa is very hard and contains saponine. One kilogram of seed contains 1,100 – 2,200 seeds.

Phenology

M. kauki basically produces flowers and fruits year around, but the peak of flowering and fruiting periods varies among sites. In Bali flowering time occurs in December-February, fruiting period in March-June.

Fruits of *Manilkara kauki*

Seeds of *Manilkara kauki*

Seed collection

Ripe fruits are indicated by the change in color, from green turning to red or brownish red with seed moisture content of about 32 %. Fruits can be collected by climbing the standing tree and picking the fruit directly for small trees. For tall trees fruits are picked using a pole mounted with a basket for collecting the fruit.

Seed Handling

Collected fruits are put into cotton, gunny or plastic bag. For ripe fruit, the seed can be extracted by peeling off the fruit skin and removing the flesh, but the fruit is sometimes hard and needs to be softened by wetting it with water and keeping it in plastic bag for 2-3 days. The seeds are then ready to be extracted easily by hand. Seeds are washed with clean water and put on bamboo tray or wire net and dried under room temperature for 1-2 days. Dried seeds should be put in sealed bag or sack and stored in a dry- cool room.

Extraction of *Manilkara kauki* seeds



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Nursery and Planting

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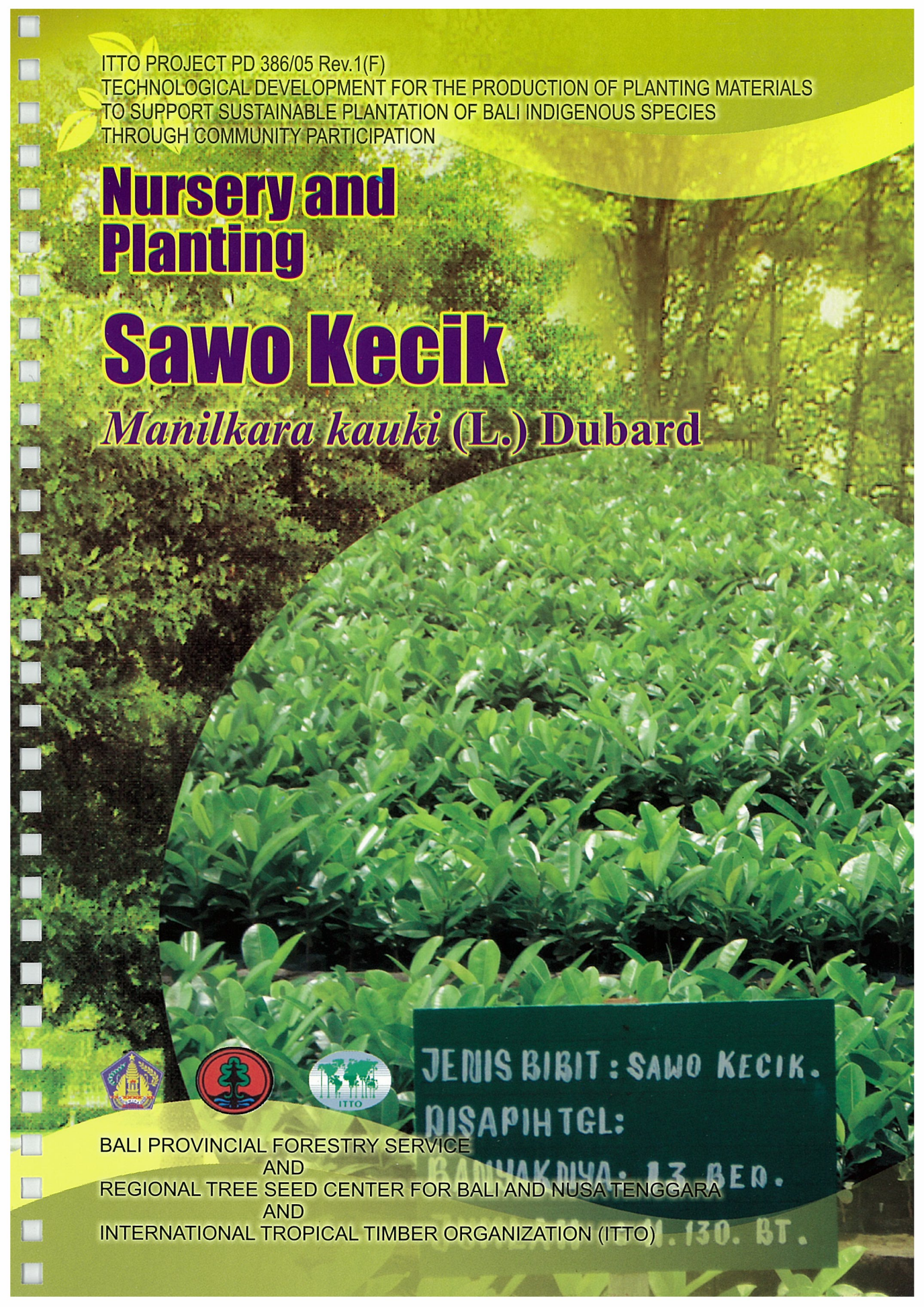

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The availability of good quality of seeds and planting stocks as well as proper planting techniques have been identified as some of the many factors crucial for the success of tree planting program. This guideline is intended to provide information on nursery and planting *Manilkara kauki* (L.) Dubard. 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

Manilkara kauki (L.) Dubard
Nursery and Planting

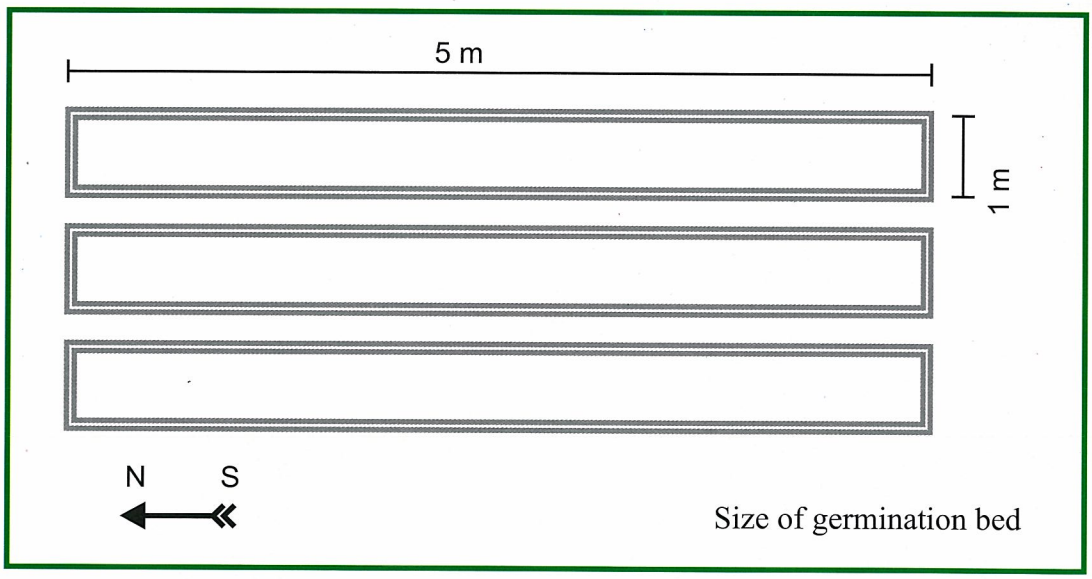
Site Selection of Nursery

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

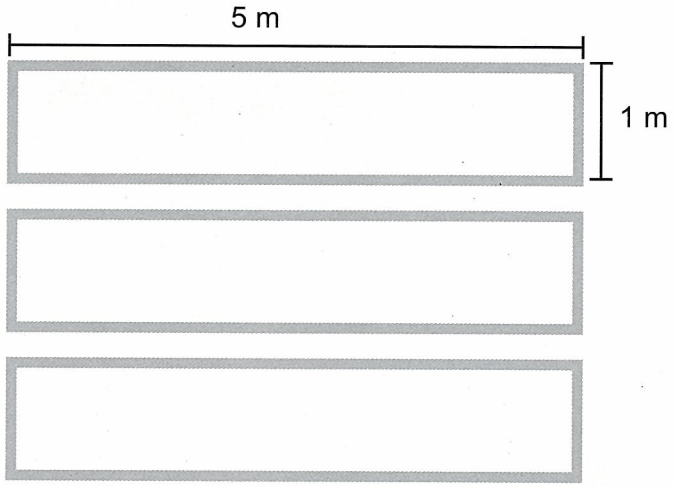
Pre-sowing treatment is needed since the seed coat is very hard and thick. The seeds are soaked in tap water for 3 x 24 hours. Clean and replace the water every day. The seeds are then sown in the germination bed, covered with a 1 cm layer of fine sand. Germinating media should be watered every day to maintain its moisture.

Seeds growing
on the germination beds.

Seedling watering
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.

Nursery beds of *M. kauki*

Seedling of *Manilkara kauki* after transplanting

Nursery of *Manilkara kauki*

Pricking Out

Generally germination starts at the third weeks 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 at 1.5 months old the seedling 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 10 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 *M. kauki* seedlings grow better under full sun light. Seedlings are ready to be planted in the field at about 12 months old, have a height of 40 - 45 cm and root collar diameter of 8 - 10 mm.

Watering *Manilkara kauki*

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.

Seedling transportation to farmer groups

Planting Site

M. kauki can grow at low elevation up to 1,500 m with a mean annual rainfall ranging between 1,500 – 3,600 mm, 0 – 6 months of dry season. The species can grow on various types of soil, but prefers soil with light texture and free drainage.

Planting

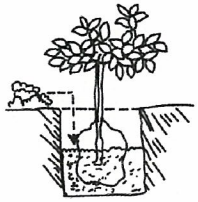
Normally seedlings are ready to be outplanted when they age 12 months old, 40-45 cm in height, more than 8 mm in root collar diameter and have 8 leaves. *M. kauki* may be planted in forest and farm lands or wood yard. The initial spacing varies depending on the planting objectives: 3 x 5 m, 4 x 5 m or 5 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 4-5 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. Second fertilizer application is done at 4-6 months old with Urea at a rate of 100 g/tree.

Manilkara kauki planting in the field

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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