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**DEMONSTRATION AND APPLICATION OF PRODUCTION AND
UTILIZATION TECHNOLOGIES FOR RATTAN
SUSTAINABLE DEVELOPMENT IN THE
ASEAN MEMBER COUNTRIES
[ITTO-Philippines-ASEAN Rattan Project]**

Technology Guide 01

**RATTAN NURSERY AND
PLANTING STOCK PRODUCTION**



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and

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INTRODUCTION

In any plantation work, production of planting materials such as seeds is the most important factor to be considered. Success in producing planting stocks greatly depends on the ability of seeds to germinate and grow at a given time. Seed viability is one of the most important factors that may contribute to the success of any planting stock production scheme. All seeds, being the usual planting material used, that are not sown immediately after collecting and cleaning are stored carefully in order to keep or prolong their viability until such time that they can be sown. The longevity of seeds to stay viable depends on a large degree upon the manner of storage used and protection from other adverse factors affecting viability.



I. RATTAN SEED TECHNOLOGY

A. Species

- Rattans are not limited to only a small population of single species. It is comprised by several species from different places around the globe.
- Brunei Darussalam has 80 different species recorded, Cambodia has 11, Indonesia has 312, Lao PDR has 44, Malaysia has 311, Myanmar has 38, Philippines has 96, Thailand has 62 and Vietnam has 30.
- Species to be used in any rattan endeavor should not be selected based on the preferences of the potential developer alone.

- Aspect of site-species compatibility should be given utmost consideration. The success of plantation establishment does not only depend on quality planting materials and silvicultural management strategies but also on the interplay of several factors, one of which is the environment.

B. Seed Sources

- Buying from the market places

Several species of rattans produced edible fruits which are collected and sold in market places. This is a good option for an immediate supply of seeds, however the quality of the sources cannot be verified since the purpose of collection is just for selling. This may result to problems related to the establishment and management of plantations.



Rattan fruits being sold in market places

- From Aborigines

Cultural minorities have been living with nature from the start of history and that their knowledge on different species of plants and animals should not be overlooked. Seeds of commercially-important species can be bought from the aborigines collecting them from the wild.



Aborigines collect rattan fruits as an additional source of family income

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• Seed Importation

In the absence of local sources, seed importation is a welcome option. However, information on the sources of seeds should be strictly scrutinized to prevent potential problems brought about by seeds collected from inferior sources. Out-of-the-country seed sources should have information available for verification. Seed certification is a good requirement.

• Established Plantations

With the recent establishment and development of plantations, seed sources are now increasing thus decreasing the dependence on natural sources. This option can be most reliable if the purpose for the established plantations is for seed production since seed certification can be availed. Even if the purpose of the plantation is for seed production, it would still be a good practice to select good mother trees. However, if the purpose is otherwise, essential activity such as selection of good mother trees should be conducted.



Established plantations of rattan

• Genebanks and Germplasm Gardens

The world has already perceived rattans' versatility as a rare material for furniture and handicrafts thus different countries are exerting effort to collect and maintain representative samples of different species of rattan. Genebanks and Germplasm Gardens are potential good sources of seeds since one can rely on the quality of planting materials.

In Malaysia, 33 genetic trials were established. Indonesia planted 20 species at the Bogor Botanical Gardens while Lao PDR has a germplasm garden of 8 species.

In the Philippines, a genebank of 45 taxa was established in Los Baños Experiment Station and Bukidnon with 25 taxa.



Rattan plants selected and planted in the genebanks and germplasm gardens

C. Seed Collection

i. Planning

- Organization of a Collection Crew

A fruit collection crew should be organized to spearhead in planning and carrying-out of activities pertaining to gathering of fruits. This would systematically facilitate the scheduled activities.



An organized collection crew is a must for a successful collection expedition

- Acquisition of necessary permit

If the seed sources are in established plantations; privately-owned

determine the appropriate number of seedlings to be raised.

- Advertisement through billboards and other modalities could be provided to attract buyers and to create awareness for immediate communities which could possibly be the consumers.
- In marketing ventures, product pricing is very instrumental.



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A. Planning

- Planning should be made several months in advance for proper addressing of operation procedures including scheduling and coordination of activities, funding and manpower requirements.

B. Organization

- Staff and employees should have sufficient technical knowledge on nursery operations for better administrative and technical direction.
- Trainings and seminars need to be conducted to equip people with much needed skills and expertise.
- Regular meetings are essential to facilitate continuous and smooth operation and ultimately to promote harmonious relationship among staff and employees.

C. Budget

- Nursery Managers should be able to anticipate the financial requirements of every target activity for this is essential in prioritizing scheduled endeavors and in proper allocation of budget.
- Projections of future targets and expenditures are needed. Special skills in fund sourcing are a plus factor for a Nursery Manager.

D. Nursery records

- A good nursery record is essential for planning, forecasting, budgeting and organizing nursery operations. It must demonstrate reliability and accuracy. It should include production records, cost records, and technical operations.

E. Marketing

- Marketing agreement maybe pursued with target buyers/clienteles to

timberland and gardens; and government-owned areas, permission should be sought and the letter permits should be secured to avoid conflicts.

• Seed Calendar

Collection of seeds depends on the interplay of several factors such as the physiographical condition and climatic type of the site. Proper timing is essential not only to avoid hazards during collection but ultimately to collect fruits/seeds in their best possible physiological condition which could lead to the production of high quality planting materials for plantation establishment. In Malaysia seed hardness is used to confirm maturity and good germination. Whenever available, a seed calendar should be a necessity for seed collection.



Ripe and unripe fruits of rattan collected at the same time.

ii. Selection of Good Mother Trees

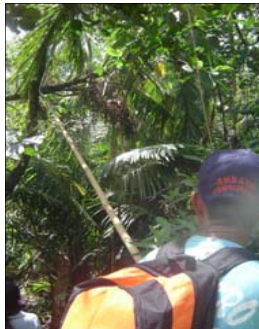
- Like every selection activities, mother trees should be selected based on their good growth, health, maturity, and freedom from pests and diseases. Also to be considered is the purpose of selection.



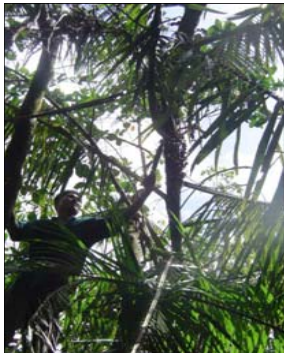
Mother plants exhibiting good growth and form

iii. Fruit Collection

- Documentations on the seed sources should be available for verification.
- Seeds or any plant parts to be used as planting material should be collected from phenotypically-good mother plants to guarantee high survival and value.
- Freedom from pests and diseases is a critical factor to consider since this will determine the future performance of the progenies.



Fruit collection using an improvised stick



Fruit collection done through climbing

- Appropriately ripe fruits should be collected with utmost care to avoid contaminations. Mature fruits can be recognized by their outer appearance or by examining the seeds.
- In the Philippines, *Calamus merrillii* (Palasan) and *Calamus ornatus* var. *philippinensis* (Limuran) fruits are best collected from October to January. Palasan fruits when ripe turn yellow or grayish while limuran fruits are yellow orange and have black fruit tips.

iv. Seed Extraction and Cleaning

- Extraction and cleaning of seeds can be done manually and the process should be carried out immediately when the fruits reach the nursery.
- The outer scaly pericarp of rattan fruit and the sarcotesta need to be removed prior to sowing to avoid low germination rate.
- The pericarp can be removed by beating with wood, stomping, and maceration while the sarcotesta can be partly removed by rubbing the

- Manual removal of weeds should be made from time to time.

vii. Sanitation

- Good sanitation of the surrounding should be maintained. Proper waste disposal and regular cleaning should be done.

F. Seedling Quality Control & Dispatch

- The seedlings of specific species have specific requirements thus raising should be done following the established protocols.

Frequent grading and culling should be done to ensure the quality of the planting stocks. Criteria such as size, age, health, vigor, stem and crown ratio, and number of leaves are pertinent in grading the quality of the stocks.

- Hardened seedlings should be prepared at least one week before the time of dispatch to the field. Special care is needed so as not to damage the roots. Use strong and durable containers.
- Fertilization should be stopped 2 months before transplanting.



IV. NURSERY MANAGEMENT

should be properly expelled manually or chemically.

- Sterilization of growing medium and proper waste and water management would provide defense against fungal attacks.
- Susceptibility to pests and diseases is greatly related to poor nutrition. When necessary, fertilizer application should be done. In Lao, after 45 days of rearing the seedlings, 1 soup spoon full of NPK 15:15:15 fertilizer dissolved in 20 liters of water is being applied every 15 days and an increase to two spoonful when seedlings are about 4 months old.
- Weak and diseased seedlings should be culled to prevent possible transmission of diseases.

v. Pest and Disease Management

- Strict implementation of nursery hygiene should be carried out to prevent pest and disease outbreaks on rattan seedlings.
- In Malaysia, attacks of small insects are controlled by insecticides such as Malathion and Dicofof. Fungicide application at 2 to 3 weeks interval is also conducted to minimize incidence of leaf blight and leaf spot.
- Knowledge on IPM is of great help in addressing problems on pests to arrive at a low-cost but effective approach to pest management.

vi. Weed Control

- Weeds should be removed as soon as they appear to prevent competition with the seedlings for nutrients, water and light.
- No weeds should be allowed to flower and fruit along the paths, roads including the immediate surroundings of the nursery thus regular cutting and/or trimming are necessary.

seeds together in a basin with water that is changed regularly until sarcotesta is removed to prevent fungal attack that may affect germination.

- In Brunei Darussalam, seed extraction is done after 3 to 5-day soaking in water followed by manual maceration in water and rubbing against a wire screen.
- In Malaysia, seed extraction is done through repeated rubbing of fruits against sawdust or sand.



Stomping



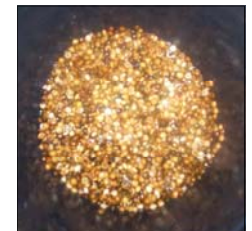
Maceration



Cleaning

v. Seed Storage

Seed storage is a technique where seeds are kept in an environmental condition such that they are maintained alive and yet prevented from germinating (Lapitan, 1991). The usual purpose of this technique is to keep excess viable seeds for future use especially during season of the year when seeds are not available in the stands.



Excess water due to cleaning should be removed from the seeds to prevent rotting before putting in a clean container for storage

- Dependent on environmental conditions.

Generally, as soon as seeds mature on the mother plant, they begin to deteriorate. The rate of deterioration is dependent on the environmental conditions around the seed or on the conditions where the seed is stored. Proper seed storage aims at maintaining the viability of the seed at the highest possible level.

- Viability is determined by the moisture content and the temperature while in storage.

In practice, the temperature can only be controlled by keeping the fruits in a well-ventilated shade or storing the seeds in cold storage. The moisture content can be controlled by drying. Reducing the moisture content to less than 40% is detrimental. It lessens viability. On the other hand, increasing to more than 60% will hasten germination of rattan (Mori, et al., 1950).

- Rattan can be stored as seed or as a fruit.

Based on the study on *Calamus merrillii* and *C. manillensis*, the longest storage period for extracted seed is only two months in cold storage (refrigerator) and reaches four months at ordinary room temperature. The fruit (unextracted seed) can be stored in cold storage for 3 months and 7 months at ordinary room temperature but with low viability (11-15%). The scale and fleshy pulps somehow aid in retaining moisture of the seed. Rattan seeds can retain viability of more than 60% for about a year when stored one meter below the ground.

In Indonesia, ripe fruits are put in polyethylene or plastic bag and stored at humid condition for 1 to 2 months, and sprayed with water twice a day.

D. Other Sources of Planting Stock

When seeds are not available in the stands or in the market, one cheap but laborious approach is to collect wildings or resort to the most

tity of water but at frequent intervals, while large seedlings require more water for adequate growth.

- Well-watered seedlings look healthy and vigorous while insufficient watering of the plants will cause wilting and stunted growth.
- It is better that the seed bed be watered at least 2 times a day.



Watering of seedlings

iii. Shading

- Keep seedlings from direct sunlight.
- This is required especially during the most delicate growth stage which is during or shortly after transplanting/potting of germinants.
- Rattan seedlings exhibit very slow growth under too much shade, thus about 50% transmitted sunlight is necessary.



Shading

iv. Plant Health Management/Nutrition

- Rattan is mostly attacked by rodents thus proper fencing is needed for protection.
- Termites feeding on coconut coir dust when used as sowing medium

E. Cultural Practices

i. Potting/Transplanting

- Pot germinants after a month from sowing or when the height is about one inch and the first leaf is about to open.
- In Lao PDR, potting soil composition is 60% top soil, 30% sand and 10% manure. In Malaysia, it is a common practice to use 3:1 ratio of soil and sand.
- Holes on the soil should be made to accommodate the root system of the germinated seedlings.
- Provide much needed shade using one layer of ordinary black garden net. 50% shading is recommended for *Calamus tenuis* in Lao PDR.
- Exercise utmost care in pricking the germinants so as not to damage their roots. A pointed stick is useful to loosen soil attached to the roots.



Hole digging on wet soil



Transplanting of germinants



Caring of transplants

ii. Watering

- Maintaining moisture is necessary for vital processes to work thus watering is an essential activity. This however is dependent on seedling size and stage of development.
- Small seedlings just past the germination stage need lesser quan-

advanced planting stock source – the tissue culture laboratories.

i. Wildlings

- Collect suckers or newly germinated wildlings with height not exceeding 30 cm. Based on past experiences, taller materials results to high mortality.
- Do not collect materials with one or two leaves only to avoid high mortality. Collect wildlings with at least 3 leaves.
- Collection of planting materials is best realized during rainy season to avoid fast and over desiccation.
- Extra caution should be noted in uprooting the wildlings or suckers. Avoid damaging the roots.



Healthy wildlings ready for collection

ii. Tissue Culture

- Plantlets from tissue culture laboratories are provided with procedures on proper handling and care. In considering this option, presence of such facilities should be guaranteed.



Plantlets reared in the laboratory ready for acclimatization in the nursery



II. NURSERY ESTABLISHMENT

A. Site Selection Criteria

- A permanent nursery must be established to provide continuous planting materials.
- The site should be accessible enough or within the vicinity of public or private transport system and can be reached by any form of transport system. This would lessen the cost of nursery establishment. It also reduces cost of transporting the seedlings.
- Depending on the number of seedlings to produce, the nursery should



Wildlings for ready collection

- Collect suckers 15 cm tall or less and with well-developed root system.
- Collect newly germinated wildlings with height not exceeding 30 cm. Based on past experiences, taller materials results to high mortality.

- Collect materials with no less than 3 leaves to have higher survival rate.
- Extra caution should be taken in uprooting the wildlings or suckers. Roots should not be damaged. Appropriate digging tools should be used.
- Transported collections should be processed and maintained immediately in a recovery chamber under a cool and completely shaded area to overcome transport stresses.
- If the nursery is too far from the collection site, roots of wildlings should be then prevented from drying by covering with soil, moss or banana leaf sheath.



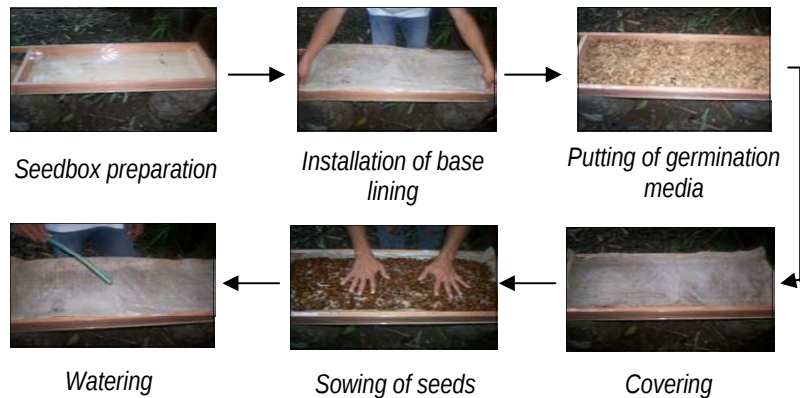
Potted wildlings

D. Potting Media



Plastic bags with potting media

- Forest soil is best but ordinary garden soil is acceptable as potting medium for rattan mixed with 10% rice hull or any organic matter to improve the physical and chemical properties of the soil.
- Fill in the 4"x6" plastic/poly bags with the prepared media and arrange in pot beds under the shade.



B. Germination Media

- Forest soil or ordinary garden soil is acceptable to use. However, sterilization should be employed to prevent fungal attack on germinating seeds.
- In Brunei Darussalam, germination medium is comprised of a mixture of topsoil and fine sawdust.
- In Lao PDR, seeds of *Calamus tenuis* germinate best in deep, moist coconut fibers.



Germination media mix

C. Wildling Culture

- Wildlings are seedlings that naturally grow from fallen seeds on forest floor.
- Suckers are side shoots or plants growing out of the nodes or base of mature rattan plants.
- Collection of planting materials is best realized during rainy season to avoid fast and over desiccation.

be wide enough to accommodate the nursery facilities.

- Accessible water sources and adequate water supply must be ensured to make certain the smooth conduct of nursery activities.
- The gradient should be slightly sloping for good drainage and with relatively good exposure to sunlight. The soil must also be given consideration. It must be of good quality and preferably with good humus content.



A well-planned permanent nursery

B. Preparation and Establishment



Road construction to facilitate movement of materials for nursery construction

- To include in this activity are the construction of fences and/or establishment of hedges or live fence along the perimeter of the nursery to ensure protection from intruders and stray animals.

- Roads and pathways should be properly laid out for ease in movement within the area. Moreover, water supply system should be properly laid-out and appropriately installed.

C. Other Necessary Facilities

- Other facilities include seedbeds/pot beds, potting shed, recovery shed, hardening shed, hardening beds, green house, seed boxes/trays, germination chamber and storage rooms for tools/equipment and materials.
- Offices and storage rooms may be provided to keep records of nursery activities and for safe-keeping of nursery supplies and chemicals, respectively.



III. PLANTING STOCK PRODUCTION

A. Seed Germination Treatments

- Extracted and cleansed seeds should immediately be sown to maximize germination.
- Treatments can be applied to enhance seed germination such as soaking in hot water for 1 day; 3-day soaking in running water; washing with sulfuric acid for 3-5 minutes; and scarification, nicking or slicing through the embryo cover. In the Philippines, hilar cover is removed to accelerate germination.

- In Lao PDR, large quantities of fruits are soaked in cold water for 7 to 10 days with daily change in water to prevent fungal growth. Seedcoat and flesh are removed either before or after soaking. For smaller quantities, after seedcoat and flesh removal, hilar cover is removed to induce fast germination.
- Immediately sow the seeds about 1 cm apart in a layer of sawdust or coir dust with about 3-4 inches thickness in seed boxes/trays or germination chamber.
- Cover with thin jute sack and place in a partly shaded area to prevent desiccation. In Brunei Darussalam, germination beds are provided with sarloin nettings (50% to 75% sunlight off.)
- Large seeds are sown in shallow drills. Smaller seeds are broadcast evenly. The sown seeds are covered with a thin layer of sawdust; a protective mulch of rough sawdust is also placed on top; and then watered (Joffre Hj Ali Ahmad, 2004).
- Rattan seeds can also be sown in seedbeds or seedboxes with equal ration of garden soil and humus and placed under partial shade.
- Fungus attack can be prevented by treating the seeds with fungicide before sowing.
- Keep the seeds moist by daily watering either manually or with the use of sprinkler or misting system. Frequency depends on the daily weather prevailing on the site.

Those seeds that germinate rapidly and vigorously under favorable conditions are likely to be capable of producing vigorous seedlings while weak or delayed germination is often fatal. Seed germination should take place only in at most three weeks.

Note:

Germination of fully matured seeds is hastened by sufficient amount of moisture.