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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 02

RATTAN PLANTATION ESTABLISHMENT AND MANAGEMENT

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Catral, C.A. and A.M. Palijon.2000. The start of something big: The TABARGA experience. Philippine Agroforestry Development News. Institute of Agroforestry, College of Forestry and Natural Resources, University of the Philippines, College, Laguna pp 30-33.

Dela Cruz, L.U. 1987. Nutritional, light and water requirements of some commercial rattan species. College of Forestry, University of the Philippines Los Baños, College, Laguna, Philippines. (Project Report, Unpublished).

Fernando, E.S. and W.R. Palaypayon. 1988. Small scale rattan farming: Notes on a case study of two sites in Panay. Proceedings of the National Symposium-Workshop on Rattan, Cebu City p 95-98.

Ketphanh, S., Dalmacio, F.L. and Santander, M.L.2004. Country Report of Rattan Production and Utilization in Lao People's Republic. *In:* Proceedings of Regional Conference on Sustainable Development of Rattan in Asia held on Jan. 22 – 23, 2004 at Manila Pavilion Hotel, Manila Philippines.

Ordinario, F. 1975. Fertilization of rattan. A paper presented during the rattan R&D Seminar Workshop, College, Laguna (Unpublished).

PCARRD, 1991. Philippine recommends for rattan production. Philippine Council for Agriculture, Forestry and natural Resources Research and Development, Los Baños, Laguna. (Philippine Recommends Series No. 55-A). pp, 95.

Razal, R.A. and A.M. Palijon. Undated. Non-Wood Forest Products of the Philippines. College of Forestry and Natural Resources, University of the Philippines Los Baños, College, Laguna, UP Press (In-Press).

Wiyono, B. and G.E. Santos, Jr. (2004). Present Status of Sustainable Rattan Production and Utilization in Indonesia. *In:*. Proceedings of Regional Conference on Sustainable Development of Rattan in Asia. Held on Jan. 22 – 23, 2004 at Manila Pavilion Hotel, Manila Philippines.

The ITTO rattan project will assist the community in putting up the following nursery facilities that may be built in the area. These may include temporary soil/potting shed, pot beds (recovery and hardening pot beds) and water reservoir (drums) for watering. Likewise the project will provide nursery and plantation tools and equipment like grass cutter, bolos, scythe, spades and shovels, pruning shears, digging bars and pruning saws and nursery and plantation supplies and materials such as gasoline, poly-bags, office supplies (ball pen, marking pens, record books and
others).

Record Keeping

Inevitably, all relevant activities related to the operations of the nursery and pilot demonstration should be recorded properly. This will be very important to determine whether the activities are consistent with the plan or the plan needs to be modified to be able to optimize the use of resources (time,
talent and treasure).

Records are very crucial if updating about the project is needed and also if planning and decision-making are to be made.

References

Ahmad, J.H.A., Mabong, D.H., and Arroyo, C. 2004. Country Status Report on Rattan Industry of Brunei Darussalam. *In*: Proceedings of Regional Conference On Sustainable Development of Rattan in Asia held on Jan. 22 to 23, 2004 at Manila Pavilion Hotel, Manila Philippines.

Barizan, R. and Rivera, M.C. 2004. Country Report on the Status of Rattan Resources and Rattan Industries In Malaysia. *In:* Proceedings of Regional Conference on Sustainable Development of Rattan in Asia. Held on Jan. 22 – 23, 2004 at Manila Pavilion Hotel, Manila Philippines

Bravo, D. and N. Andin. 1990. How to establish and operate a rattan nursery and plantation. “How-to-Series” Volume 1 No. 3, Ecosystem Research and Development Bureau, College, Laguna, Philippines.

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I. Rationale

A. *Why is there a need to establish rattan plantation?*

1. Rattan supply for the furniture industry comes mainly from the secondary and virgin forests.
2. The continuous conversion of the natural forests into other land uses has tremendously caused the dwindling supply of raw rattans for the furniture industry.
3. If supply of high quality rattan poles can be assured, growth and expansion of the rattan-dependent industries can be further enhanced.
4. Rattan plantation establishment has a lot of benefits:

   4.a Can augment the supply of high quality rattan for the industry

   4.b Can help uplift the socio-economic status of the community engaged in rattan production, processing and trade.

   4.c Since rattan plants need support trees for their growth and development, establishment of rattan plantation will definitely contribute to the care, protection and conservation of trees.

   4.d he trees conserved due to rattan are essential in maintaining not only the aesthetics of the landscape but also in sustaining the ecological conditions in the area.

B. *Why is the technology guide important?*

1. Provides the *'how-to"* on plantation establishment, maintenance and management.
2. Useful for the local communities, private individuals, non-government organizations (NGO) and others who are interested in rattan production.

II. Plantation Establishment

What are the phases of rattan plantation establishment? These include site and species selection, site preparation and outplanting.

A. Site and species selection

In establishing a rattan plantation, it is very important that the site characteristics match with the site requirements of the species or vice versa. If species-

Figure 23. Harvested edible rattan shoots being sold in local market in Thailand.

The community people who will be attending the training on rattan will qualify to be participant-beneficiary of the rattan project. Specifically, they will be primarily involved in the rattan seedling culture and in the establishment and management of rattan pilot demonstration.

In the implementation of the plan, material inputs like plastic bags, fertilizers, pesticide will be provided to the participants/beneficiaries of the project.

The quality and quantity of involvement of the participants/beneficiaries in all of the activities will be recorded and kept.

Site Coordinator will supervise and monitor all relevant activities. The benefits or incentive that will accrue to each of the participants/beneficiaries will depend on the quality and quantity of the output.

Facilities, tools and equipment for the establishment of plantation

In the production of the rattan planting stocks needed for plantation development, establishment of home nursery will be encouraged. The participants/ beneficiaries are given the option to group themselves and establish their own home nursery.

processing industries using any available transportation facilities in the site.

2. Harvesting rattan edible shoots

2.a As practiced in Lao PDR (Ketphanh, Dalmacio, and Santander, 2004), after 8 months from establishment , the shoot with the longest stem is removed during the first harvesting (Figure 22). After two weeks another shoot can be harvested from the same hill. Production of shoot from each clump can be done once a month. This can be done the whole year round particularly if there is proper irrigation, nutrition and cultural management. Figure 23 shows the harvested shoots being sold in the local market in Thailand

2.b If no irrigation is employed, then the production may be limited only during the rainy season.

Figure 22. Harvesting shoots (Courtesy Thai Rattan Scientist)

C. Management

Organization for rattan plantation

Specific for this project, the plan together with the various approaches and activities will be crafted, through participatory approach, by the community. The crafting of this plan will be facilitated by the site coordinator.

site compatibility is assured then plantation establishment can be highly successful.

1. *What are the criteria for the selection of the species?*

1.a. Species possesses the following characteristics:

1.a.1 Suitability to the existing site conditions

1.a.2 Appropriate to the product or combination of products (shoot, cane, dye or fruits) desired

1.a.3 Availability of market

1.a.4 Potential as alternative source of livelihood for the community

1.a.5 Preferred by the community.

2. *What are the criteria for site selection?*

Site factors influencing the habitat requirements of the species are interacting and varied. The site factors that must be considered in selecting a site for the establishment of plantation include: physiography, soils, climate and vegetation (PCARRD, 1991; Razal and Palijon, Undated).

2.a *Physiography*

2.a.1 Each species has its own range of elevation where it is growing naturally well.

2.a.2 Some species like palasan (*Calamus merrillii*) thrive well in low elevations while others like limuran (*Calamus ornatus* var. *philippinensis*) are very vigorous and robust in high altitude.

2.a.3 Knowledge of elevation requirements of the species to make sure of the normal growth and development of the species is necessary.

2.a.4 In establishing a plantation, it is suggested that areas be situated in lower elevations, accessible and in not very steep slopes for easier maintenance and management of the plantation.

2.b Soils

2.b.1 Rattan species have varying needs for substrates in their growth and survival.

2.b.2 Most species of rattans prefer soils that are either sandy loam or clay loam with the following characteristics (Razal and Palijon, Undated):

2.b.2.a High moisture content
2.b.2.b Rich in organic matter
2.b.2.c Slightly acidic or with pH ranging from 5 to almost neutral.

2.c Climate

2.c.1 Some rattan species have wide distribution while others are confined to a narrow geographic situation due to differences in climatic conditions particularly in terms of the amount and distribution of rainfall

2.c.2 Palasan (*Calamus merrillii*) is one of the species with a very wide distribution in the country. It is considered as one of the species with the highest climatic adaptability characteristics.

2.c.3 Rattan plantation established in areas having unpronounced dry and wet season is more successful than in areas with distinct and drier sites (PCARRD, 1991).

2.d Existing vegetation

2.d.1 Rattans grow well and produce high quality canes depending on the kind of vegetation present in the area.

2.d.2 Rattans primarily need tree-vegetated areas for shade and support.

2.d.3 Rattans can grow taller with support trees (Figure 1A). Rattan plants without support trees (Figure 1B) tend to lodge with its cane including the fronds, cirrus and/or flagellum entangling with each other.

2.d.4 The density or number of individual trees per unit area and the thickness of the crown of the trees influence the growth and development of rattans.

2.d.5 Most rattan species require 50% to 70% relative light intensity (Bravo and Andin, 1990).

2.d.6 Tree-vegetated areas to be selected should allow enough light illumination.

2.d.7 If canopy does not permit sufficient light transmission then the type of vegetation should allow silvicultural treatments like crown thinning/modification to suit the light requirements of the rattan species.

1.j.1 In harvesting big diameter cane, the base and top portion of the stem and the cirrus and flagellum are cut for several days or weeks to allow the fronds and thorns to dry for easy pulling and cleaning before they are finally collected.

Figure 20. Premature and improper harvesting of palasan (*C. merrillii*) cane.

Figure 21. Harvested rattan poles delivered in the processing center.

1.j.2 The rattan stems are cut into desired length usually ranging from3.1 m to 4.1 m. The canes numbering to about 10 to 20 are tied together and hauled manually to a designated collection area. Then the traders transport the canes to the raw cane market or

Figure 19. Pulling down the cane from the tree. Best done if pulling is done by a team of 2 to 3 persons.

1.e.2 The scythe is used for cutting the cane on top of the tree, frond and flagellum or cirrus clinging on the branches of the support tree.

1.e.3 Afterward, the cane is pulled down manually or with the use of animals.

1.e.4 Recently, the use of winch has been tried particularly if the area is accessible.

1.f Pulling down the cane without cutting the fronds, cirrus and flagellum is more often impossible. If it is possible, the method causes considerable damage to branches of support trees and only small portion of the commercial cane can be extracted. Premature and improper harvesting causes considerable wastage (Figure 20).

1.g Canes with at least 16 m in length can be harvested from every plant.

1.h If canes are harvested from the forests, only rattan with a length of 25 lineal meter or longer shall be cut and gathered.

1.i The big diameter cane, whether harvested from the forests or plantation, is normally cut into 4 m merchantable poles (Figure 21) (PCARRD 1991).

1.j In Indonesia (Wiyono and Santos Jr. 2004), selective cutting system (i.e. only mature canes are harvested) is widely employed. Small diameter canes are commonly harvested 6 years to 8 years after plantation establishment while 12 years to 15 years for big diameter canes.

(A) (B)

Figure 1. Growth of rattan plants with (A) and without (B) support trees.

3. What are the areas that can be utilized for rattan plantation establishment?

In the Philippines, several government-owned areas have been identified as available for the establishment of rattan plantation (Philippine Master Plan for Forest Development- DENR, 1990). These include logged-over areas, reforestation areas and industrial tree plantation.

3.a Logged-over or secondary forests (Figure 2)

3.a.1 Are areas with sufficient canopy openings that could allow 50% to 70% illumination is suitable for rattan plantation.

3.a.2 Are areas that normally have better soil conditions (i.e, high humus/organic matter, favorable soil moisture and pH) for the growth and development of rattan.

3.a.3 One of the constraints normally met by rattan permit-holders who are supposed to do replanting and enhancement, however, is that the secondary forests are within the logging concessions and thus the removal of the support trees are under the control of the concessionaires.

3.a.4 In Malaysia, large-scale cultivation of rattan in logged-over natural forests using the most economically important rattan species, the large diameter cane *C. manan,* was reported to have been started in the mid-1980's and was intensified in the 1990's (Barizan and Rivera, 2004).

Figure 2. Logged-over forests for rattan growing

3.b Reforestation areas

3.b.1 Millions of hectares of grasslands and brushlands have been reforested through contracts using a variety of tree species (Figure 3) like:

- 3.b.1.a Yemane (*Gmelina arborea*)
- 3.b.1.b Mahogany (*Swietenia marcophylla*)
- 3.b.1.c Narra (*Pterocarpus indicus*)
- 3.b.1.d Knife acacia (*Acacia auriculiformis*)
- 3.b.1.e Mangium (*Acacia mangium*)
- 3.b.1.f Molluccan sau *(Paraserianthes falcataria*)
- 3.b.1.g Bagras (*Eucalyptus deglupta*) .

3.b.2 Many of the reforestation areas have become suitable for rattan plantation due to presence of tree species that can serve as nurse and support trees for the rattans.

3.b.3 Soil conditions in these areas have considerably been improved due to the planted tree species.

3.b.4 If the intention of the reforestation is to harvest the trees at maturity, then inter-planting rattan should be planned so that harvesting age of rattan coincides with the harvesting age of the tree species.

3.c Industrial tree plantations (ITPs)

3.c.1 Public forestlands leased for ITPs, primarily to produce timber in commercial scale, can be used for inter-planting rattan. The wood or timber serves as the main crop while the rattan poles as secon-

1. Harvesting canes.

1.a Rattan plantation for cane production ready for harvesting from the 9th to the 15th year after establishment (PCARRD, 1991) (Figure 18).

Figure 18. Nine year old palasan *(Calamus merrillii).*

1.b Naturally depends on the rate of growth and development as influenced by the kind of cultural management and environmental conditions.

1.c Successive harvesting can be done at an interval of 3 ½ years. This is particularly applied on the succeeding canes of clustering rattan species like palasan.

1.d Harvesting by:

1.d.1 Pulling down the cane (Figure 19) from the support trees needs appropriate tools and skills.

1.d.2 Traditionally, if the rattan cane has enough length that can be cut, the skilled cane collector climb the tree, cut the top most portion of commercial quality.

1.d.3 On the way down, the flagellum or the cirrus is cut to make extraction easier. Pulling down the cane is more effective if done by a team, at least a pair of collectors (Virtucio and Sy, 1988).

1.e Another method of harvesting is bone by:

1.e.1 Using scythe attached to the pole.

9. Thinning

9.a For clustering rattan species like *C. scipionum, C. ornatus, C. merrillii* (Figure 17) thinning of some of the stems is done to reduce competition for growth within the clump. This allows the remaining suckers to grow more vigorously (Barizan and Rivera 2004).

Figure 17. Clustering rattan (Palasan, *Calamus merrillii).*

10. Protection of the plantation

With regard to protection of the rattan plantation, the activities include:

10.a Construction and maintenance of fire breaks.

10.b Deployment of plantation protection crew to see to it that the plantation is safe not only from poachers, browsing animals, but also from fire (Razal and Palijon, Undated).

10.c Since rattans commonly planted under tree-vegetated areas like tree farms and plantations, the protection activities are only supplementary to the protection of the latter.

B. Harvesting Technologies

Harvesting and post harvesting technologies vary depending on the intended products from the plantation.

dary products.

Figure 3. Reforestation areas that can be utilized for rattan plantation.

4. *What are other areas in the Philippines that can be used for rattan growing*?
These areas include: CBFM areas, multiple-use and sustainable-use zones of many protected areas, private tree farms/plantations, agro-forestry farms and home gardens.

4.a Community-based forest Management Programs (CBFM areas)-

4.a.1 Most CBFM areas have existing secondary natural vegetation and artificially planted tree species that can likewise be used for rattan growing.

4.b Buffer and multiple-use/sustainable use zones of protected areas-

4.b.1 Zones in many protected areas like the Bicol Natural Park (Figure 4) have been recently established. Aside from the strict protection zone, recreation zone, restoration zone, buffer zone, the multiple use zone (MUZ) and sustainable-use zone (SUZ) were included. These MUZ and SUZ are utilized for rattan planting in BNP.

4.b.2 In multiple use/sustainable use zones limited or regulated extraction of non-timber forest products particularly rattan, bamboos and vines is allowed through a resource utilization permit (RUP). The permit is given particularly to communities situated very near to the protected area that have been involved in the development

like planting and nurturing of the non-timber resources.

Figure 4. The Bicol Natural Park

4.c Private tree farms/plantations-

*4.c.*1 Tree farming in privately-owned and alienable and disposable lands in many parts of the country have become very popular.

*4.*c.2 Farms or plantations not only of timber trees like mahogany, yemane, bagras, moluccan sau, mangium, knife acacia but also other crops like rubber (*Hevea braziliensis*), oil palm (*Elaeis guinensis*) and coconut (*Cocos nucifera*) are common in the Philippines and in other ASEAN countries.

*4.*c.3 Some tree farmers intercrop non-timber producing species like rattan and bamboos to diversify the products and increase income.

4.d Home gardens and agro-forestry farms-

4.d.1 Integration of edible fruit-bearing rattan like lituko, *Calamus manilensis*) in home gardens using forest trees, fruit trees and palms as support is common in Nueva Viscaya and some parts of the Cordillera.

4.d.2 In Iloilo and other sites in Panay, trees along farm boundaries and inside the agro-forestry farms are used as support for the rattans (Figure 5)(Catral and Palijon, 2000; Fernando and Palaypayon, 1988).

4.d.3 If integration of rattan in agroforestry can be done in some parts of the country, other agro-forestry farmers in other parts of the Philippines can likewise adopt such farming scheme.

rubber plantation. The target for the final stocking is at least 60% of the original population (Barizan and Rivera 2004).

7.d.2 In Indonesia, replanting of dead rattan plants using seedlings of the same age with the originally out-planted ones is done 2 to 3 months after establishment (Wiyono and Santos Jr. 2004).

7.d.3 In Brunei Darussalam, replacement of dead out-planted rattans is undertaken during the first maintenance activity ((Ahmad, J.H.A., Mabong, D.H., and Arroyo, C. 2004).

8. Integrated Pest Management (IPM)

8.a Not much information on the pest and diseases of rattans in plantation are available.

8.b One of the major pests that observed is the rhinoceros beetle, *Oryctes rhinocerous*(L.) (Coleoptera: Scarabaeidae) (Figure16). This beetle attacks the shoot of the rattan regardless of the growth stage of rattan.

8.c Application of systemic pesticide like Furadan at 20 to 50 g per hole before planting and during the subsequent life stages of rattan, as practiced in Indonesia (Wiyono and Santos, Jr., 2004) is recommended. Similarly, during the early growth and development of rattan, rats can be potential problem since these animals like to relish the shoot of the newly planted rattans. Trapping and/or application of rodenticide (rat poison) around the base of the newly planted rattan is likewise necessary to minimize mortality.

Figure 16. Rhinoceros beetle (larval stage) infesting shoots of newly planted rattans.

6.c.3 Complete fertilizer (20-10-5) at 6 g per hill once a year (Ordinario, 1975).

6.d In other ASEAN-member countries, the following nutrition management practices were undertaken:

6.d.1 In Brunei Darussalam, 100 g complete fertilizer (12-12-17 + 2 Mg + TE), 25 g in each of the 4 holes dug in each of the 4 cardinal directions 30 cm away from the base around the planted seedling is applied immediately after planting (Ahmad, J.H.A., Mabong, D.H., and Arroyo, C. 2004).

6.d.2 In Indonesia, either manure with compost or urea about 10g to 20 g per hole is normally applied before planting (Wiyono and Santos, Jr., 2004).

6.d.3 In Lao PDR, organic fertilizers, preferably manure and compost, are applied a month after out-planting of rattan intended for shoot production (Ketphanh, S., Dalmacio, F.L. and Santander, M.L.2004).

6.d.4 In Malaysia, slow release fertilizer (AGROBLEN 16-8-9 + 3 Mg) is applied in the planting hole at 100 g/hill. This is done only once in rattan plantation established in logged-over forest. On the other hand, Christmas Island Phosphate (CIRP) fertilizer at a rate of 100 g/hole is applied during planting of rattan in rubber plantation (Barizan and Rivera, 2004).

7. Replanting

7.a Just like other plants, rattans are subjected to a lot of stresses. Unavoidably, some may likely to die probably due to quite a number of reasons.

7.b Immediately replace those individuals that did not survive to maintain full stocking so that production can be maximized.

7.c Usually done during weeding operations scheduled within the initial two years of plantation establishment. Rattan seedlings should therefore be available in the nursery for replacement purposes.

7.d In other ASEAN member countries, replacements are also done by the following methods:

7.d.1 In Malaysia, replacement of dead or unhealthy out-planted seedlings is done during the first 3 years of establishment regardless of whether the rattan plantation is in logged-over forests or

Figure 5. Rattan integration in agroforestry farm in Iloilo.

B. Site preparation activities

What are the site preparation activities involved in rattan plantation establishment? Prior to planting, the following site preparation activities should be undertaken properly: survey, boundary delineation, and compartmentalization; design and lay-out; clearing/brushing; canopy modification; holing, staking and out-planting.

1. Survey, boundary delineation and compartmentalization

1.a Whether the area has existing natural secondary forests, plantations or agro-forestry farms, it is necessary to do an actual survey in order to assess not only the extent of the area but also the existing bio-physical conditions of the site.

1.b The boundary of the designated plantation should be delineated on the ground and properly drawn on the map for easy planning.

1.c Once the extent and the boundaries of the area have been determined, it is likewise important to divide the site into compartments, say 10 or 20 hectares, for ease of establishment and management of the plantation.

2. *Design and lay-out of the plantation-*

Planting design is very critical because this determines the number of rattan plants that can be planted in the area that

is aimed at producing the maximum volume of quality canes, edible shoots, edible fruits or dye.

2.a The planting design for rattan is normally affected by the following:

2.a.1 Growth habit of the species whether clustering or solitary;

2.a.2 Type of product (whether for cane, edible fruit, edible shoot or dye)

2.a.3 Area available

2.a.4 Conditions of the existing vegetation.

2.b If the area is natural secondary forests, only patches that are not having naturally growing rattans are to be enhanced through planting.

2.c If the area is tree farms/plantations, industrial tree plantations, reforestation areas, the planting scheme will definitely be dictated by the spacing of the trees that will serve as support for the rattans.

2.d.If the area is home gardens and/or agro-forestry farms, the planting scheme will be influenced by the distribution of the trees along the farm boundaries and inside the area.

3.*What are the spacing of rattan plants for specific product?* Spacing varies as to the kind of rattan product the plantation is intended for.

S*pacing of rattans for canes*

3.a Spacing is very variable in reforestation areas, industrial tree plantations and tree farms of the Philippines and other neighboring ASEAN countries.

3.b Spacing naturally depends on site conditions, type and structure of existing vegetation and rattan species used.

3.c Spacing of 5m x 5 m for palasan (*Calamus merrillii*) (Figure 6) is adopted (PCARRD, 1991). This spacing was observed to be too close in good sites. The species is clustering or clump-forming i.e., each plant is capable of producing five or more suckers with vigorous growth, making the area too crowded with the above spacing (ERDB and NDC as cited in PCARRD, 1991). In Indonesia, this spacing is also practiced.

3.d Wider spacing like 5 m x 7 m or 5 m x 8 m should therefore be considered when planting in good sites.

gin to develop the cane (Ahmad, J.H.A., Mabong, D.H., and Arroyo, C. 2004).

4.e In Malaysia, weeding operation on rattan plantation established in logged over forests are done during the first 3 years after out-planting, the frequency of which depends on how vigorous the re-growth of weeds is. Circle weeding with a radius of 1 m or line weeding with a distance of 1m on both sides of the planting line is adopted Weeding operation (about 3 to 4 times a year) is stopped once the rattan plants have started to climb on the support trees. However, the pathways/ baselines are cleaned once a year. Weeding operation on rattan established in rubber plantation is conducted only when the need arises and usually done simultaneously with dried frond removal (Barizan and Rivera, 2004).

5. Cultivation

5.a Immediately after the weeds have been removed, the soil should be cultivated to make the soil loose hence improving water absorption retention and aeration.

5.b It is also done to maintain the soil mound around the base of the plant. Furthermore, mulching should again be applied.

6. Nutrition- Depending on the soil nutrient status and the conditions/ requirements of the rattan species,

6.a Sufficient amount of organic and inorganic fertilizers should be applied to rattan plants to ensure better growth and development.

6.b Apply fertilizer during rainy season. Normally, the type and dosage of fertilizers are determined based on the results of soil analysis and the kind of growth of particular rattan species.

6.c In the Philippines, the following types and dosages of fertilizers were found to stimulate the growth and development of rattans:

6.c.1 10 grams of complete fertilizer (14-14-14) per hill a month after planting and with 6 grams of the same type of fertilizer per hill every 6 months for 3 years after establishment;

6.c.2 5 to 7 g of complete fertilizer (14-14-14) per hill once a year for three consecutive years with the first application to be done at the beginning of the 2nd weeding operation (PCARRD, 1991);

*3.b M*ulching:

3.b.1 Suppresses the growth of weeds hence minimizes competition.

*3.b.2 Helps con*serve moisture and keeps the level of temperature favorable for the growth of the roots.

*3.b.3 L*essens soil erosion. Once the mulch is decomposed, it will provide additional nutrients that are needed by the plant for its growth.

4.*Weeding*

4.a Some undergrowths like shrubs (e.g. *Chromolaena odorata*), grasses (e.g. *Imperata cylindrica*), reeds, and vines (e.g *Mikania cordata*) grow profusely in the rattan plantation area (Figure 15).

Figure 15. Weeds entangling rattan plants

4.b Undesirable plants, if not removed, definitely will suppress the rattan plants.

4.c Thus, particularly the first 2 to 3 years of plantation establishment, it is necessary to conduct weeding. It has been a practice in the Philippines to do weeding 3 months after planting and every 4 months thereafter (PCARRD, 1991). The practice definitely changes depending on the extent and rate of growth of competing weeds.

4.d In Brunei Darussalam, complete weeding and/or brushing cum ring weeding of each out-planted seedling along each strip is done 1 yr after out-planting and every six months thereafter until the rattans be-

Figure 6. The 5 m x 5 m spacing for palasan (*Calamus merrillii*)

How about the planting design and spacing of rattans for canes in other ASEAN member countries? Different planting designs and spacing adopted in other ASEAN member countries are shown below.

3.e In logged over areas of Brunei (Ahamad, Mabong and Arroyo, 2004)

3e.1 Planting strips with a width of 5 m normally spaced at 20 m apart is used. There are three planting lines in the planting strip. The two outlying strips are each 1 m away from the edges of the planting strip and 1.5 m apart from the center of the planting line. The rattan plants are planted in quincunx arrangement, i.e. 5 seedlings are planted: the four seedlings occupy the corners of the rectangle while the remaining seedling is planted at the center. Approximately, the distance between seedlings along the planting line is 2.5 m resulting to a planting density of about 495 seedlings per hectare (Figure 7).

3.f In logged over-areas of Malaysia (Barizan and Rivera, 2004)

3.f.1 Line planting for clustering rattan and group planting for solitary rattan are adopted. In the former, the seedlings are planted singly per planting spot along the planting line. In the latter, about 3 to5 seedlings, are planted per planting point and are usually spaced a meter apart.

3.f.2 Both line and group planting are used in *strip planting* method being adopted in logged-over forests.

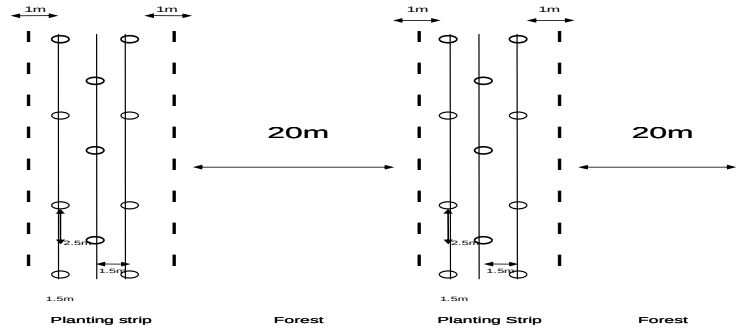

Figure 7. Planting arrangement adopted for rattan in plantation logged-over areas (Drawn as described by Ahmad, Mabong and Arroyo, 2004).

3.f.3 There are 3 types of *strip planting lay-outs* used in Malaysia

3.f.3.a In the 1st layout (Figure 8a), there are planting strip and the forest strip. The planting strip can be 5 m to 10 m wide while the forest strip can be 30 m to 40 m wide. Along the planting strip, all the trees of no commercial value including the undergrowth are cleared while the trees on the forest strip are left undisturbed. The minimum distance between seedlings along the planting line is 1m for solitary rattan while 2 m for clustering rattan. Two planting lines on the planting strip are said to be the optimum for solitary rattan while single for clustering rattan.

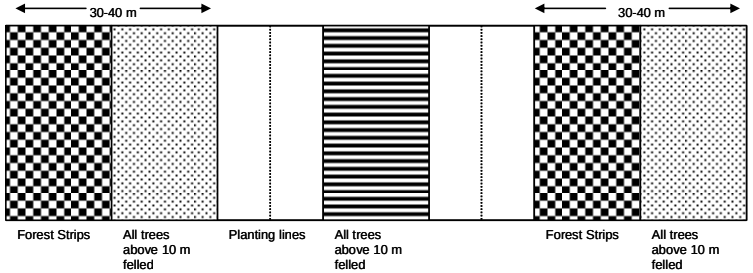

Figure 8a . Strip planting in old logged forest (Nur Supardi & Aminuddin 1992).

1. Basal fertilizer application

1.a To boost the early growth of rattan, apply either organic or inorganic fertilizer immediately after the hole is prepared or during planting.

1.b The amount and kind of fertilizer that should be applied depend on the conditions of the soil.

1.c Soil sampling and analysis should be done prior to plantation establishment so that appropriate dosage is determined.

2. Mounding

2.a Done so that enough soil is provided around the base of the plant particularly in sloping and relatively steep areas.

2.b Makes the rooting environment more favorable and provides better anchorage for the plant. The mound enhances drainage making the soil moist and not waterlogged during rainy season.

3. Mulching

*3.a L*eaf litter and humus are collected near the spot where rattan seedling is planted and used as mulch (Figure 14).

Figure 14. Leaf litter are collected and used as mulch where rattan seedling is planted.

Figure 13. Hauling potted seedlings packed in banana leaf sheath.

4. Method of planting

4.a Planting is done by carefully removing the poly-bag so that the earth-balled soil around the root system is kept intact.

4.b Before putting the seedling into the hole, the bottom of the hole is first backfilled with a layer of top soil of about 3 cm thick.

4.c The seedling placed at the center of the hole should be 1 cm lower than the ground surface. The sides of the root-ball are completely backfilled with loose soil and heeled-in to set the seedling firmly in the planting hole.

III. Plantation Management

A. What are the rattan plantation care, maintenance and protection activities?

The rattans, just like trees, have to be nurtured/tended to ensure their normal growth and development. Among the early tending (care and maintenance) operations that rattans need include basal fertilizer (either organic or inorganic) application, mounding and mulching while the late tending operations include weeding and cultivation, replanting, crown treatment, nutrition management and integrated pest management.

3.f.3.b The 2nd lay-out (Fig 8b), a lane of 1.8 m wide is cleared of all undergrowth on either side of the planting line. Specifically intended for the solitary rattan, the planting distance is 3 m x 4.6 m hence having a population of 725 plants/ha.

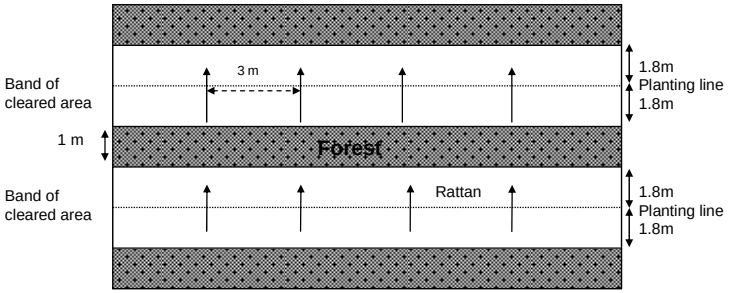

Figure 8b. Line planting layout for solitary-stemmed rattan species under secondary forest. Planting distance is 4.6m X 3m (Barizan and Rivera 2004).

3.f.3.c The 3rd lay-out is basically similar with the 2nd lay-out only it is intended for clustering rattan with a spacing of 3.4 m x 6.7 m with a population of 439 plants/ha (Figure 8c).

3.g In rubber plantations of Malaysia

3.g.1 Three types of planting systems for rattan in rubber plantation have been developed.

3.g.1.a In Planting System I (Figure 9a), the rattan seedlings are usually located in the center of the rectangle or square with the corners represented by the planted rubber trees. The planting distance of the rattan along the row is the same as the distance of the rubber trees only the row of the former is located at the center of the two rows of the latter. Rattans then are planted in alternately rows or rubber trees. The rubber trees are commonly spaced at 3.05 along rows m x 6.1 m between rows. With this planting system, planting distance of rattan becomes 3.05 m along rows x 12.2 m between rows. The ratio of planting density of rubber trees and rattan therefore is 2:1.

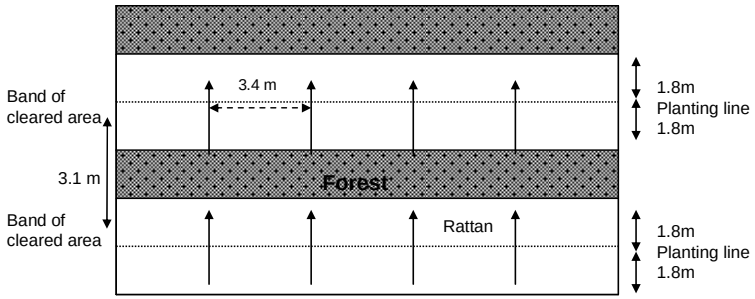

Figure 8c. Line planting layout for multiple-stemmed rattan species under secondary forest. Planting distance is 6.7m X 3.4m (Barizan and Rivera 2004).

3.g.1.b In Planting System II, (Figure 9b), the planting pattern of rubber is the same as in planting system I but the distance of planting along the rows (also located at the middle of rows of rubber) for rattan is twice than that of rubber. The succeeding row of rattan is however situated at the middle of the following two rows of rubber trees. The planting distance along the row for rattan is the same as in the first row only the planting is one slide down making the planting pattern of rattan in triangular shape. The planting distance of rattan is 6.1 m along the rows and 6.9 m between plants on the succeeding rows. The planting density ratio of rubber trees and rattans is similarly 2:1.

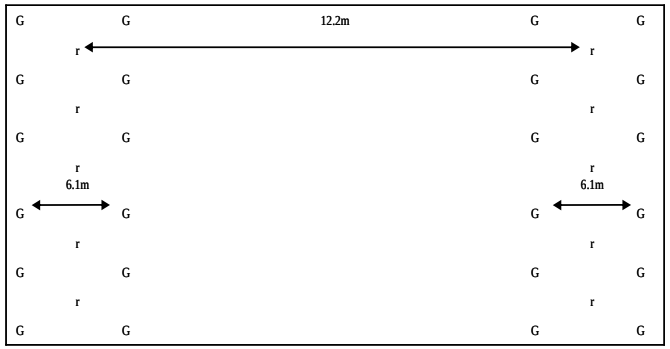

Figure 9a. Planting system I – layput of alternate row rattan planting in rubber plantation. G=rubber tree at spacing 6.1m X 3.05m; r=rattan plant at spacing 12.2m X 6m (Barizan and Rivera 2004).

Figure 12. Potted seedlings packed in banana leaf sheath ready for dispatch.

2. Size and quality of planting materials

2.a In most ASEAN member countries, the size of the planting materials commonly out-planted should not be less than 30 cm in height with at least 4 leaves. The planting materials should be hardened for at least a month (Razal and Palijon, Undated; Ahmad, J.H.A., Mabong, D.H., and Arroyo, C. 2004)

2.b In Lao PDR, good quality seedlings, 9 month to 12 month old, that were hardened in the nursery are used for planting rattan for shoot production (Ketphanh, S., Dalmacio, F.L. and Santander, M.L.2004).

2.c. In Malaysia, potted rattan seedlings 8 to 12 month old with a height ranging from 30 cm to 50 cm are used for planting in rubber plantation (Barizan and Rivera, 2004).

3. Hauling and transport of planting materials

3.a Rattans seedlings are delicate just like other plant seedlings. Thus it is necessary to handle the seedlings carefully to avoid damage during hauling and transport.

3.b A number of potted seedlings can be best brought to the planting site using backpack bamboo baskets or locally known as *kaing* and improvised boxes (backpack). Or hauling can be done if packed in groups using local materials like banana leaf sheath (Figure 13).

3.c The rattan seedlings before transported to the planting site should be placed in shaded areas if final hauling to the planting site is to be delayed to avoid exposure to high light intensity.

the seedlings.

6.d After planting, the stake should be placed back on the spot as marker for easy maintenance in the future.

Figure 11. Strip brushing

C. Outplanting

1. Season for field planting

1.a Using high quality potted rattan seedlings (Figure 12) or wildlings, out planting should be done during the most favorable time of the year.

1.b In many ASEAN countries, climatic conditions are variable. In areas with pronounced dry and wet season, out-planting should be done at the onset of the rainy season. This gives more time for the seedlings to fully recover and be able to tolerate the harsh conditions during the dry season.

1.c In areas with no pronounced dry and wet season and/or with well-distributed rainfall throughout the year, out-planting may be done anytime, unless there is abnormal climatic occurrence like El Nino or prolonged dry spell (PCARRD, 1991).

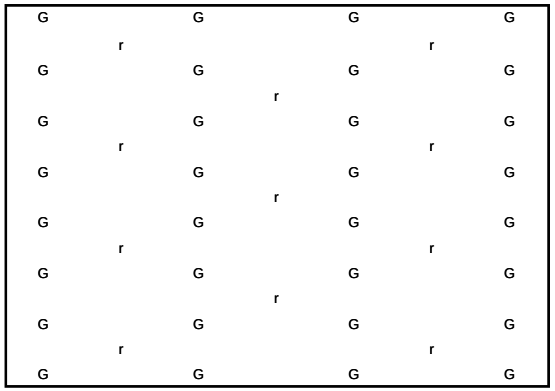

Figure 9b. Planting system II – rattan plants are planted in triangle shape. G=rubber tree at spacing 6.1m X 3.05m; r=rattan plant at spacing 6.1m X 6.1m X 6.9m (Barizan and Rivera 2004).

3.g.1.c Planting system III (Figure 9c) is applied when rubber trees are planted in a very wide spacing, e.g, 3.05 along rows and 8.5 m between rows. Here the rattan plants are planted in alternate rows, just like in planting system I. However, the rattan plants are planted in a very close spacing along the row i.e., only 1.5 m but very wide spacing between rows, i.e., 17 m.

Planting design for rattan shoot production

The design is quite different from the one used for cane production. Likewise, the areas normally utilized for rattan shoot production are open areas and alleys of agroforestry farms.

Spacing of rattan for shoot production

3.h In Thailand the spacing for clustering rattan (*C. tenuis*) that has been proven effective for maximum production of quality shoot is 0.5 to 1 m x 2.5 m (Figure 10). This spacing is also adopted in Lao PDR (Ketphanh, Dalmacio and Santander, 2004)

Figure 9c. Planting system III – rattan plants are planted in alternate rows of rubber trees. G=rubber tree at spacing 8.5m X 3.05m; r=rattan plant at spacing 17.0m X 1.5m (Barizan and Rivera 2004).

Planting design and spacing of rattan for fruit production. This varies with the kind of areas available for planting.

3.i In the Northern Philippines particularly Nueva Viscaya and Cordillera, where edible rattan production is quite popular, the spacing of 5 m x 5 m is used if the area is tree plantation.

Figure 10. Spacing of 0.5mto 1 m x2.5 m for edible shoot production.

3.j In agroforestry farms and home gardens, spacing is dictated by the distribution of support trees along the boundary and inside the farm and garden. Trees are either forest trees or fruit trees.

Planting design and spacing of rattan for dye production. The spacing may just be similar to spacing used for cane production and fruit production.

3.k In Indonesia where growing of rattan specifically for dye production is popular, the spacing used is 3 m x 3m to 4m x 4m

4. Clearing and brushing

4.a The method employed depends on the vegetation type (logged-over forest or tree plantations), the kind of planting design/system and the species and density of undergrowth that may compete with the rattan species

4.b Generally, if the undergrowth is thick then strip clearing (Figure 11) or complete brushing is done. On the contrary, if the undergrowth is sparse then spot clearing may be the best option. It will have little disturbance to the site and is less costly.

5. Crown modification

5.a Removal of excess branches of existing trees along the planting strips is necessary before planting and even after establishment. This will increase the light that will pass through the canopy so that rattan would have adequate light for their growth and development.

5.b The extent of crown reduction will definitely depend on the light requirements of the species. In Malaysia, it was reported that *C. manan* needs 50% light or 50% shade during establishment (Barizan and Rivera, 2004).

6. Staking and holing

6.a Stakes made of local materials that are taller than the seedlings should be placed on each planting spot to direct the men preparing the hole for planting.

6.b As practiced in Indonesia, planting hole of about 4 cm to 5 cm deeper than the height of the earth-balled root system and at least 4 cm wider than the diameter of the earth-ball is prepared. Such allowances will give sufficient space around the sides and bottom of the earth-ball for backfilling (Wiyono and Santos Jr. 2004).

6.c In Malaysia the size of the planting hole varies from 20cm x 20cm x 20cm or 30cm x 30cm x 30cm depending on the size of the root-ball of