Proceedings of the National Conference on Plantation Management and Utilization of Rattan

10-12 May 2004

Bangkok, Thailand

Royal Forest Department
and
International Tropical Timber Organization

National Conference on Plantation Management and Utilization of Rattan

Proceedings of the National Conference on

Plantation Management and Utilization of Rattan

Fortune Ballroom, Best Western Fortune Hotel

Bangkok

10 - 12 May 2004

Organized by

Royal Forest Department

and

National Park, Wildlife and Plant Conservation Department

with the Cooperation and Support of

The International Tropical Timber Organization (ITTO)

July 2005

Proceedings of the National Conference on Plantation Management and Utilization of Rattan

1st edition: July 2005

ISBN: 974-7627-34-5

International Tropical Timber Organization (ITTO)
Supported Publishing

Publishing by: AksornsiamPrinting Bangkok Tel. 02410 7813

PREFACE

The national conference on "Plantation Management and Utilization of Rattan in Thailand" is one of the activities of the project PD 24/00 Rev. 1 (I): Promotion of Sustainable Utilization of Rattan from Plantation in Thailand. The main objective is to provide the knowledge and experience in the fields of rattan plantation, management and utilization to the persons in charged and interested people.

The 3-day conference was held at Best Western Fortune Hotel, Fortune Tower, Bangkok, during 10-12 May 2004. There were 70 participants from Royal Forest Department, National Park Wildlife and Plant Conservation Department, Universities, Government Sectors, Private Sectors and Non-Government Organizations.

Mr. Piroaj Punpugdee, Director of Forest Economic and Forest Products Research Office, reported the activities of project together with an importance and expected outcome of the conference to Mr. Chatchai Ratanophat, Director General of The Royal Forest Department, who presided over the opening ceremony.

The conference included special lectures by 1 Indonesian expert and 5 Thai specialists in the fields of rattan plantation management, utilization, marketing, law and regulation. The project staff also presented the results from their research works. Presentation was delivered in Thai language. One-day excursion was organized to visit Raw Rattan Material Factory and Rattan Products Company in Angthong province, and at Bangsai Arts and Crafts Centre in Ayutthaya province.

In the last day of conference, participants were divided into 3 groups according to their interest, *i.e.* 1) Rattan Plantation and Management, 2) Rattan Utilization, and 3) Marketing to exchange their knowledge and experience as well as to draw the discussion on the future directions of rattan research and development in Thailand.

The project staff would like to thank the International Tropical Timber Organization (ITTO) for the supports to this meeting and to Thai Duean Pen Rattan

Raw Material Factory, Chai Wiwat Co., Ltd. Rattan Products Company and Bangsai Arts and Crafts Centre of Her Majesty Queen Sirikit of Thailand for their hospitality and arrangement for the visit.

Special thanks are given to all participants for their valuable efforts to make this conference success. Last by not least, the credits should go to all project staff for their tireless efforts during the entire course of the conference. This conference would not have been possible without them.

Promotion of Sustainable Utilization
of Rattan from Plantation in Thailand
PD 24/00 Rev.1(I)

ORGANIZING COMMITTEE

Chairman :

Mr. Chatchai Ratanophat	Director General of the Royal Forest Department	

Vice-Chairman :

Mr. Piroaj Punpugdee	Director of Forest Economic and Forest Products Research Office	RFD

Advisory Committee:

Mrs. Wanida Subansenee		RFD

Organizing Committee:

Mr. Songkram Thammincha		KUFF
Mr. Bunvong Thaiutsa		KUFF
Ms. Pannee Denrungruang	Project Leader	RFD
Ms. Rungnapar Pattanavibool	Assistant Project Leader	DNP
Mr. Suchart Thaipetch	Expert on Wood Identification	RFD
Mr. Yanyong Kangkarn	Technical Official	RFD
Mr. Chanatip Kuldilok	Silvicultural Scientist	RFD
Mr. Tanit Nuyim	Silvicultural Scientist	DNP
Ms. Sirirat Janmahasatein	Soil Scientist	DNP
Ms. Nutthakorn Semsuntud	Silvicultural Scientist	DNP
Ms. Walaiporn Satitviboon	Forest Biologist	DNP
Ms. Mayuree Jitkaew	Scientist (Wood Protection)	RFD
Ms. Paiwan Lek-U-Thai	Scientist (Wood Protection)	RFD
Mr. Smit Boonsermsuk	Forest Biologist	DNP
Mr. Prachern Soithongkum	Technical Official	RFD
Mr. Boonsong Sompor	Technical Official	RFD
Mr. Sapit Diloksumpan	Forest Physiologist	DNP
Mr. Watinee Thongchet	Forest Scientist	RFD
Ms. Vichuda Bualueng	Assistant Finance Officer	RFD
Ms. Varuesa Wannakhun	Project Secretary	

Secretariat:

Mr. Smit Boonsermsuk	Forest Biologist	DNP
Ms. Varuesa Wannakhun	Project Secretary	

Invited Speakers:

Mr. PHJ Nainggolan	Forest Management and Reforestation, Indonesia
Mr. Kowit Sombun	National Management Consultant of Rattan Project PD 24/00 Rev.1 (I)
Ms. Opor Suwannamek	KMITL
Mr. Somyot Chookamnerd	Narathiwat Rubber Research Center, The Office of Agricultural Research and Development Region 8
Mr. Bandit Sanitprachakorn	Permission Division, RFD

Sponsor:

International Tropical Timber Organization - ITTO

Remarks : DNP: Department of National Park, Wildlife and Plant Conservation
RFD: Royal Forest Department
KUFF: Kasetsart University Faculty of Forestry
KMITL: King Mongkut's Institute of Technology Ladkrabang

CONTENTS


Programme
National Conference on
"Plantation Management and Utilization of Rattan"

10 - 12 May 2004
Fortune Ballroom, Best Western Fortune Hotel
Rachadapisek Rd., Dindaeng, Bangkok

Monday 10 May, 2004

08:00 – 09:00	Registration
09:00 – 09:30	Opening Ceremony
	Special Lectures:
09.30 – 10:00	Past, Present and Trend of Future Studies on Rattan *PHJ Nainggolan*
10.00 – 10:30	General Perspectives of Rattan in Thailand *Kowit Sombun*
10.30 – 11:00	Present and Future of Rattan Marketing *Opor Suwanamek*
11.00 – 11:30	Planting Rattan in Rubber Plantation *Somyot Chookumnerd*
11.30 – 12:00	Law and Regulation Related to Rattan *Bandit Sanitprachakorn*
12:00 – 13:00	Lunch
	Session I: Cultivation and Utilization of Rattans
13.00 – 13:20	Plantation and Management of Edible Rattan *Yanyong Kangkarn*
13.20 – 13:40	Processing and Packaging of Rattan Shoot *Smit Boonsermsuk*
13.40 – 14:20	Cultivation of Rattan for Cane Production: Pattern and Yield - Case Study at Narathiwat Province *Tanit Nuyim* - Case Study at Krabi Province *Chanatip Kuldilok*

14.20 – 14:40	Soil Characteristics of the Project Sites *Sirirat Janmahasatien*
14.40 – 15:00	Coffee Break
	Session II: Various Studies on Rattan
15.00 – 15:20	Growth and Photosynthetic Performance of *Calamus viminalis* *Sapit Diloksumpan*
15.20 – 15:40	Mechanical of Rattan Cane *Suchart Thaipet*
15.40 – 16:00	Protection of Rattan Cane *Mayuree Jitkeaw*
16.00 – 16.30	Set up of Working Groups on Rattan: Plantation, Utilization, and Marketing
18.00	Welcome Party

Tuesday 11 May, 2004

	Study Tour at Ayuttaya and Angthong Provinces
08:00 – 10:00	Leave for Rattan Raw Material Factory :Thai Duean Pen, Angthong Province
10:00 – 10:40	Arrive at Thai Duean Pen
10:40 – 11:30	Leave for Rattan Products Company: Chai Wiwat Co, Ltd. Angthong Province
11:30 – 12:30	Arrive at Chai Wiwat Co. Ltd.
12:30 – 13:30	Lunch
13:30 – 14:30	Leave for Bangsai Arts and Crafts Centre, Ayutttaya Province
14.30 – 15:30	Arrive at Bangsai Arts and Crafts Centre:
15:30 – 17:00	Leave for Bangkok
17:00	Arrive Best Western Fortune Hotel

Wednesday 12 May, 2004

08.30 – 12.00	Workshops on Rattan: Group 1: Plantation and Management Group 2: Rattan Utilization Group 3: Marketing
12:00 – 13:00	Lunch
13.00 – 16.30	Presentations and Discussions
16.30 – 17:00	Closing Ceremony

OPENING REPORT

Piroaj Punpugdee

Director of Forest Economic and Forest Products Research Office

Director General of the Royal Forest Department;

On behalf of the Organizing Committee and participants, it is a great honor for the kind of Director General of Royal Forest Department to come to chair the opening ceremony of the National Conference on Plantation Management and Utilization of Rattan today.

Rattan is important economic palm specie since it was widely used both in local level and in industrial level. Light, strong, high flexibility and not so expensive are rattan's specific characteristics. These reasons showed why rattan becomes popular for furniture and household building especially agricultural appliances. Based on the investigation information, more than 60 species of rattans were found and distributed in swampy areas and moist evergreen forest throughout Thailand. Presently, Thailand is short of rattan raw materials due to the diminishing of forest areas and over harvested of rattan from natural forest. The need of rattan raw materials for local people and industry tend to increase. Therefore, reducing of rattan harvesting from natural forest and increasing of utilization efficiency by encouraging people the knowledge on sustainable plantation management and utilization should be concerned and practiced.

Sponsored by ITTO, the national conference on "Plantation management and utilization of rattan" is held to let people related such as farmer, technician and trader to exchange their knowledge and experiences for better understanding on rattan management and utilization. These will include marketing, laws and field trip.

The conference will be held for 3 days from 10-12 May 2004. The seventy participants comprise of Royal Forest Department executives, researchers, technical officers and traders from several organization and leaders of the community. The conference divided into lecture, workshop and field trip. Workshop were arranged into 3 small groups namely; plantation and

management, utilization and marketing, respectively. The knowledge gained from this conference will be transferred to the next conference and will also be applied for further study.

Now it is a good time to invite the Director General of Royal Forest Department to declare the opening of the conference.

OPENING ADDRESS

Chatchai Ratanophat

Director General of Royal Forest Department

Director of Forest Economics and Forest Products Research Office
Project Leader, Participants, Distinguish Guests, Ladies and Gentlemen,

It is my great honor and pleasure to chair the opening ceremony of the National Conference on Plantation Management and Utilization of Rattan. First of all, I would like to thank ITTO and all organizers for the support to make arrangements for this conference.

Rattan is one of the most important forest products of the country. It has been widely used since the ancient time. Rattan is used to produce different things for different purposes such as equipment, household items and even sport gears. At present, rattan is still being used as some components, if not all, of many containers around us especially during the festivals. However, situation has changed, rattan becomes scarce and expensive. Many rattan products have been substituted by plastic such as baskets, chairs and wicker ball (Takror). Rattan in natural forest has decreased while demand still existed. Therefore, rattan plantations must be raised to replace natural rattans and fulfill the needs of the people.

This conference provides a good opportunity to researchers, lecturers, farmers and traders to exchange their knowledge and experiences. I believe that this conference will be fruitful to all participants not only industrial level but also household level to apply for sustainable economic and social development.

I do hope that all participants will spend this valuable time for your most effective in exchanging knowledge and experiences on rattan management and utilization. Finally, I hope that the goal of this conference will be attained.

May I now declare the Conference on Plantation Management and Utilization of Rattan open.

SPECIAL LECTURES

PAST, PRESENT, FUTURE TREND STUDIES ON RATTAN

PHJ Nainggolan

PT. Kerassan Huta Nauli, Indonesia

INTRODUCTION

Rattans are spiny climbing palms occurring in the old world tropic, tropical rain forest and sub-tropics. They are the source of cane for the furniture industry. They belong to the non timber forest product that contributed 6.5% of the revenue, from entire forest product industries in Indonesia.

It is no doubt that Indonesia has long been known as the biggest rattan exporting in the world. Since 1980's, Indonesian has also been dominating rattan supply by accounting for 80% of total world market. Rattan industry in the country has played a significant role on both economy development and people livelihood, particularly on those who are living surrounding the forest areas. Based on the Bureau of Central Statistics in the 2000's, illustrated that on economic sector, rattan contributed more than US$ 300 million per annum to the national foreign exchange earning in the 1998 and 1999.

Rattan products become popular because of its beauty, freshness, easy to bend, brightness, light, endurance, and natural. Nowadays, although the products are still in a great demand, the activities of weaving and utilization rattan cane almost completely disappeared from countries. Main problem is the lack of raw-materials, especially a commercial species.

As far as the diameter concerned, rattan has been classified in two major groups *i.e.*: large diameter groups (diameter 12 mm to 40 mm) and small diameter groups (diameter 2 mm to 12 mm). Nation wide however, there are recognized groups *i.e.* small with diameter range 2 mm to 12 mm, medium diameter from 12 mm to 26 mm, and the large with 27 mm diameter and ups.

Rattan Trade

International trade in rattan dates to the mid 19th century, however village level utilization in the Asian region spans many centuries. In 1922 to 1927 Singapore exported rattan about 27,500 – 16,000 tons mainly to Hong Kong, the United State and France. During this period, exported rattan from Kalimantan, Sumatra, and Sulawesi increased from 9,400 to 19,300 tons and 10,300 to 21,800 tons respectively. In 1979, booming of raw material, rattan export did not seem enough to encourage the export of finished goods. Until mid 1980's, barring the illegal trades, the export finished products increased significantly. Total export of 135,000 tons in 2001 increased to 139,698 tons in 2002. Along with such increases, these were sizable decreases in value from US$ 300,929,134 to US$ 290,886,105 in that period. At that time Vietnam and China were the largest buyers.

In Indonesia, the installed capacity of rattan industries amounts to 533,000 tons raw material per year. In the recent year, the industries can absorb only in the neighborhood of 108,658 tons a year. Consequently, number of industries has to work under capacity or closed down. While production planning based on accurate data of resources from natural forest is unreliable, and rattan cultivation's are yet to be made.

CURRENT STATUS OF PRODUCTION AND UTILIZATION OF RATTAN

Exploitation of Rattan from Natural Forest

Sustainable has become a common word in modern society. The jargon often use in achieving sustainability from cradle to grave, will also applicable if rattan production and utilization ought to be sustainable managed.

From the supply side, Indonesia has a huge variety of this endemic species found grow naturally. Harvesting of such material has been exploited since long ago and no significant attempt of cultivation was made. Both large diameter and small diameter canes exploited from natural forest without used estimate with respect to Annual Available Cut (AAC).

Over 250 huge rattan factory, with thousand of small scattered one's around the country are having great potential capable of absorbing some half

million tons of raw materials. However, the best estimate with respect to annual available cut was set at 600-700 thousand tons per year for all species (a commercial and non-commercial).

Continuing reliance on natural grown rattan is unreasonable to supply raw material for industry. This has been proven by the disappearance of the excellent quality manau (*Calamus manan*), down sizing and down grading of canes, and hence, high price fluctuation. It is happened also to another species *i.e.*: *Calamus* spp. (crocodile nest) and *Daemonorops bulu* (rotan bulu). At this condition will be raw material unsustainable and continuously.

Low Incentives for Farmers

Rattan farmer are weaker node in the production chain before trader and manufacturer. Fair share amongst those players is hard to realize. When new regulations regarding trade mechanism or new trade policies be imposed, all sectors will be effected. It may be an incentive in one sector but it can be disincentive for the others. Once the trade ban was lifted in 1992, China and Vietnam emerged as new big players in rattan industries. They became potential competitors in global markets especially in Europe, Japan, Taiwan, and Philippine.

When there was economic down turn in the European Union, there was a market slow down and followed by low prices. The market share was rapidly picked up by China and Vietnam. They can produce similar products but better quality at lower prices. This is possible due to higher production efficiency and better quality of the products. All sectors in the production chain were affected.

Current Status of Rattan Products

If the present trend continue, the scarcity of raw material for industry will become inevitable. Low enforcement to curb down the illegal trade of raw material is another important aspect to consider. It is now time to embark on extensive cultivation of rattan aimed at improving the competitive advantage of rattan and rattan products and utilize their invaluable source to it's fully extent possible.

Sequence and status of rattan products from natural forest from the first time harvest up to present are:

Past Status of Rattan Product from Natural Forest

1. Rattan harvesting from natural forest still under the annual available cut. Potency (stock) in the field still abundant.
2. Rattan trade unattractive business for investor. Variation of rattan and rattan products still unimproved.
3. Scientist study on:
   - The anatomy of rattan that mostly used by villager.
   - Identification of rattan species from natural forest, their distribution, used, habitat and others.
4. Cultivation: In Central Kalimantan (Dadahup) some rattans *i.e. Calamus caesius* and *C. trachycoleus* has been planted.
5. No data recorded about the stock of rattan in the natural forest.
6. At the end of this period (1960 to 1965's) rattan trade started become attractive.

Present Status

1. Over-exploitation of rattan from natural forest as a consequence the commercial species become rare and endanger. Annual available cut not applied, harvesting dictated by buyer.
2. Large diameter cane; *Calamus manan*; *C. inops* and *C. zollingerii* become rare.
3. Law enforcement to avoid illegal export doesn't effective.
4. Still no accurate data of rattan from natural and plantation.
5. Some non-commercial species at past period become marketable: *i.e. Calamus flabelloides* (pulut merah); *Korthalsia scaphigera* (rotan semut); *Calamus javensis* (ratan lilin), *Calamus* spp. (crocodile nest) and others.
6. Lack of knowledge on:
   - Ecological information of existing species of rattan still unknown.
   - Silviculture information of a commercial species.
   - Growth rate of a commercial species.
   - *etc.*

7. No, seed orchard preparation to supply a good seed quality. Hard to collect seeds in large amount for intensive cultivation.

8. Cultivation of a commercial species still on trial plots.

The priorities for rattan research and development are:

1. Survey the existing resources
   - To document and use indigenous knowledge about rattan.
   - To establish accurate data of all rattan species (commercial and non-commercial) stock in natural forest and plantation areas.
   - To document knowledge on the ecological aspect to obtain optimal growth.
   - To establish the taxonomic and resource base and the rate of resource depletion.

2. Development propagation techniques
   - To build "Seed Orchard" to permit the large-scale production of superior seed to establish intensive cultivation.
   - Seed storage and handling.

3. Investigation of technique of cultivation
   - To identify and test cultivation and management techniques for cultivating a commercial rattan at village level and on a commercial scale.

4. Improved harvesting system, use and marketing
   - To explore opportunities for developing appropriate techniques for harvesting and processing included post harvest protection, and added value of products for Domestic and International market.

5. Germplasm collection, storage, exchange and characterization
   - To expand greatly of living collection of rattan.
   - To explore the existing natural genetic diversity which already at risk of depletion.

6. National policies
   - To examine national policies covering harvesting, use, marketing and development of the resources.
   - To examine quarantine laws for possible solution to allow the exchange of propagules and germplasm.

Establishing commercial rattan plantation in the forest serves two things. One is to secure continuous flow of raw material, and the other to provide better livelihood for forest dweller, these by reducing forest degradation. It is particularly suitable when done in logged over areas, secondary forest and forest timber industry, as far as the Forestry Agreement (FA) permits

MANAGEMENT OF RATTAN PLANTATION ESTABLISHMENT

Nursery

During the early years of rattan, no proper nursery techniques were adopted by small holder cultivators. Rattan seeds or even fruits directly sown in the field or wild seedlings found growing naturally were gathered for transplanting at selected site. Rattan seeds (sarcotesta removed) kept in a basket made of purun (*Lepironia articulata*) until they germinated (sprouted) within few weeks and young seedling transplanted in a large seed-bed at the wider spacing of about 25 x 25 cm, and the seedlings would be kept in the second nursery until they reach a height of 0.75 to 1.0 m and then be planted out in the forest.

The others nursery technique done by small holders are taken from the wild seedlings and kept them in the basket put on a floating platform (raft) tied to the edge of a riverbanks until new shoots grow about 3 to 4 months, than planted in the forest. These nursery beds were usually sited at the grower's background and it was very easy for growers to raise the seedlings properly. The shortcomings of these methods were:

1. The first transplanting can cause a lot of root damage to the young seedlings.
2. If seedling raising up to one meter height makes them very clumsy and heavy to transport to the field for planting. They may have become too spring and un-pleasant to handle.
3. The aged of seedling 12-15 months would cause further serious root damage to the seedlings and it's effected to the survival rate and growth may also be impeded.

In some areas (Dadahup) Central Kalimantan, seeds were sown in wooden boxes and transplanted to black polythene bags. These bags were arranged in blocks on the ground or in tiers on a wooden structure. The use of polythene bags

minimizes root damage during transplanting, ensures higher survival rate, faster and better seedling establishment in the field.

The technique described is suitable mainly for raising small numbers of seedlings for research purpose or for planting by small holders. Cost and practically are the most important guiding factors in deciding on which technique should be used.

Planting Material

Nursery establishment for raising a large numbers of seedlings of commercial rattans including:

(1) Fruit Collection

With establishment of about 5,000 ha of commercial rattan plantations with *i.e.* Manau (*Calamus manan*) should be assured that adequate rattan fruit/seed supply of about twelve millions with 90 % germination capacity.

Fruits bearing branches (infructescense) are collected from the rattan plant should be separated from branches (Figure 1) and packed in sacks made from gunny or mengkuang. Fruits should be kept cool and moist at all time in order to maintain their viability. If delivery of fruits takes long time from the source, remove fruit sarcotesta and clean seeds then put them in gunny sacks. These sacks provide good aeration and hence prevent undesirable heat build-up among the fruits. These sacks can be kept moist or wet by watering without becoming easily torn like a gunny sacks does. After the sacks of fruits have delivered to the nursery site, they should be spread out on gunny sacks after few days, seeds already put in plastic bags directly and the others soon in the seed beds under shelter at a cool site. Too much heat build-up in the sacks may either kill the embryos, that a reason if the delivery of seeds takes time *i.e.* more than weeks kept water content of about 50 %. To keep water content constant, put seeds in wooden boxes mixed with rotten sawdust and watering.

(2) Fruit Processing

It is a standard practice to remove the fruit scales (pericarp) by crushed and then rubbed by feet the sarcotesta against a gunny sacks laid flat before being washed off with water. Repeated rubbing and washing until the seeds are free from sarcotesta (Figure 2).

Figure 1. Fruits collection with branches in the basket, and lay in canoe (perahu).

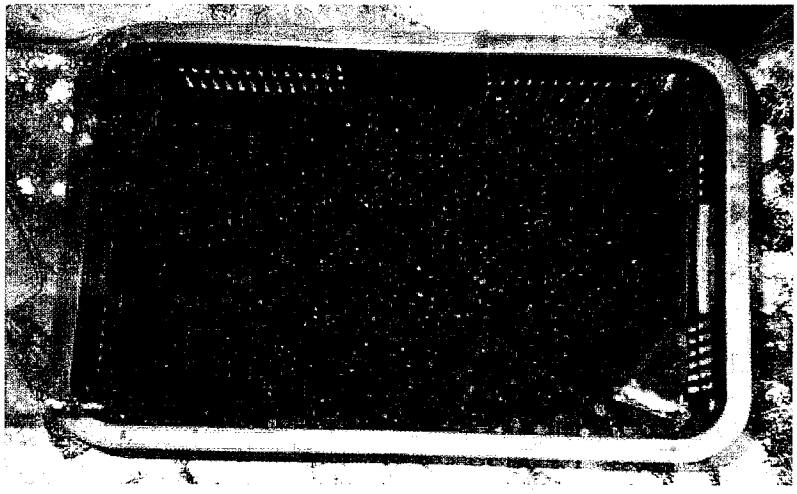


Figure 2. Seeds free from sarcotesta.

(3) Sowing Seeds

The use of raised seedbed is recommended for seed sowing (Figure 3). The raised bed should consist of a layer of sandy loam 5 to 10 cm thick, and overlay by a 3 cm thick of rotten sawdust or humus. The whole surrounded by plants to maintain the height of the bed.

Figure 3. Seed-bed for seed germination with plastic covered, to increase temperature and seed will be germinated at the same time and uniform.

(4) Transplanting

The beds should be rectangular in shape, about one meter wide and of any convenient length. The side chosen for the seed-bed should be flat or gently sloping and in an area where good top soil is available and must have a perennial source of irrigation water.

Seedlings are ready for transplanting when rattan seeds germinated, the first sign is the emergence of spear like protuberances after which the seedling leaves expand. Before transplanting, the seed-bed should be thoroughly watered to loosen the sowing medium so that seedlings can be pricked out easily with minimum damage to the root system. In the polythene bag to which the seedling is to be transplanted, a hole must deep enough. To accommodate the seedling, roots should be held between the fingers with its roots suspended in the hole. The hole should then be filled with soil before the seedling is released. By this way, roots will not compress and crumpled. The soil around the newly filled hole should be gently compacted to ensure close contact between the soil medium and the seedling

roots. Immediately after transplanting, seedlings should be watered thoroughly. The success rate of transplanting should not be less than 90 %. Within a week, success or failure of transplanting should be known and any casualties should be replaced as soon as possible so that polythene bag and nursery spaces are not left vacant and wasted (Figure 4).

Figure 4. Transplanting seedling into polythene bags with sizes of 11 x 20 cm.

(5) Shade

Seedlings raised in polythene bags in the seedling-bed need shade to grow well. Shade can be provided by using Nypa leafs or black colors plastic screen with light intensity 50 % or 60 % (Figure 5).

Maintenance of Seedlings

The after care of seedlings in seedling-beds (Figure 6) consists of replacing weak and dead seedlings, watering regularly, weeding, fertilizing, pest and disease control.

Figure 5. Seedling under plastics screen shade.

Figure 6. After maintenance for 9 months, seedlings are ready to transplant to the plantation site.

Depending on weather conditions, watering should be carried out as often as necessary to keep the soil medium moist. On dry season and hot day, two watering, one in the morning and one in the early evening may necessary. For a large nursery handling many thousand of seedlings at a time, a sprinkler system will be necessary to provide timely and efficient watering.

Manual weeding should be carried out as often as necessary, perhaps once a month, to rid the polythene bags weeds. Weeding and breaking of soil crust can be done together and should be carried out before fertilizer application.

Fertilization can be carried out if necessary, hardening of seedling is needed if the time of planting and weather condition are not sequentially.

Fruits production of Pulut merah (Figure 7) is low, on the other hand plantation need in large amount of seedlings. To obey the problems, the inhabitants (grower) took the clump of Pulut merah from the natural forest (Figure 8) then put them, in a small pond to get new shoots growth in the nursery. Put the shoots into plastic bags and keep for several months. After 4 months the shoot is ready to transfer to plantation site (Figure 9).

A strip line planting system is carried out in the open areas of peat swamp forest using *Glirisidia* sp. (Gamal), and the inter-cropping species such as banana, citrus, manihot, pine-apple and forest trees.

Figure 7. Fruits of rattan Pulut merah (*Calamus flabelloides*).

Figure 8. Shoots from the clump that taken from natural forest.

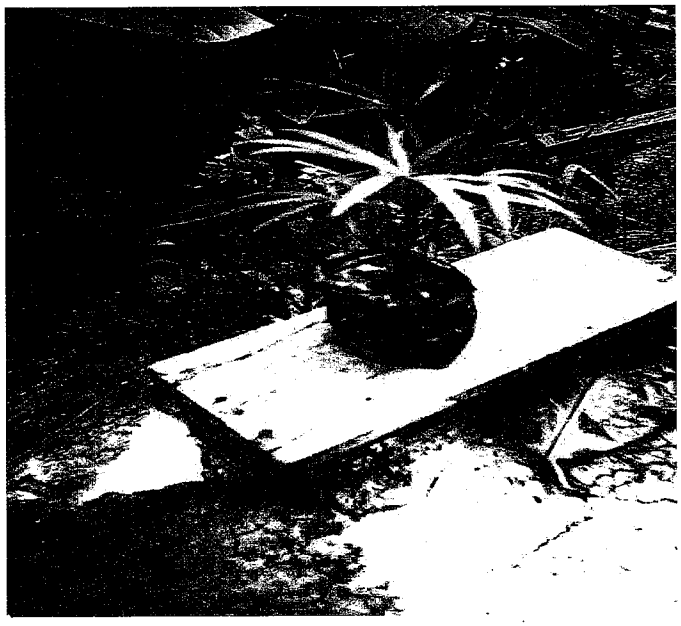


Figure 9. Shoots after 4 months in nursery and ready to be transferred to the planting site.

for a few months such as Pulut merah (*Calamus flabelloides*) by using Gamal (*Gliricidia* sp.) supported trees which belong to Leguminosae.

A large-diameter rattan canes should be planted in secondary forest with density of large-diameter trees, mostly the big canes rattans both clustered and solitaire can reach to the upper top of tree's canopy about height more 50 m tall. Large-diameter canes such as *Calamus manan*, *C. scipionum*, *C. inops*, *etc.* with strong cirri and flagella, petiole reach about of 6 m and flagella about of 5 m tightly attached in the canopy and branches of trees.

Field Preparation

Field preparation involves of operations such as unbrushing, lining and selective felling and cutting of trees. These operations will prepare planting paths for establishing rattan seedlings.

Unbrushing involves slashing of all undergrowth and young sapling with knives as close to the ground as possible. This works should be carried out to the extent that subsequent lining works could be proceeded easily and accurately. Depending on the actual condition therefore, unbrushing could be carried out only along the intended planting lines or through out the plantation areas.

This is important in secondary forest where dense undergrowth impedes survey work and movement of workers. For plantation forest, it may not be necessary to carry out unbrushing at all.

Lining

Lining is carried out to work the planting rows and planting points. It is more difficult to do lining in secondary forest where accurate sighting is difficult and where trees are irregular space. In plantation forest with neat rows of trees serving us guides, spacing between rows and within rows may need to be adjusted at times to accommodate trees standing in the way.

Selective Felling and Cutting

Along planting line that has been demarcated a 20 m wide clear planting path is prepared. Trees within the planting path and outside should be felled and removed if they are found to be obstructing movements of workers. Pruning of tree branches to allow more light to reach rattan seedlings may also be necessary under certain circumstances. It is also quite labors intensive and tedious and small chainsaws are usually used. Mechanical felling is preferred to the application of

tree poisons. This is because the desired field conditions for successful seedling establishing are instantly created whereas tree poisons take too long to have an effect.

Planting System

(1) Virgin forest

Virgin forests are usually rich with timber except gaps caused by dead trees (old) or strong winds and it's not economically. Planting of rattan in virgin forest has been not practiced and is not recommended. Usually virgin forests are confined to the highlands and inaccessible.

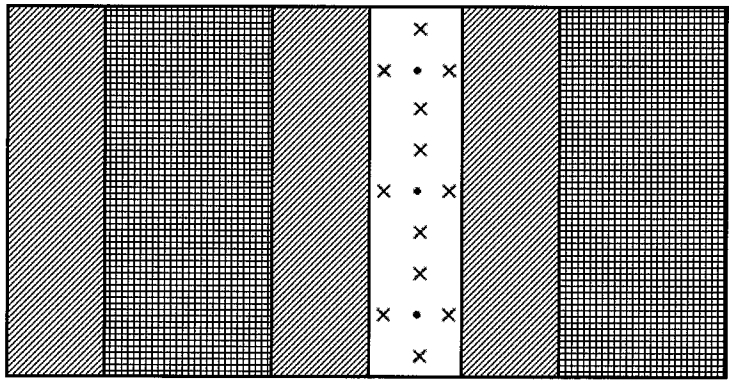
(2) Old secondary forest

Old secondary forests are that have been logged long ago, the canopy is reaching to the mature phase, whereby the light penetration is low. Felling of some trees is necessary to open up the canopy to allow penetration of light to reach undergrowth.

Strip planting is recommended in old secondary forest, so as to seduce damage to the forest. The minimal planting should be set at 1,000 seedlings per hectare, and 250 seedlings per hectare for solitary and clustering species, respectively (Figure 10). For easier maintenance, the distance between seedlings 1 m from planting points and the distance between strip line 5 to 12 m for solitary species. For a small-diameter species and clustered the distance between seedling in the strip line 2 m or 4 m and between strip line 8 to 10m (Figure 11).

All the vegetation along planting lines must be cleared, trees, and bushes, except those shading the seedlings on both sides of planting lines. When the rattans are in the initial stage of climbing, they should be trained (*i.e.* their climbing organs need to be trained onto tree branches) in one direction, so that there will be a clear line for easier movement during maintenance and harvesting.

Spacing of rattans planting certain defined by conditions of vegetation (distribution, density, canopy strata) that covered forest beside solitary or clustered. Spacing should be manipulated due to the conditions of forest. Large-diameter canes usually can reach to the upper part of the canopy.



Spacing 12 × 4 m = 1,000 seedlings/ha
7 × 4 m = 1,750 seedlings/ha
5 × 4 m = 2,500 seedlings/ha
12 × 5 m = 800 seedlings/ha
7 × 5 m = 1,400 seedlings/ha
5 × 5 m = 2,000 seedlings/ha

Sapling felling lower than 4 m height

• Planting points

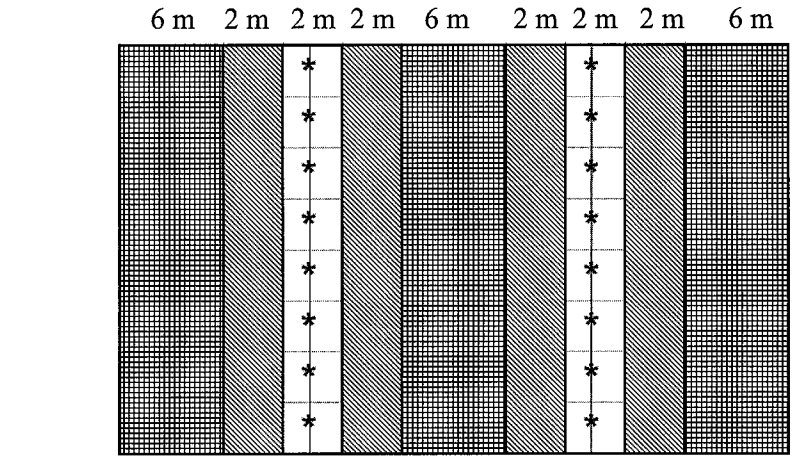
Forest strips (undisturbed)

Figure 10. Planting systems large-diameter solitaire.

(3) Newly logged forest

The planting system for rattan in newly logged forest depends on intensity, density, and distribution of the trees after logging. The forest canopy is in the gaps phase, therefore less work on the lines because of the amount of undergrowth present. Species of rattan that will planting depends on the conditions of forest, for instance if the highest trees and diameter more than 30 cm still left about 100 trees and second strata of canopy available it recommended large-diameter cane both solitaire and clustered.

Group planting for clustered large-diameter species such as Tahiti, Semambu, and others suitable if planting density more distance space about of 300 seedlings per hectare (See Figure 4 for growth and competition between them can be avoided). This condition gave more space.



Spacing : 10 × 2 m = 500 seedlings / ha
8 × 2 m = 625 seedlings / ha
10 × 4 m = 250 seedlings / ha
8 × 4 m = 300 seedlings / ha

Planting Points

Secondary forest, trees height less 20 m and < 30 cm diameter

All sapling more than 5 m felled

Figure 11. Planting systems of a small-diameter canes and clustered.

(4) Belukar and forest marginal areas

Belukar or regenerating forest consist a few small trees of commercial species with diameter lower 25-30 cm, height 20 m and a shorter pioneer trees. In this area, the forest canopy is closed with few gaps and the undergrowth is dense. Canopy manipulation is much easier as the forest is of two strata (the over head trees and the ground vegetation) and there is less limitation on the trees to be cut, much work will be spent on line clearing before and after planting.

Line planting at closer planting distance for a small-diameter clustered about of 625 seedlings per hectare (see Figure 2.). If forest conditions favorable to maximize land use, the planting density per hectare about of 800 seedlings. For large-diameter solitary species planting density should be set at 800 to 1,600 seedlings per hectare (see Figure 3.)

(5) Fringes of forest

In order to maximize forest land utilization and production, it's suggested that a few line of rattan could be established under some shade along the forest block along the forest roads.

The planting rattan along forest block roads will not reduce only last but also reduce maintenance last since the areas are easily to reach and accessible. Areas along the forest roads are generally sparsely shaded, therefore little or no manipulation of the canopy necessary. The other advantage of this system is the ease harvesting and transportation of cane. Mechanical harvesting can be applied by using a four wheel vehicle.

(6) Rubber plantation

Rubber (*Hevea brasiliensis*) in which rattan is inter-cropped divided into two categories, *i.e.* well managed commercial plantation or small holding and derelict abandoned commercial plantation or small holdings.

As for is known, the first attempt to use rubber as support / shade trees for rattan was in Kalimantan, Indonesia. Along of the banks of Barito river in central Kalimantan, *Calamus caesius* (sega) and *C. trachycoleus* planted by small holders under derelict rubber farm of small holdings.

In central Kalimantan that rattan established under derelict rubber however, not spread to other parts of Indonesia, *i.e.* Sumatra there are thousands of hectares of rubber plantation so called "rubber forest" is not adopted. It is more productive and profitable, although the holdings of rubber plantation have remained unchanged.

In Lengkawi Kedah, Malaysia planted manan (*Calamus manan*) large-diameter cane growing under the old rubber trees. However, these rubber trees could stand the heavy weight of a full grown rattan clump needs further assessment, especially if a holding is to be completely planted with this rattan species.

The advantages of using rubber trees as support/shade trees for rattan are as follows :

a. The existing rubber stands could be inter-planted without incurring the additional cost and time for establishing a new plantation.

b. Regular spacing of trees gives regular support and more uniform sunlight.

c. There is adequate low branching for support provided that the rubber frees no too old or tall before the rattan plants are introduced.

d. Annual "wintering" result in the shading of rubber leaves provides more sunlight for vigorous growth of the rattan plants.

e. Rubber trees can still be taped, wherever possible, to provide supplementary income.

Different clones of rubber probably vary in their suitability as support/shade trees because of different in branching habit, maximum height attainable, strength of branches, adaptability to the soil conditions and proneness to wind damage, age of trees and planting density (see Figures 3 and 4).

(7) Peat swamp and bushes

The planting system for rattan in peat swamps and bushes with a small-diameter canes such as: Pulut merah (*Calamus flabelloides*) by planting support/shade trees about 6 months before planting.

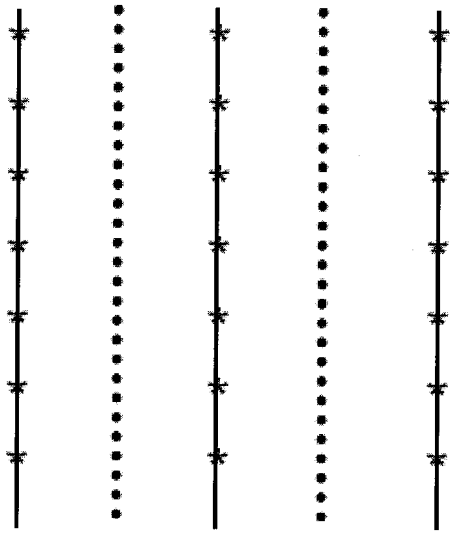
Peat swamps with bushes consist of shorter of plants and grasses, flooding temporary about 2 months in rainy season, can be cultivated with small-diameter clustered rattans.

In east Kalimantan, Melak District, Muara Pahu, the inhabitants planted Pulut merah. Use Gamal (*Glirisidia* sp.) that belong to Leguminosae as supporting tree in the planting line of 2 m spacing.

After 5 years the amount of stems in each clump about of 60-90 stems and production about 640 kg/wet ha/years up to 1,343 kg/wet ha/years (see Figure 12).

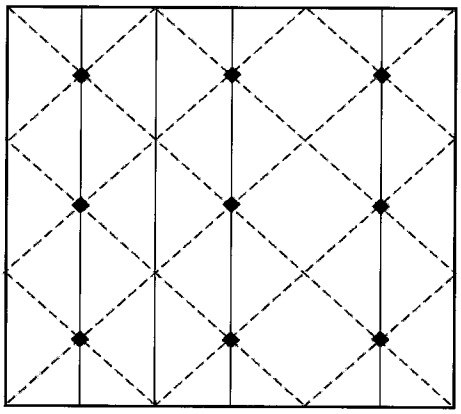
Inter-cropping species belong to citrus, manihot, grasses for cattle, pineapple, and bananas for forestry species.

For large-diameter cane (solitaire)
Spacing: 6 × 1 m = 1600 seedlings/ha
6 × 2 m = 800 seedlings/ha



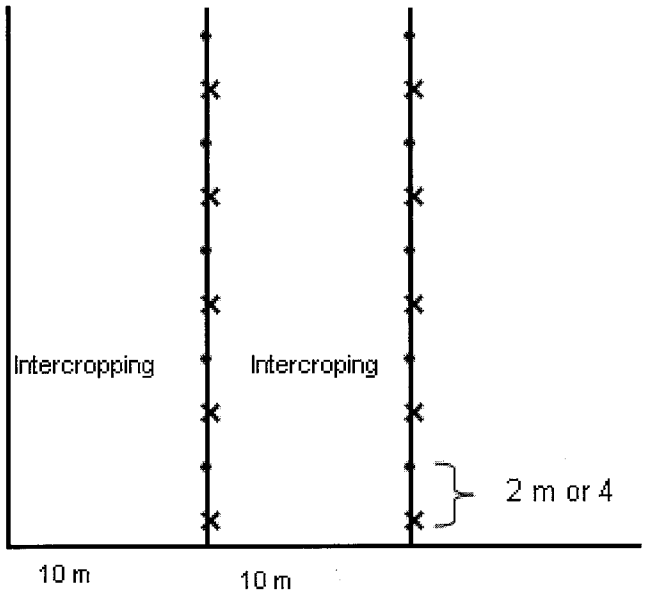
* Forest plantation trees for fast growing species.
• Large-diameter rattans not recommended.

Figure 12. Planting system large-diameter cane solitaire at rubber and forest plantation.



Spacing 6 × 5 m = 300 seedling / ha
Large-diameter and small-diameter clustered rattan species.

Figure 13. Planting system large and small diameter cane clustered at rubber and forest plantations.



Spacing : 2 × 10 m = 500 seedlings / ha
4 × 10 m = 250 seedlings / ha

Figure 14. Planting system of a small-diameter cane of *Calamus flabelloides* peat swamps and bushes.

Figure 15. Newly logged areas for rattans plantation both small and large diameter canes.

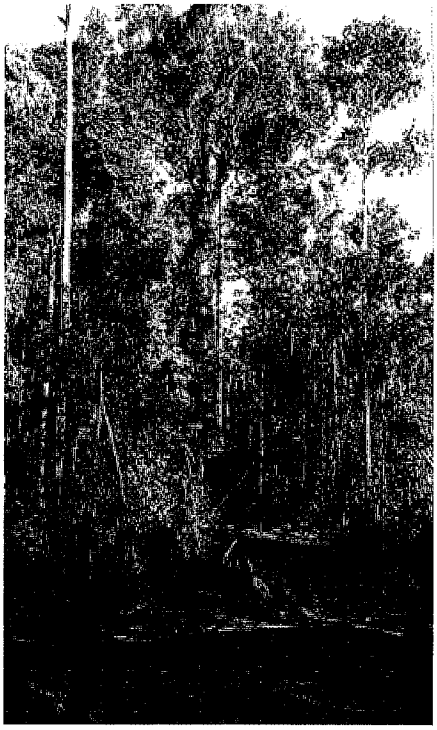


Figure 16. Old logged areas for large diameter (solitaire or clustered) canes of rattan.

Rattan Cultivation

Besides other environment factors, rattans (especially the large diameter canes), require aerial support and stronger trees for good growth, where the rattans climb up to the upper part of the canopy. Light intensity and supporting trees must be considered in the selection of the planting site and to decide on the desired planting system to be used.

Ecological aspects to be considered in determining the planting systems are the vegetation (phenotype) especially density and distribution of trees and canopy. Manipulation of vegetation to enhance light intensity that favorable for optimum growth of rattan is needed.

Vegetation

The homogeneity of vegetation depends on the type of forest (virgins logged-over, secondary, shrubs and plantation) that available. Canopy strata

influence management techniques required for rattan planting. Since our interests toward managing the rattan plantation, it is need to consider the space for rattan growth, sufficient light and supporting trees for the rattans to climb.

To establish planting areas under dense undergrowth requires more time and labor, but mostly secondary forest or logged-over forest with the highest trees not more than 20 m, the amount of light reaching the undergrowth in generally height, therefore, must be taken not to provide excessive opening which would lead to seedling scorch or destroy potential support.

Light

Dense canopy or multi-canopy forest will allow minimal light penetration. Line clearing is much easier, but more work is needed to open canopy.

Tree Branches

During the initial stage after planting, rattan seedlings will remain erect to certain height before cirri or flagella are produced. After two or three years after planting cirri/flagella developed the rattan cling or are hooked to the nearest available support such as shrubs and trees branches in process of staying erect toward the light. If there is no support or if the support is weak the rattan will abruptly is gradually due to own weight or through being blown by wind.

Medium and tall trees will provide continuous support and allow the rattans to have a constant in height at each successive node until a maximum is reach.

The strength of the tree branches should be also considered to support the rattans. Usually good supporting trees in such a way as to provide extended support for the cirri/flagella. The tree crown should be broad and not to dense, and allow the rattan to emerge above its canopy.

The Site Growth Cycle

The growth cycle of forest canopy can be divided into three phases are: the gap phase, the building phase and mature phase. The planting lines are made and some of the trees along planting lines are felled to manipulate the canopy, gaps are created. The dynamics from gap phase through building phase and finally to the mature phase must be considered in planning in rattan project. The productivity of the forest generally increases in the gap phase and declines in the mature phase.

The time span of this work required to establish and maintain the planting lines. The growth of planted rattan should correspond with development of these phases, so that the rattans have secured support by the time the canopy closes.

Soil and Terrain

Although rattans is normally above sea level up to the hill forest about of 3,000 m from sea level, but they abundant in the low-land. Establishment of rattan plantation on low-land areas is much easier and cheaper.

On step terrain is an arduous, especially when transport seedlings, time consuming and expensive. On step terrain the rattan tend to climb on to trees below it as their branches are closer. As the stem growth longer and the crown are above the tree canopy, the rattan will climb on the trees above it which provide continuous support. The process continues and the rattan crown will farther uphill away from the base. If the planting lines were along the slope and seedlings closely spaced, the rattan crowns tend to clump together or be packed along the lone. This will make harvesting difficult and to avoid this, we recommended that planting lines should be aligned along the hill contour.

Wind

Wind plays an important role in the movement of the rattan crown. Through wind movement the cirri/flagella come in contact with tree branches.

Strong winds will also break tree branches where rattan hanging and will result in damage of the rattan shoots and fallen branches can also damage young seedlings. If the trees weak, the branches only left in the top part (*Pinus merkusii*) continues by insects attacked. That is a reason that fast growing species are not recommended.

Commercial Considerations

The commercial species cultivation will have to take in account numerous factors, of which probability is the most important. The others are market abilities, forms of material, *i.e.* as raw cane, semi-processed, or finished products and weather for domestic or foreign. Markets are the most important factors that must be considered. Other important factors are the gestation period, and single or multiple stemmed growth form, i.e. whether providing a single or multiple

harvests. Size of the project or size of the land planted will also have hearing on choice, sufficient knowledge of the silviculture of the species.

Having taken into account all these factors, the apparent choice of small diameter and large-diameter species for Indonesian conditions are:

1. A small-diameter species belongs to *Calamus caesius*, *C. trachycoleus*, and others (Table 1).

Table 1. A commercial species of a small rattan canes that should be planted for furniture

No.	Name		Explanation
	Vernacular	Scientific	
1.	Rotan sega/taman	*Calamus caesius*	Lowland up to 900 m, alluvial soils in the bank of rivers, clustered.
2.	Rotan irit	*Calamus trachycoleus*	Lowland and flooded in several months, clustered.
3.	Rotan pulut merah	*Calamus flabelloides*	Lowland and flooded for several months, ridge and dry soils, clustered.
4.	Rotan pulut putih	*Calamus flabellatus*	Lowland and wet soil closed to the streams, clustered.
5.	Rotan lilin/cacing	*Calamus javanesis*	Lowland up to the mountain and Dipterocarpaceae forest, clustered.
6.	Rotan balam	*Calamus optimus*	Lowland, slope and ridge especially stream and river banks, clustered.
7.	Rotan sarang buaya	*Calamus* spp.	In the river banks with alluvial soils, colors blackish and Rengas trees, clustered.
8.	Rotan lacak merah	*Calamus eriocanthus*	Between swamp or peat up to ridge or between lowland and slope areas, clustered.
9.	Rotan tikas	*Calamus blumei*	Mountain and slope areas, clustered
10.	Rotan sabut	*Daemonorops sabut*	Lowland up to the mountain, stream especially with river banks, clustered.
11.	Rotan semut	*Korthalsia scaphigera*	Dipterocarpaceae forest, ridge and slope, clustered.

3. A large-diameter species belongs to *Calamus manan* (manau), *Calamus ornatus*, and others (Table 2).

Table 2. A commercial species of large-diameter rattan canes should be planted for furniture

No.	Name		Explanation
	Vernacular	Scientific	
1.	Rotan manan	*Calamus manan* *Calamus gigantea*	Lowland, ridge, slope and Dipterocarpaceae forest, solitaire.
2.	Rotan batang/ pondos saisagan	*Calamus zollingerii*	Mountain forest, ridge, and slope, clustered.
3.	Rotan Semambu	*Calamus scipionum*	Lowland, slope and ridge Dipterocarpaceae forest, clustered.
4.	Rotan kesup, buku dalam dan lambang	*Calamus ornatus*	Lowland up to the mountain and Dipterocarpaceae forest, clustered.
5.	Rotan tohiti	*Calamus inops*	Lowland mountain and slope, solitaire.
6.	Rotan manau tikus	*Calamus tumidus*	Mountain and Dipterocarpaceae, solitaire.
7.	Rotan balukbuk	*Daemonorops burkianus*	Between two mountain slopes, streams, clustered.
8.	Rotan kotok	*Daemonorops fissa*	Lowland forest areas clustered.
9.	Rotan dahan	*Daemonorops flagellaris*	Peat swamp forest areas, clustered

3. Rattans belong to the *Daemonorops* species that produces resin (dragon blood) (Table 3).

The advantages of small diameter species are:

(1) The small-diameter rattan species produce high quality canes that are in demand and here well established markets, both local and overseas. There is also flexibility in marketing them as raw material canes or semi-finished or finished products.

Table 3. Rattan produces a commercial resin "dragon blood"

No.	Name		Explanation
	Vernacular	Scientific	
1.	Rotan jernang	*Daemonorops draco*	Lowland up to the primary Dipterocarpaceae forest, clustered.
2.	Rotan tunggal/uwi jernang kecil	*Daemonorops didymophylla*	Valley, streams and slope of hill Dipterocarpaceae, clustered.
3.	Rotan tali ayam/ jernang	*Daemonorops micracantha*	Lowland up to 50 m sea level, clustered.
4.	Rotan jernang	*Daemonorops draconella*	Lowland up to hill forest, clustered.

(2) They are multiple-stemmed species and produce new suckers continuously there by allowing multiple harvesting and it's related multiple incomes.

(3) The first harvest of cane was carried out in 7 or 8 years after planting. The gestation period of harvest is relativity shorter and continuously harvesting about of 40 years.

(4) Utilization of canes is flexible (frame, webbing, core, *etc.*).

(5) The inhabitants can be cultivated in the back yard or on a large scale plantation for commercial production.

(6) Seeds are relativity easy to obtain in a big amount.

Planting Operation

Seedlings Transportation

Depending on the scale of planting and conditions at the project site, seedlings may be transported by different methods. In large scale of planting, seedlings of rattan in polythene bags are usually packed into tractor trailer or large truck to be transported to the planting site (Figure 17). To minimize mortality resulting from exposure of seedling to strong sunlight and heating during transport, nursery shade should be gradually removed one to two months before field planting to harder the seedlings. Before loading onto the truck, seedlings should be

Planting Maintenance

Following field planting of seedlings, several operations need to be carried out to ensure successfully establishment and good growth of the young plants are :

(1) Transplanting

Replacement of the dead seedlings with vigorous and healthy seedlings should be completed within three to six months.

(2) Planting Path Maintenance

The planting path should be maintained from weeds especially climbers one to allow easy movement of workers for maintenance work.

Weeding can be carried out manually (without using herbicides) at six months intervals, is sufficiently for most areas.

(3) Canopy Opening

This is the most important planting operation that ensure good growth of rattan seedlings. While rattans do not need full sun to grow well, about 60-70 % light intensity by canopy manipulation.

Two years after planting when the rattan stem are well formed and have already climbed on to the nearby, tree support (strata I), canopy manipulation is not longer required.

(4) Stem Training.

This operation is optional on higher land but quite essential in flood prone areas. It is aimed at helping the rattans to gain tree support as early as possible so that it does not lie on the ground.

GENERAL PERSPECTIVES OF RATTAN IN THAILAND

Kowit Sombun

Royal Forest Department, Bangkok, Thailand

Rattan Management and Utilization in Thailand

Rattan is the cane with prominent nodes that need tree as support for normal growing and climbing the trees with extension of thorny organ like arms. The canes cover with thorny leaves sheath and normally have diameter not larger than 10 cm but mostly between 1-2 cm. The leaves look like palm leaves and equip with spines. There are many species mostly grown in the moist area of tropical moist forest like tropical rain forests, evergreen forests and moist mixed deciduous forest in the tropical zone.

The Important of Rattan in Thai Economy

Rattan and rattan product have an export value of 32 to 87 million baths annually. The annual import items from rattan have value of 1 to 21 million baths. It showed that rattan contributed considerably to the general economy of the country. During the recent year due to declining of raw material so the export value from rattan reduce considerably.

The role of rattan in the rural economy is very important as local people very much depend on rattan for their living. As rattan is the raw material readily available in the rural area in the old day that local people can used to produce various utensils need for their own use. Cash income also can be obtained from handicraft making from rattan. In many areas local people popularly use rattan shoots for food and also for medicine. The decline of rattan resources due to

population growth of which very much effect on the rural economy as once play major role.

The Distribution of Rattan in Thailand

Rattan is an endemic species and that its distribution tightly depends on the environmental condition of the area. In general rattans are distributed all over the country from south to north, but it grows only in the wet pocket of the moist forest only. Rattan in Thailand can be classified into two major groups, those that grow in almost tropical rain forest climate and another that grow in other moist tropical forests like ever green forest and moist mixed deciduous forest. The tropical rain forest species are those that grow from Chumporn province down south to the border of Malaysia. *Calamus manan* is an important species in this group. These rattan species need moist climate almost all year round. The other groups are those that grow in ever green and moist mixed deciduous forest in other part of the country. These species can grow in more prolong dry season climate. The important species in this group is *C. viminalis* that has been planted for shoot production even under full sunlight in the dry climate and another important is *C. latifolius* having been grown in the garden for cane production and fruits in the north eastern part of Thailand.

Rattan Resources

As Thailand is situated between 5 and 20 north latitude, so there are species from both humid and monsoon type of rattan. Most of economically important rattan species can be found in Thailand, but the growing area is not so large. Most of them grow in the small moist pocket areas scatter all over the country. The important rattan species that can be found in Thailand are *Calamus manan, C. ornatus, C. scipionum, C. palustris, C. latifolius, C. longisetus, C. perigrinus* and also *C. poilanei.*

The economic species of rattan according to Subansenee (1996) are as fallow: *Calamus. perigrinus, C. manan, C. wailong, C. longisetus, C. erectus, C. latifolius, C. caesius, C. axillaris, C. blumei, C. pandanosmus, C. myrianthus, Calamus* sp. *(Wai sum), Daemonorop sabut, C. saimensis and C. palustris.* There are some many other species that still are not identified. It could be said that Thailand has good rattan resources in term of species diversity, but the distribution area is limited.

Rattan Management

Management for Cane

Normally people collect rattan from natural forest without any define management methodologies as the resources is not so intensive therefore enforcement and monitoring face some difficulty. This is the reason why natural resource of rattan is almost depleted. There just begin to establish rattan plantation for management. The growth performance of two rattan species *C. logisetus* and *C. latifolius* in the trial at age 10 years can be shown in Tables 1 and 2.

Table 1. Growth performance of 10-year old two rattan species

	C. longisetus	*C. latifolius*
CAR	3.9 m	2.3 m
MAI	1.3 m	1.3 m
CAI (cluster)	5.7 m	6.1 m
MAI (cluster)	1.6 m	2.0 m
Canes/cluster	1.6 canes	3.3 canes
Suckers/cluster	6.1	6.3

Table 2. Length class distribution in percentage at 9 and 10 year

	Age (years)	1	2	3	4	5	6
C. longisetus	9	9.52	36.81	42.86	11.11	0	0
	10	6.32	11.11	34.92	26.98	17.46	3.18
C. latifolius	9	2.82	32.39	43.66	16.90	4.23	0
	10	1.41	11.29	45.47	26.18	11.27	2.82

From the above information, it could be recommended that at age 10 years these rattans species can be harvested for canes. The canes can be selectively harvest only those that longer than 18 m, and only 10 percent of the total length should be harvested annually. It is expected that 200 m of canes can be obtained at

each harvesting in one rai. It will generate 2,000 Baht of income per rai which is rather small compare with other production. The income from rattan together with the benefit from supporting trees will be considerable. Therefore rattan plantation management is possible and economically feasible. The others rattan species might also be managed in the similar fashion. The small diameter cane species can be harvested may be within 3 to 5 years up to quality need and species use in plantation will add more advantage for management. The rattan plantation technology must be developed further before it can be really applicable for practical as many other aspect of management must be taken into consideration, such as supporting tree, number of canes left for growing, *etc.*

Management for Shoot Production

The development for the management for shoot of three rattan species *C. viminalis, C. siamensis* and *C.tenuis* is quite successful and rather sophisticated. From Kangkan (2002), rattan is normally grown in an open area for shoot production with the spacing of 1 x 3 m or other convenience spacing. The shoot can be harvested at early as 1 to 1.5 year and full production of shoot at 6 years. The shoot production can last more than 20 year. The income approximately 10,000 Baht can be obtained per one rai, which is very good income compare with other crops. Each farmer can manage two rais for good production. The management is quite intensive so in order to increase yield genetic improvement must be undertaken. The products from shoot can also be improved in order to expand marketing, such as health food and beverage. More development can be done for rattan shoot production industry.

Combine Management for Cane and Shoot

The management can be devised for both shoot and cane production. This direction will allow cane production to be economically feasible. Farmers can get good early income from shoot and extra benefit from cane in the long run as raw material for handicraft and furniture industry. This will create more jobs and generate more income for rural people. This type of management has to use trees to support canes for growing so the environmental condition of the plantation will be better than open production and sustainable production under more biodiversity can be manage easily. This kind of development must be emphasized in the future.

Rattan Utilization

Human knows how to use rattan for his living since long time. There are some records showing that Thai people use rattan in their living more than 3,000 years at least.

MARKETING OF RATTAN PRODUCTS: A CASE OF KOW SUPAMONKOL EXPORT CO., LTD.

Opor Suwannamek

King Mongkut's Institute of Technology Ladkrabang, Bangkok

Rattan products especially furniture, is one of the important exports of Thailand. However, the situation of an international trade of rattan products between 1995 and 2002 indicated the continuous importation of furniture, approximately 20,000-30,000 kilograms which are worth of 3-6 million Baht, while the volume and value of export were 724,549 kilograms and 70.54 million Baht in 1995 compared to 287,407 kilograms and 33.86 million Baht in 2002. At present, rattan is a scarce commodity in domestic market that causes the high price compared with other natural products such as reeds and water hyacinth. One of the reasons behind is the lack of replanting of rattan after exploitation. In addition, a strict regulation due to the announcement of rattan as a reserved plant species for cutting caused a less attempt on plantation. Nevertheless, there are some Thai entrepreneurs who have confidence in this business and continue their international trading of rattan furniture for decades, one of them is Kow Supamonkol Export Co., Ltd.

OVERVIEW

Kow Supamonkol Export Co., Ltd. is located at No. 32/14 Moo 5, Romklao Rd., Minburi district, Bangkok. The company has been founded by Khun Vichai Kowsupamonkol for more than 20 years. Starting from shipping and painting rattan furniture, he noticed that rattan furniture had been graded in a hi-end market that the consumers were in high economic position as well as among foreign tourists with high purchasing power. These experiences challenge him to undertake this international business. At present, the major export markets are in Europe, USA., and other emerging markets, especially China and Russia.

Imported Materials from Neighboring Countries, while Blending with Domestic Skilful Labors

For export business, rattan is mostly imported from abroad. As mentioned earlier, rattan has been declared as a reserved plant species for cutting. However, the importation of rattan material requires no tariff. Rattan exporting countries are Indonesia, Myanmar, Lao People's Democratic Republic, and Vietnam. Importing channels of this company are at least from 3 major routes:

1. **Indonesia** – method of purchasing is in kilogram of 5-meter canes that 1,000 kilograms costs US$ 700. Rattan from Indonesia is of higher quality than that of Myanmar.

2. **Myanmar** - method of purchasing is a piece with 4.30 meters long that costs 35 Baht each. The size is quite big compared with those from Indonesia.

3. **Ranong province, Thailand.** Rattan from this channel is routed in a form of fresh materials from Myanmar.

The company has its own stock of rattan. In addition, there are other materials to be made with rattan such as reeds and water hyacinth. Skill labor is necessary and there are 170 workers in this plant. Besides, other complementary goods such as pillow and cotton seat cover are ordered from the origins that have placed in various parts of Thailand.

Rattan Furniture for a Mass Market

At present, there are leading producers of this rattan industry dispersed all over Thailand. Among these, Penang Thai Rattan Ltd., Part. and Hawaii Thai Export Co., Ltd. have long reputation on rattan furniture. They have focused on the hi-end market. Synthetic rattan has been applied as well.

The company is one of the top rattan exporters who focuses on a mass market. Marketing strategies are less profitable, various kinds of household decorative goods, and inventory control for economical cost and keeping area. Task is divided for both its own labors, for bigger pieces, and sub-contractors, for smaller pieces such as stool. Particularly the latter, beauty and on-time delivery are a crucial issue to consider. Design is from the company itself and especially from overseas agents in order to meet the demand of the customers.

Europe and USA are the destination, then expanding to the emerging markets. Of the company's total furniture export, the European markets, especially France and Germany, and USA share about 60% and 40%, respectively. These markets are large markets for Thai rattan furniture. Japan, however, is not the company's target as the market requires high standards. Recently, the company got a contact from Chinese and Russian customers through the exhibition held by government agency. However, there are many competitors especially those from Indonesia and Myanmar. Consequently, the company has set up marketing strategies and tactics to maintain its competency in the international market. Pricing as well as communication strategies have been applied.

The Competitors: Indonesia and Myanmar

Fertile rattan resource and low labor cost facilitate these two countries with lower overall costs of production. In addition, Generalised System of Preferences (GSP) gained from the importing nations helps make their products competitive internationally. However, political and economic instability in these countries may impair the growth of this industry.

Support from the Government

In case of export products, the government supports the marketing promotion through exhibition, meeting, road show, and some privileges especially 0.36% of tax compensation, and exemption of export tax. The promotion of One Tambon One Product (OTOP) helps the company to get more quality and more beautiful products that can be put together with its furniture. In addition, the company received "5 stars" OTOP in Minburi district.

Trend of Rattan Furniture in the Company's View

The fluctuation of exchange rate that may cause the Baht overvalued is the main issue that exporters have serious concern. When considering overall, it is a business cycle. For the company's point of view, the trend of markets for rattan products is "sometimes declined, but it will be recovered soon".

Marketing Impediments and Suggestions

1. Factors relating to general environment

1.1 More severe of international competition
1.2 Fluctuation of exchange rate
1.3 Trend of rattan shortage due to more control on export from the origin
1.4 Foreign consumers' taste and habit

2. Factors relating to operational environment
   2.1 Late delivery from the sub-contractors
   2.2 Quality and standard

3. Recommendations for the development of rattan markets :
   3.1 Promoting the use of domestic products
   3.2 Promoting the use of rattan with other materials such as leather and reeds to reduce production cost and differentiate the products through the design
   3.3 Skills development for workers
   3.4 Marketing promotion and foreign study trip
   3.5 Networking and clustering

PLANTING RATTAN IN RUBBER PLANTATION

Somyot Chookumnerd

Office of Agricultural Research and Development Region 8,
Department of Agriculture

Rattan plays an important role in economic and social development. Rattan furniture industry and rattan products can reduce the import of rattan products making the annual revenue of several hundred million Baht. These help avoid rural migration as well as create local employment, which distribute more income to people of different levels. Therefore, procurement of rattan raw material is very essential for furniture and rattan product industries. However, rattan production in Thailand has been decreased due to the depletion of forest areas. The problems have been temporarily relieved by importing of raw material, despite high price of imported items. Critical point is that the rattan export countries, Indonesia and Malaysia, launch various measures to limit the export of raw rattan. This can be indicated by the decrease in import volume from 27,187.6 ton in 1989 to 11,826.4 ton in 1993 or 56.5% decrease. The harvesting capacity of rattan from natural forest was by then 329 ton or only 3% of the total demand that severely affected to rattan productions and export. In 1988, value of exported rattan furniture equaled 1,182.9 million Baht, compared with 304.1 million Baht in 1993. Therefore, the government needs to find out long-term solution for the shortage of rattan raw materials. This could be done by promotion of sustainable management of rattan plantations in natural forest, especially in rubber plantations which covers 10.5 million rai in the south, 1.5 million rai in the east, and 0.3 million rai in the northeast. Moreover, research on rattan utilization along with conservation should be initiated.

LAW AND REGULATION RELATED TO RATTAN

Bundit Sanitprachakorn

Permission Division, Royal Forest Department, Bangkok

Land for rattan plantation can be classified into private land and state land. Private land must have the land title deed or document called Nor Sor Sam or Sor Por Kor to certify the right on particular piece of land while these documents are not eligible on the land belonging to the state. Mostly, the problems stem from poverty and illegal occupancy of land especially on state land, such as protected area and degraded forest.

Even if rattan is in the list of prohibited species, the regulations are not in effect in case of rattan that grows on the land under property right. It can be harvested and transported if the owner has document issued by the Royal Forest Department. Imported raw material is not prohibited but transportation needs a certificate of origin.

Questions on law and regulations about rattan can be raised and will be solved during the discussion.

TECHNICAL SESSION

PLANTING AND MANAGEMENT OF RATTAN FOR SHOOT PRODUCTION

Yanyong Kangkarn

The experiment included four studies, *i.e.*, 1) the effects of manure and chemical fertilizer and 2) the effects of watering and manure application on shoot production of *Calamus viminalis*, as well as 3) spacing trial of *C. viminalis* and *C. siamensis* planted in tree plantation, and 4) establishment and management of *C. tenuis* and *C. siamensis* for combined shoot and cane production.

Study on Fertilizer Application on Shoot Production of Wai Dong (*C. viminalis*)

The results of the experiment on the effects of manure and chemical fertilizer application on shoot production of *C. viminalis* revealed that, 4-year-old *C. viminalis* being manured once a year had the shoot production of 10.89 shoots/cluster. The productivity was significantly better than those with chemical fertilizer (25-7-7, 100 gm/cluster twice a year) which produced an average of 9.76 shoots/cluster, and average of 7.01 shoots/cluster in control. The results of these two treatments were also significantly better than that of control.

Study on Effect of Watering and Fertilizer Application on Shoot Production of *Calamus viminalis*

A 5-year-old *C. viminalis* treated with manure cum 60 mm watering once every week (Tr_1) or 30 mm twice a week (Tr_2) had better shoot production than those of sole manuring (Tr_3) and control (Tr_4). There was no difference in shoot production among 2 methods of watering. The manuring alone also had better shoot production significantly better than the control. The result from this experiment also confirmed that manuring gave better shoot production than the control.

The average shoot production at the end of the 18th month of Tr_1, Tr_2, Tr_3 and Tr_4 was 10.6, 10.9, 8.3 and 5.8 shoots/cluster, respectively, while the weight of consumable part of shoot was 40.0, 40.5, 36.0 and 28.5 gm/shoot. Tr_1 and Tr_2 were not different, but significantly better than all the others, among which Tr_2 was the best. Rattan under twice-a-week watering had larger shoots with more consumable part.

Study on Planting Space of *Calamus viminalis* and *Calamus siamensis* for Shoot Production

The result showed that *C. viminalis* and *C. siamensis* planted under tree plantation with two densities had good survival rate, *i.e.*, higher than 95%.

At 18 months after planting, average shoot production of *C. viminalis* at 1 x 1 m and 1 x 0.5 m planting spaces was 2.0 and 1.8 shoots/cluster, respectively, compared with 2.0 and 2.1 shoots/cluster of *C. siamensis*. At 1 x 1 m spacing, shoot production of both species was not statistically different. However, *C. siamensis* at 1 x 0.5 m spacing produced more shoot than *C. viminalis* with statistical difference in number of shoots.

The average consumable part per shoot of *C. viminalis* at 1 x 1 m and 1 x 0.5 m planting spaces was 21.9 and 16.4 gm/shoot, respectively, compared with 21.6 and 18.2 gm/shoot of *C. siamensis*. It was shown that at 1 x 1 m spacing the consumable part of the shoots of these two species was not statistically different, but at 1 x 0.5 m spacing *C. siamensis* produced larger shoot with more consumable part than *C. viminalis*. Moreover, shoots of both species at 1 x 0.5 m spacing were smaller with less consumable part than those produced at 1 x 1 m spacing.

Study on Planting Technique of *Calamus tenuis* and *Calamus siamensis* for Shoot and Cane Production

The results of the study on integrated management for shoot and cane production indicated that *C. tenuis* and *C. siamensis* had the average cane length of 1.47 m and 1.63 m within 1 year and 6 months after planting in tree plantation with no statistical difference. It was found that the average shoot production of *C. tenuis* and *C. siamensis* were 3.0 and 3.5 shoots/cluster respectively with statistical difference.

Keywords: *Calamus viminalis, Calamus siamensis,* spacing, cane, production

PROCESSING AND PACKAGING OF RATTAN SHOOTS

Smit Boonsermsuk[1] and Pannee Denrungruang[2]

[1]National Park, Wildlife and Plant Conservation Department,
[2]Royal Forest Department

There are more than 60 species of rattan in Thailand, but only one species of Calamus is well known in the northeastern region as the species with most favorite edible shoots. This species is referred to as Waai Dong that is extensively planted in the areas of Sakon Nakhon province. The cane of this rattan species is medium-sized with diameter of 2.0-2.5 cm. The study on rattan shoot processing was conducted in order to find out the possibility for rattan shoot preservation as well as to encourage the farmers who are interested in rattan shoot production. The rattan shoots were put into a 6 oz. glass bottle filled with a mixture of brine of 2% and syrup 30% concentrations adjusted with citric acid for pH below 4.5. The products of rattan shoots in brine and syrup were kept in room temperature for microorganism examination for 3 and 6 months. There was no microorganism found in rattan shoot product. The nutritive value of rattan products showed little change from fresh rattan shoot in protein and fat. The energy (Kcal) from rattan shoot in syrup was higher than that in brine, because of sucrose. The dehydrated product was better in texture and color. The results of sensory evaluation between two treatments, rattan shoot in brine and rattan shoot in syrup indicated that the mean of sensory evaluation was between 3.69 and 4.90 and the products were accepted by panelists.

Keywords: *Calamus* sp., rattan shoots processing, rattan shoots in brine, rattan shoots in syrup

STUDY ON PLANTING AND MANAGEMENT OF *CALAMUS CAESIUS* FOR CANE PRODUCTION AT NARATHIWAT PROVINCE

Tanit Nuyim

National Park, Wildlife and Plant Conservation Department,

The study on planting and management of *Calamus caesius* for cane production was carried out in natural forests in Narathiwat province during 2001 to 2004. Three experimental plots were established from which the data on growth and number of shoots were collected. An average length of 5-year-old *C. caesius* growing in swampy area with temporary flood was 368.08 cm compared with 71.17 cm of those in degraded area along hill slope. The 18-year-old *C. caesius* planted in abandoned deforested area had the cane of 404.14 cm long in average. Results from the experiment on harvesting system showed that 1–2 canes/clump harvesting resulted in induction of growth performance and the increase in the number of new shoots, while harvesting of 3 canes per clump caused a decrease in growth and number of new shoots during the first year, but increase in the following years.

Keywords: *Calamus caesius,* rattan, Narathiwat, Thailand

YIELD OF 13-15 YEARS OLD, *CALAMUS LONGISETUS* AND *CALAMUS LATIFOLIUS* IN *AZADIRACHTA EXCELSA* PLANTATION

Chanatip Kuldilok

Royal Forest Department, Chatuchak, Bangkok

Yield of 13-15-year-old *Calamus longisetus* and *Calamus latifolius* planted in *Azadirachta excelsa* plantation was studied at Nai Chong Seed Production Area station, Krabi province. Results showed that *C. longisetus* and *C. latifolius* at 13, 14 and 15 years old in the plot without fertilizer applied produce an average length of 17.77, 19.34, 23.68 m, and 25.21, 26.98, 29.52 m, respectively while those with fertilizer applied produce an average length of 10.65, 13.64, 15.33 m and 29.81, 34.56, 35.34 m, respectively. Means annual increment of *C. longisetus* and *C. latifolius* in plot without and with fertilizer were 2.96, 2.34 m/year and 2.16, 2.77 m/year, respectively. Survival rates of *C. longisetus* and *C. latifolius* were 89% and 91%, respectively. Ratio of merchantable length of *C. longisetus* was 55% of total length while that in *C. latifolius* was 60%. Merchantable length of *C. longisetus* and *C. latifolius* can be calculated as 565.76, 612.63, 746.54 and 1,085.93, 1,178.30, 1,244.78 m/rai in 13, 14 and 15 years old rattan, respectively. It can be concluded that *C. latifolius* grew better and produced more production than *C. longisetus* in all aspects.

Keywords: *Calamus longisetus, Calamus latifolius, Azadirachta excelsa* production, fertilizer

DETERMINATION OF SOIL CHARACTERISTICS UNDER RATTAN EXPERIMENTAL PLOTS OF THE PROJECT SITES

Sirirat Janmahasatien

National Park, Wildlife and Plant Conservation Department, Chatuchak, Bangkok

The studies on soil characteristics in rattan experimental plots of the project sites were carried out in Narathiwat, Krabi and Sakon Nakhon provinces. The study areas were set in various rattan experimental plots including forest and encroachment areas. The results of soil surveys revealed that Reddish Brown Lateritic Soils covered the plots in Narathiwat. These soils were deep and moderately well drained with reddish brown sandy loam topsoil. Distinct lateritic soils were found in lower horizons. The evaluated soil fertility was low. Red Brown Earths were found in the plots in Krabi province. These soils were poorly drained with dark reddish brown clayey texture and medium fertility. The soils in the Sakon Nakhon experimental plots were Gray Podzolic Soils developed from old alluvium on fans. Soil profile diffused in smooth boundary with any distinct strong brown iron mottles and low fertility. The results of the studies described the characteristics of soils in rattan experimental plots. Information of soil properties together with the growth rate of rattan species will be used to evaluate suitability site for rattan species.

GROWTH AND PHOTOSYNTHETIC PERFORMANCE OF *CALAMUS VIMINALIS*

Sapit Diloksumpan

National Park, Wildlife and Plant Conservation Department, Chatuchak, Bangkok

The objective of the study was to compare the growth of *Calamus viminalsis* seedlings grown under different light conditions as well as their growth and photosynthetic performance after planting in *Combretum quardangulare* plantation. Growth measurements of *C. viminalis* seedlings were taken place one year after growing under different light environments including 30 and 50% light intensities under nursery conditions and under the shade of *Samanea saman* (rain tree) trees. The results showed that the seedlings grown under 30 and 50% light intensities had significantly greater ($p < 0.01$) height and diameter growth as well as total dry weight compared to those under *S. saman* shade. Particularly, the latter had only 50% of the total dry weight of the other two groups, probably due to their deep shade environments (only 15-20% of full sunlight) and/or their leaves covered by lac.

Eighteen and twenty four months after planting in *Combretum quadrangulare* plantation, *C. viminalis* grown under 30 and 50% light intensities showed greater growth performance, indicating its ability to adapt to shade environment in *Combretum quadrangulare* plantation with 30% of full sunlight. In the long term, however, this rattan species growing under rain tree tended to adapt well even though it had lower growth rate before planting in the field. Furthermore, photosynthetic performance of all the three groups was similar in the wet season but slightly different in their responses to seasonal drought during the dry season. *C. viminalis* growing under rain tree was able to maintain higher leaf photosynthetic activity in the dry season where water availability became limited,

while that from seedlings under 30% light intensity was able to minimize water losses through leaf transpiration under such stress condition, resulting in greater water use efficiency. Further research on physiological processes contributing to rattan growth as well as genetic improvement is, therefore, recommended for sustainable management of *C. viminalis* plantation.

MECHANICAL PROPERTIES OF *CALAMUS LONGISETUS* GRIFF. AND *CALAMUS LATIFOLIUS* ROXB.

Suchart Thaipet

Royal Forest Department Department, Chatuchak, Bangkok

The study on mechanical properties of *Calamus longisetus* Griff. and *Calamus latifolius* Roxb. was conducted in laboratory of the Royal Forest Department during 2003-2004. Canes of these two rattan species were collected from Naichong Seed Production Station, Krabi. Eight specimens were prepared from node and internode of rattan canes, each part of which was used in each test. Tensile, compression parallel to grain, hardness, density and moisture content were determined.

For *C. longisetus*, tensile, compression parallel to grain, hardness, density and moisture content of node part was 266 kg/cm^2/26.1 Mpa, 288 kg/cm^2/22.4 Mpa, 251 kg/2.48 kN, 303 kg/m^3 and 10.63 percent, respectively, whereas 404 kg/cm^2/39.6 Mpa, 262 kg/m^2/25.7 Mpa, 206 kg/2.04 kN, 328 kg/m^3 and 10.35 percent was respectively in case of internode part.

Tensile, compression parallel to grain, hardness, density and moisture content of node part of *C. latifolius* was 429 kg/cm^2/42.1 Mpa, 431 kg/cm^2/42.3 Mpa, 462 kg/4.57 kN, 425 kg/m^3 and 10.73 percent, respectively, compared with 327 kg/cm^2/32.1 Mpa, 389 kg/cm^2/38.2 Mpa, 450 kg/4.45 kN, 352 kg/m^3 and 10.00 percent of the internode part.

PROTECTION OF RATTAN CANE

Mayuree Jitkaew

Royal Forest Department, Chatuchak, Bangkok

Waai Pong (*Calamus latifolius*) and Waai Kam Puan (*Calamus longisetus*) were harvested from plantation in Krabi Province for the study on rattan protection to find suitable and practical methods of controlling staining fungi and insect infestation on rattan canes. Both species were treated with different processes. The results revealed that diesel oil curing at 105°C for 10 minutes showed the best result against fungi, followed by the mixture of diesel and kerosene (ratio 3:1) at 105°C for 20 minutes, diesel and palm oil (ratio 5:1 and 1:1) at 115°C for 20 minutes, and palm oil at 120°C for 30 minutes. There were less growth of mold and staining fungi on the skin of rattan canes which were good appearance with creamy white color. The immersion of rattan canes in 10% Boron compounds also showed a good appearance after peeling off the skins. In contrary, immersion of rattan canes in 1% Stemona solution for 24 hours could not protect rattan from staining fungi. For the infestation of insect, all treatments of both species and control (non-treated) were not attacked by any insect, especially powder-post beetle.

EXCURSION REPORT

EXCURSION REPORT

A one-day excursion was organized in order to allow participants to be familiar with and have a chance to exchange their experiences and information prior to being divided into 3 discussion groups.

Thai Duean Pen Rattan Raw Material Factory in Angthong Province

The factory is located at No. 223, Poh Praya - Ta Ruae Road, Moo 3, Sarm Koh district, Angthong province. This factory has been open for more than 10 years. Rattan raw materials are ordered mostly from Indonesia (Sulawesi Island), China and Myanmar. At this factory, all participants had a good chance to observe the demonstration on the preparation of rattan raw material before distributing to the customers. The processes include grading, mechanical peeling, polishing, threading, bleaching, sulfurization, washing and drying. Bleached rattan raw materials are distributed to all over Thailand, export being prohibited by law.

Chai Wiwat Co, Ltd. Rattan Products Company at Angthong Province

The company is located at No. 55/1, Poh-Thong District, Angthong province. The company produces various kinds of rattan products for both wholesale and retail. The products come from the villagers around Angthong province and neighboring provinces such as Singha Buri and Petchaboon. The company provides raw materials and the patterns of design to the villagers who sometimes create their own.

Queen Sirikit Bangsai Arts and Crafts Centre of Thailand at Ayutthaya Province

The centre is located at Bangsai district, Ayutthaya province. Rattan product is very well-known as it is guaranteed by the name of the centre. Participants had a chance to observe the process of rattan furniture production. During the last training on rattan weaving and furniture making organized by RFD supported by ITTO, the center's expert on furniture making was a resource person.

WORKING GROUP REPORT

LIST OF GROUP PARTICIPANTS

Group 1: Rattan Plantation and Management

Mr. Apidet Teowsirisup
Mr. Bopit Kietvuttinon
Mr. Bunpen Nuanchawee
Mr. Chaiya Klaiklung
Ms. Duangjai Sookchaloem
Mr. Nipat Sivatintugo
Mr. Thanapong Pothitan
Mr. Warawut Suwannarat
Ms. Nipol Chaisalee
Ms. Nuntana Boonyanun
Mr. Piroj Wannakul
Mr. Somdet Champee
Mr. Somkuan Switachart
Mr. Surapong Anuchon
Mr. Vudhikorn Khumcharoen
Ms. Wilawan Wichiennopparat

Group 2: Utilization of Rattan

Ms. Boonserm Ampun
Mr. Chawalit Supasarn
Ms. Choojit Anantachoke
Mr. Jedsada Punsata
Ms. Narumol Rattanakonpun
Ms. Piyawadee Bauchongkol
Ms. Prapasiri Pongprayoon
Mr. Vallayuth Fueangvivat
Ms. Tasanee Pattanaseree

Group 3: Rattan Marketing

Mr. Adisak Poin
Ms. Apinya Jarernpipatsiri
Mr. Boonchai Temsutilap
Mr. Chinnaworn Chotitawornrut
Mr. Kamphon Witisitti
Ms. Kanokwan Pettrikaew
Mr. Kiti Kungsadal
Mr. Komsak Soparat
Mr. Komsun Ruangritsarakul
Mr. Wattana Prompraison
Ms. Rasri Polrachom
Ms. Rattana Silpasuppakornwong
Ms. Samai Sripakdee
Mr. Somchai Ratchatrakoon
Ms. Somjai Srimongkontip
Mr. Thongkum Chaiyes
Mr. Vieng Vareenin
Ms. Vitchanee Boonyapatipark
Mr. Watcharakorn Punchon

WORKING GROUP REPORTS

Group 1: Rattan Plantation and Management

Problem/Fact	Recommendation / Solution
1. Planting site	• Planting in the national forest area such as old plantations, degraded forests, community forests and public areas. • Planting in private areas such as old private plantations, farmland and rubber plantation.
2. Unclear policy and direction	• Push forth the policies of related organizations on the increase in plantation areas, seed sources area, and knowledge learned. • Promotion of rattan planting and sustainable utilization.
3. Law and regulations to enhance rattan plantation in community and public areas	• Revision of the law to support rattan planting and utilization in the specific areas.
4. Less planting activities in public areas	• Enhance planting rattan in public area supported by Royal Forest Department, Forest Industrial Organization, and Department of Agricultural Extension.
5. Lack of information and technical knowledge on potential rattan species	• Encourage for more research and development. • Establish training center for rattan planting and sustainable utilization, including a demonstration plots. • Recommended species for plantation : **Large cane:** *Calamus manan, C. blumei, C. peregrinus, C. latifolius, C. rudentum.* **Small cane** : *C. caesius, Calamus pandanosmus, C. myrianthus*, Wai Kanun, Wai Sanim, *Daemonorops sabut*, *Calamus palustris, Calamus rudentum*, Wai Saikai, *Calamus javensis* and Wai Kao

Group 1 (cont.)

Problem/Fact	Recommendation / Solution
	• **Edible shoot**: *C. viminalis, C.siamensis* and *C. tenuis*
6. Lack of seeds and access to seed source areas in natural forests.	• Establishment of seed production area • Propagation by tissue culture • International program on species exchange.
7. Lack of information and knowledge on rattan planting for cane production and agro-forestry technique.	• More attention on planting of high potential rattan species • Documentation of knowledge on economic rattan species.
8. Lack of knowledge on maintenance of particular rattan species.	• More study on management and maintenance of rattan.
9. Lacking of knowledge on pest and disease management.	• More research on rattan protection against pest and disease.
10. Lack of good cooperation with local people.	• More public relations on sustainable utilization of rattan.
11. Lack of knowledge on harvesting and post harvest technology.	• More study about pre and post harvesting of rattan. • Documentation of basic information on rattan growing and management. • Producing varieties of media and publications for knowledge dissemination.
12. Lack of technical information on growing economic species.	• Training workshop for the exchange of knowledge and experience. • Establish cooperation among related organizations. • Funds for growing rattan. • Study on value added of rattan products. • Promotion in tri-lateral system: Industrial, Government, and Agriculturist

Group 1 (cont.)

Problem/Fact	Recommendation / Solution
13. Low economic returns and restriction by law and regulations.	• Application of law enforcement on tax exemption for rattan farmers.

Group 2: Utilization of Rattan

Problem/Fact	Recommendation / Solution
1. Shoots and fruits.	• Study / Analyze chemical components and nutrition value in rattan shoot and other vegetables in the same dish. • Research on local wisdom on rattan foodstuff. • Study on processing and packaging such as rattan curry in the bottle, tea from dried rattan shoot, dye from rattan seed, and icecream or jam.
2. Rattan products made of cane, skin and remnants.	• Promotion of rattan planting. • Training workshop on rattan production. • Revision of law and regulations. • Utilization of rattan remnants for making paper, charcoal, composite-board, and fertilizer • Study on appropriate combination of rattan with other materials for furniture.
3. For other purposes	• Compilation of local wisdom on rattan utilization. • Study on chemical properties in different parts of rattan

Group 2 (cont.)

Problem/Fact	Recommendation / Solution
4. Problems on rattan utilization - *rattan cane* 1) Lack of raw material 2) Destruction of pest and disease 3) Quality of material 4) Incomplete processes of production 5) Lack of diverse products 6) Product design. - *Rattan shoot* 1) Fresh shoot preservation 2) Bitter taste 3) Lack of knowledge on processing and packaging	• Study on the possibilities of total utilization. • Dissemination the knowledge on rattan protection. • Design and processing development. • Seek of the partners. • Training workshop arrangement. • Promotion of collaboration among partners and related person. • Study on the possibility of total utilization. • Research on rattan shoots preservation and processing. • Research and development on preservation and processing techniques. • Encourage the farmers to grow potential rattan species.

Group 3: Rattan Marketing

Problem/Fact	Recommendation / Solution
1. **Weaving products** The order of products is not steady resulting in unsteady income and uncertainty of employment.	• Clear target for the market • Improve the product designs • Upgrade the products for higher market • Create the product unique for the group and different from the competitorís product • Establish the networking

Group 3 (cont.)

Problem/Fact	Recommendation / Solution
	• Promotion of the products: neater and prominent products with punctual delivery • Create the link between government and research institutes on new design of the products
2. **Furniture products** 1) Demands and supplies 2) Higher price of raw material	• Reduce the production cost by combining rattan with other materials • Promotion rattan planting • Revise the law and regulations on rattan transport • Enhancing rattan planting for furniture industry (such as *Calamus manan*, Wai Nam Pung, *C. pandanosmus, C. latifolius etc.*)
3. **Bottled rattan shoots** 1) Scarcely sold out due to the competition from fresh shoot 2) Unable to extend the market 3) Lack of marketing knowledge	• Improvement of rattan shoot preservation, processing and packaging • Training workshop on rattan marketing for the housewife group • Customer-oriented promotion of rattan products.

QUESTIONS AND ANSWERS

Q : What is the purpose of processing and packaging of rattan shoots?

A : The purpose is to preserve rattan shoots in order to be sell during off-season and to ease the transportation. Rattan shoots after processing are still bitter. It has been found that rattan shoots preserved in brine solution can be kept longer than those in syrup. Nutritional values of rattan shoot in syrup are slightly higher than that in brine solution.

Q : What should be a reasonable price for the bottled rattan shoots? Is it worth investing?

A : The cost of bottled rattan shoot is estimated to be 40 – 45 Baht per bottle (60 Baht wages included). Most farmers have their own rattan plantation that saves the cost of raw material. However, the price of fresh shoots is not much different from that of the bottled one.

Q : Does rattan shoot contain useful medicinal property?

A : Due to its bitter taste, root and shoot of rattan have been used to cure the fever in rural area. However, there has not been technical evidence reported. Moreover, when people think of bamboo shoot they always think of uric acid and this perception prevails in case of rattan shoot. In fact, there is no evidence of such effect on those who regularly consume rattan shoots in Sakon Nakorn province. Moreover, it is found that some chemical components, which react as antioxidant, have been found in rattan shoots.

Q : When rattan cane is cut, clear sap exudes from the cut. This sap should be analyzed since it may contain specific and useful chemical compound.

A : This is an interesting recommendation and should be followed by research in future.

Q : How about the taste, nutrition value and cost of preserved rattan production? Which one is more valuable?

A : Taste of preserved rattan shoot depends on individual preference. Dried rattan shoot may be tough and crispy compared with the bottled one. However, there is no commercial dried rattan shoots in Thailand but in Laos, the price of dried rattan shoot is approximately 500 Baht per kilogram. The material is simply prepared by sun drying and packed in ordinary plastic bag.

Q : Does it has any change to the nutritive value in preserved rattan shoot of the project?

A : Comparing between fresh shoots and the preserved ones in brine solution, it was found that amount of Thiamine (vitamin B1) in rattan shoots in brine solution was reduced. This may be due to the heat during boiling process during which some were dissolved. Therefore, dried shoots may keep more nutritive value than the boiled ones in solution.

Q : Dried rattan shoot has potential to be an interesting product, the project should promote dried rattan shoot as a pilot product?

A : Actually, dried rattan shoot is not the aim of project from the start. It is just an effective utilization, and the tiny remains can also be processed and used for making tea.

Q : There are recommendations from the floor on various issues the project should consider and try to find the right answer. These recommendations are as follows.

1. Ecological structure; such as vegetation, composition and supporting species. Some fungi may grow within rattan clump and absorb useful chemical substances from rattan. These issues need to be studied.
2. Some local wisdom should be investigated especially the way of how to consume rattan shoot. It has been noticed that local people always use leaves of particular plant, *e.g.* Ya Nang known as medicinal plants, to cook with rattan shoots and make the dish more tasteful. It has also been known that young shoot is less bitter.
3. Knowledge on how to use rattan for medicinal purposes, such as boiled shoot is used to relieve fever in children, and boiled sucker to cure articulatory disease.

4. Study on growth of various rattan as plantation should be included.
5. Fumigating or coating the cut surface of rattan cane with oil color will help protect deterioration from pest and disease.

A : Project will take a serious concern to conduct the research on such topics.

Q : What is the reason for clear cutting of old rattan clumps and burning all debris. Why don't we use tractor for ploughing and cover debris with earth to make fertilizer?

A : Wai Dong (*Calamus viminalis*) over 10 years old has nature of growing laterally and the clump expands resulting in being more difficult to manage especially when grow in narrow spacing. Clear cut and burn seems to be more practical and causes no harm to the rattan clump while the new shoots can sprout well. Moreover, using tractor for ploughing in rattan plantation will face the problem from rattan spine that always flattens the tires. It was also found that fire is a good inducing agent for new shoot sprouting. Making fertilizer from rattan debris is also an interesting issue that should be taken into consideration.

Q: Which rattan species should be promoted to the farmers in southern region, for cane utilizing in particular?

A: At the age of 13 – 15 years, *C. latifolius* produces higher yield than *C. longisetus*. Therefore, *C. latifolius* should be the species for plantation in southern Thailand. However, the planting site should be carefully selected since this species requires optimal light intensity. *C. caesius* is most suitable to be planted in rubber plantation. At present, economic information on these rattan species is not much available.

Q: Is Wai Dong shoot growing under the shade of the tree edible?

A: Yes, but the edible part may be less than that growing under direct sunlight, as the rattan under the shade will increase more in length than in diameter.

Q: Wai Horm, called by local people, is one of the potential rattan species. What genus it belongs to and how can we plant this species?

A: Wai Horm has been imported from Myanmar. This rattan species is very good for neat and fined weaving products. In Thailand, similar species is found at Khao Sok, Surathani province. Leaf sheath of this species provides good smell when wounded. There has been an attempted to collect the seeds of this species but scarcely successful. The species has been classified as *Calamus pandanosmus*, but it may be other species. *C. pandanosmus* is not native to Myanmar. For the time being, information about planting technique of this species is not available.

Q: Due to the shortage of rattan canes within the country, why don't we import more from our neighboring countries?

A: It is not a proper way to solve the problems of the shortage of raw material by importing as we may face different kinds of problems and limitation from the policy of exporting countries. Thus, it is more appropriate to promote rattan plantation establishment for sustainable use of rattan resource.

CONCLUSION OF THE CONFERENCE

CONCLUSIONS OF THE CONFERENCE

1) The 3-day conference on Plantation Management and Utilization of Rattan, held at Best Western Fortune Hotel, Bangkok during 10-12 May 2004, jointly organized by Royal Forest Department (RFD), National Park Wildlife and Plant Conservation Department (DNP) and International Tropical Timber organization (ITTO). There were 70 participants from Royal Forest Department, National Park, Wildlife and Plant Conservation Department, Universities, government and private sectors and non-government organizations.

2) The conference reached the goal with fruitful outcomes as expected. The contents that have been set up and well prepared did cover all the knowledge related to rattan plantation management and utilization. Invited lecturers and an Indonesian expert presented their useful knowledge and experience to all participants. Finally, most of the challenges and obstacles have been addressed and future development was set up. The issues discussed were summarized in working group reports and frequently asked questions.

RECOMMENDATIONS

1) There should be more study on management and maintenance of rattan resource.

2) Promotion on rattan planting and sustainable utilization should include the activities in public area and the national forest such as old plantations, degraded forests, community forest with the support of ITTO, Royal Forest Department, Forestry Industrial Organization, and Department of Agricultural Extension.

3) Push forth the policy of related organizations on the increase of plantation areas, seed source areas, and knowledge dissemination.

4) Rattan species for the plantation

- Large : *Calamus manan, C. blumei, C. peregrinus, C. latifolius, C. rudentum.*
- Small cane: *Calamus caesius, C. pandanosmus, C. myrianthus,* Wai Ka Nun, Wai Sanim. *Daenomorops sabut* and *C. palustris, C. rudentum,* Wai Sai Kai, *C. javensis* and Wai Kao.
- Edible shoot: *Calamus viminalis, C. siamensis* and *C. tenuis*

5) Further studies should include processing and packaging such as rattan shoots and rattan curry in bottle, tea from dried rattan shoot, dye from rattan seed for ice cream and jam, chemical components of rattan shoot for medicinal purposes and combination of rattan shoots and other vegetables.

6) Workshop/conference to exchange knowledge and experience should regularly be organized.

CLOSING REPORT

Pannee Denrungruang

Project Leader

Director of Forest Economics and Forest Products Research Office,
Project Consultants, Participants and Distinguish Guests

On behalf of the organizing committee and all participants of the National Conference on Plantation Management and Utilization of Rattan in Thailand, I would like to thank the acting Deputy Director General of the Royal Forest Department, Mr. Piroaj Punpugdee, for his presence as a chairman of the closing ceremony.

The conference was held for three days at Best Western Fortune Hotel during 10-12 May 2004. There are 70 participants from Royal Forest Department, National Park, Wildlife and Plant Conservation Department, universities, government sectors, private sectors and non-government organizations under ITTO supported.

This conference includes the special lectures by invited Indonesian expert and 5 scientists in the fields of rattan plantation management, utilization, marketing, law and regulations. The project staff also present the results from their studies.

A 1-day excursion was arranged to visit Rattan Raw Material Factory and Rattan Products Company. Participants were also divided into 3 groups for discussion according to there interest, *i.e.*, Rattan Plantation and Management, Rattan Utilization, and Marketing. The results of the conference will be submitted to the Royal Forest Department for further actions.

I would like to say that this conference is very successful and fruitful. Many useful recommendations and suggestions from the participants will be very useful for further development of rattan resources in Thailand.

At this moment, I would like to invite Mr. Piroaj Punpugdee, Acting Deputy Director General of the Royal Forest Department to deliver a closing speech for the National Conference on Plantation Management and Utilization of Rattan in Thailand.

CLOSING REMARK

Piroaj Punpugdee

Director of Forest Economics and Forest Products Research Office

Project Leader, Participants and Distinguish Guests

It is a great honor for me to chair the closing ceremony of National Conference on Plantation Management and Utilization of Rattan. Prior to the closing, I would like to give special thanks to all delegates and lecturers for your useful recommendations for further improvement on sustainable management and utilization of rattan.

Especially the lecturers and our invited guest from Indonesia who shared their experiences and comments to solve the problems of planting, management, utilization and marketing of rattan and rattan products that have been raised during the conference.

From my observation, the success of this conference come from the effective collaboration among various organizations, both government and private sectors. I do hope that all solutions and recommendations from this conference will be useful for sustainable development of rattan.

I would like to thank the International Tropical Timber Organization for the financial support and Thai Duean Pen Co. Ltd., Chai Vivat Company, and Bang Sai Art and Craft Centre for kind arrangements for our field trips. Finally, special thanks are given to the organizing committee and staff who make this conference successful.

I would like to take this opportunity to wish you all the happiness and progress in your life and a safe and sound journey.

May I now declare the Conference on Plantation Management and Utilization of Rattan close.

LIST OF PARTICIPANTS

A

Adisak Poin	Viriyasak Industry Co., Ltd., 35 Moo 9, Nongtakya, Tamung district, Kanchanaburi Tel. 0-3464-4301
Apidet Teowsirisup	Reforestation and Extention Center 2 Udon Thani Muang district, Udon Thani Tel. 0-1471-0400 Fax. 0-4234-2001
Apinya Jarernpipatsiri	Chai Wiwat Co, Ltd. Rattan Products Company, 55/1 Angkaew, Phothong district, Angthong Tel. 0-3569-1701, Fax. 0-3569-1701

B

Boonchai Temsutilap	Satu Pradit Rattan Raw Materials Co. Ltd., 40/45-46. Chalermprakiet 30, Sukhumvit 103, Pravet district, Bangkok Tel. 0-2726-2137-8 Fax. 0-2726-2139
Boonserm Ampun	Moo 15, Klangdong, Pagchong district, Nakhon Ratchasima province Tel. 0-4436-1128, Fax. 0-4436-1128
Boonyong Kethet	Mahasarakham University, Mahasarakham Tel. 0-1872-7400 Fax. 0-4375-4361
Bopit Kietvuttinon	Silviculture and Botanical Division, National Park, Wildlife and Plant Conservation Department, Bangkok Tel. 0-2561-4292-3 ext 408, 409, Fax. 0-2579-9576
Bunpen Nuanchawee	Cooperative Plantation Lopburi, 10, Silathip, Chaibadan district, Lopburi Tel. 0-3642-6652, 0-6012-1940

C

Chaiya Klaiklung	Khon Kaen Provincial Forest Office, 255/4 Soonratchakarn road, Nai-Muang, Muang district, Khon Kaen Tel. 0-4323-7971, Fax: 0-4323-7279
Chawalit Supasarn	Chiang Mai Provincial Forest Office, Chareonprated road, Changklan, Muang district, Chiang Mai Tel. 0-5327-5265, Fax. 0-5327-5265
Chinnaworn Chotitawornrut	The 8th Industrial Promotion Regional Centre, Suphanburi province, 117, Moo 1, Malaiman road, Donkamyan, Muang district, Supanburi Tel. 0-3555-5644, 0-3554-5517 Fax. 0-3555-5522
Choojit Anantachoke	Forest Economics and Forest Products Research Office, Royal Forest Department, Bangkok Tel. 0-2561-4292-3 ext 861, 476 Fax. 0-2579-5412
Chuan Teerawutudom	Conservation and Management Office
Chudchawan Sutthisrisilapa	Silviculture and Botanical Division, National Park, Wildlife and Plant Conservation Department, Bangkok Tel. 0-2561-4292-3 ext 408, Fax. 0-2579-9576

D

Duangjai Sookchaloem	Forest Biology, Faculty of Forestry, Kasetsart University, Bangkok Tel. 0-2579-0176 ext 518, Fax. 0-2942-8107

J

Janya Jarernrattawong	National Park, Wild life and Plant Conservation Department, Bangkok Tel. 0-2561-4292-3 ext 442, Fax. 0-2579-9576
Jedsada Punsata	Phrae Provincial Forest Office, 140 Yantrakitkosol road, Pamaek, Muang Phrae district, Phrae Tel. 0-5451-1637, Fax. 0-5451-1637

K

Kamphon Witisitti	The 8th Industrial Promotion Regional Centre, Suphanburi province, 117, Moo 1, Malaiman road, Donkamyan, Muang district, Supanburi Tel. 0-3555-5644, 0-3554-5517 Fax. 0-3555-5522
Kanokwan Pettrikaew	112 Moo 7 Kaemaon, Jombuang district, Ratchaburi Tel. 0-9085-3295
Kiti Kungsadal	Narathiwat Provincial Forest Office, Prachasongkrau, Muang district, Narathiwat Tel. 0-7351-1554, Fax. 0-7351-3311
Komsak Soparat	Nan Provincial Forest Office, 92 Mahavong road, Nai-vieng, Muang district, Nan Tel. 0-5471-0136, Fax. 0-5471-0136
Komsun Ruangritsarakul	Kanchanaburi Provincial Forest Office, Muang district, Kanchanaburi Tel. 0-3451-1566 Fax. 0-3451-4415

N

Narumol Rattanakonpun	Faculty of Science, Kasetsart University, Ladyao, Chatuchak, Bangkok Tel. 0-1343-5687

Nipat Sivatintugo	Department of Agricultural Extension, Phaholyothin road, Chatuchak, Bangkok Tel. 0-2940-6116
Nipol Chaisalee	Phetchaburi Provincial Forest Office, 87, Moo 1, Raisom, Muang district, Phetchaburi Tel. 0-3242-5028 Fax. 0-3242-5028
Nuntana Boonyanun	Kanchanaburi Provincial Forest Office, Muang district, Kanchanaburi Tel. 0-3451-1566 Fax. 0-3451-4415
Nuntana Chongchaited	Nutrition Division, Department of Health, Tivanond road, Muang district, Nontaburi province. Tel. 0-2968-7618-19

P

Piroj Wannakul	Yasothorn Forest Nursery Office, Kuthung, Muang district, Yasothorn Tel. 0-4573-7354 , Fax. 0-4572-4351
Piyawadee Bauchongkol	Forest Economics and Forest Products Research Office, Royal Forest Department, Bangkok Tel. 0-2561-4292-3 ext 484, Fax. 0-2579-5412
Prakid Pathomsirikul	Kon Kaen Provincial Forest Office, 255/4 Soonratchakarn Street, Nai-Muang, Muang district, Khon Kaen Tel. 0-4323-7971, Fax: 0-4323-7279
Prapasiri Pongprayoon	Faculty of Science, Kasetsart University, Ladyao, Chatuchak, Bangkok Tel. 0-9456-3423
Preeyanuch Charernvipatsiri	Chai Wiwat Co, Ltd. Rattan Products Company, 55/1 Angkaew, Phothong district, Angthong Tel. 0-3569-1701, Fax. 0-3569-1701

R

Rasri Polrachom	34 Moo 4, Bann- Nakam, Huayang, Muang district, Sakon Nakhon Tel. 0-4274-7327

Rattana Silpasuppakornwong	Bangkok
Renoo Suwannarat	Forest Economics and Forest Products Research Office, Royal Forest Department, Bangkok Tel. 0-2561-4841, Fax. 0-2561-4841

S

Samai Sripakdee	Moo 15, Klangdong, Pagchong district, Nakhon Ratchasima province Tel. 0-4436-1128, Fax. 0-4436-1128
Somboon Boonyern	National Park, Wild life and Plant Conservation Department, Bangkok
Somchai Ratchatrakoon	Kraidec Co. Ltd., Bangkok Tel. 0-1345-7749
Somdet Champee	Reforestation and Extention Center 2 Udon Thani province, Muang district, Udon Thani Tel. 0-1574-2021 Fax. 0-4234-2002
Somjai Srimongkontip	RECOFTC, Kasetsart University, Ladyao, Chatuchak, Bangkok Tel. 0-2940-5700 ext. 1231 Fax. 0-2561-4880
Somkuan Switachart	4/270 Sereethai, Buengkum district, Bangkok Tel. 0-2379-7757
Surapong Anuchon	Sakon Nakhon Provincial Forest Office, 1603, Mallalai road, Muang district, Sakon Nakhon Tel. 0-4271-1460 Fax. 0-4273-3148
Surasak Lorjitsieng	Bureau of Community Forest Management, Royal Forest Department, Bangkok Tel. 0-2579-5416, Fax. 0-2579-5416

T

Tasanee Pattanaseree	Forest Economics and Forest Products Research Office, Royal Forest Department, Bangkok Tel. 0-2561-4292-3 ext 476, Fax. 0-2579-5412

Tawat Jirayut	Forest Economics and Forest Products Research Office, Royal Forest Department, Bangkok Tel. 0-2561-4292-3 ext 897, Fax. 0-2940-6285
Thanapong Pothitan	Reforestation Office, Royal Forest Department, Bangkok Tel. 0-2579-7725, Fax. 0-2579-9595
Thirdpong Supaperm	Forest Nursery Group, Royal Forest Department, Bangkok Tel. 0-2561-4841 , Fax. 0-2561-4841
Thongkum Chaiyes	114 Moo 7 Kaemaon, Jombuang district, Ratchaburi Tel. 0-9085-3295

U

Udom Tareechit	Pracuab Khiri Khan Provincial Forest Office, 18 Tedsabanbamrung road, Muang district, Pracuab Khiri Khan Tel. 0-3261-1275 Fax. 0-3260-2496

V

Vallayuth Fueangvivat	Forest Economics and Forest Products Research Office, Royal Forest Department, Bangkok Tel. 0-2561-4292-3 ext 484, Fax. 0-2579-5412
Vieng Vareenin	The 8th Industrial Promotion Regional Centre, Suphanburi province, 117, Moo 1, Malaiman road, Donkamyan, Muang district, Supanburi Tel. 0-3555-5644, 0-3554-5517 Fax. 0-3555-5522
Vitchanee Boonyapatipark	Forest Economics and Forest Products Research Office, Royal Forest Department, Bangkok Tel. 0-2579-5411, Fax. 0-2579-5411
Vudhikorn Khumcharoen	Reforestation Office, Royal Forest Department, Bangkok Tel. 0-2579-7725, Fax. 0-2579-5588

W

Warawut Suwannarat	Moo 15, Klangdong, Pagchong district, Nakhon Ratchasima province Tel. 0-4436-1128, Fax. 0-4436-1128
Watcharakorn Punchon	Bangsai Arts and Crafts Centre of Her Majesty Queen Sirikit of Thailand (the Centre), Chang-Yai, Bangsai district, Ayutthaya Tel. 0-3536-6252-3, 0-7112-6732 Fax. 0-3536-6092
Wattana Prompraison	34 Moo 4, Bann- Nakam, Huayang, Muang district, Sakon Nakhon Province Tel. 0-4274-7327
Wilawan Wichiennopparat	Silviculture and Botanical Division, National Park, Wildlife and Plant Conservation Department, Bangkok Tel. 0-2561-4292-3 ext 442, Fax. 0-2536-8110

ANNEX

10 May 2004

OPENING CEREMONY

11 May 2004

EXCURSION

12 May 2004





PRESENTATION AND GROUP DISCUSSION

PD 24/00 Rev.1 (I)
Promotion of Sustainable Utilization of Rattan from Plantations in Thailand

Forest Management and Forest Products Research Office
Royal Forest Department

Supported by
International Tropical Timber Organization - ITTO

Royal Forest Department
61 Phaholyothin Rd., Ladyao, Chatuchak, Bangkok 10900 THAILAND
Tel. (66)2-579-9177