UNIVERSITI PUTRA MALAYSIA

SOME ASPECTS OF INTERCROPPING RATIAN (CALAMUS MANAN MIQ.) WITH RUBBER (HEVEA BRASILIENSIS WILLD.) IN MALAYSIA

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FH 2000 16

SOME ASPECTS OF INTERCROPPING RATTAN (*CALAMUS MANAN* MIQ.) WITH RUBBER (*HEVEA BRASILIENSIS* WILLD.) IN MALAYSIA

By

WIN MYINT

Thesis Submitted in Fulfilment of the Requirement for the Degree of
Master of Science in the Faculty of Forestry
Universiti Putra Malaysia

December 2000

TO BELOVED MY PARENTS AND TEACHERS

Abstract of thesis submitted to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

SOME ASPECTS OF INTERCROPPING RATTAN (*CALAMUS MANAN* MIQ.) WITH RUBBER (*HEVEA BRASILIENSIS* WILLD.) IN MALAYSIA

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December 2000

Chairman: **Professor Dato' Nik Muhamad bin Nik Ab. Majid, Ph.D**

Faculty: **Forestry**

Intercropping rattan with mature rubber trees is a new agroforestry system. This study was carried out in a 10-year old rattan plantation that had been intercropped with rubber when the rubber trees were 6-years old. This study focused on the aspects of soil conservation, growth of rattan and rubber, and economic viability. The study comprises of four experiments and economic analysis.

The first experiment assessed the effects of rattan planting on some selected soil properties. The results showed no significant adverse effects but improvement in bulk density, moisture content, soil acidity (pH) and cation exchange capacity (CEC). In addition, there was a significant increase in total phosphorous (P), magnesium (Mg) and sodium (Na).

The second experiment on foliar analysis revealed that there was no significant negative effect on foliar nutrients of rubber due to intercropping. Besides,

the nutrient concentrations in rattan leaves were not significantly different from than that of rubber. The third experiment also demonstrated no significant effect on growth of rubber trees in terms of diameter breast height (dbh) and height of main trunk due to intercropping.

The fourth experiment recorded the growth rate of rattan by 2.4 meter per year. The experiment also showed that; (i) rattan prefers better drainage for diameter growth, (ii) light significantly produce greater stem length. Besides, an observation of hanging ability of rattan plant found that 19.2 percent of the plants was completely crawling on the ground, and 24.4 percent and 56.4 percent were able to hang more than half and less than half of their lengths onto rubber trees, respectively.

The economic analysis indicated that growing *C. manan* in a 6-year old rubber and harvesting 10 years later is economically viable, giving an IRR, NPV and B/C Ratio of 34.85 percent, RM 8,737 and 4.99, respectively. On the aspect of financial evaluation the results showed the financially feasibility of intercropping rattan producing IRR, NPV, and B/C Ratio of 23.52 percent, RM 3,406 and 2.28, respectively. The sensitivity analysis showed that the project is more sensitive to changes in price of rattan than changes in cost of rattan planting. The harvesting age at 10-years old is the best option among the 12, 15 and 19-year options, giving the highest economic return. An economic analysis on the intercropping of rattan for sustainable production indicated economic viability achieving IRR, NPV and B/C Ratio of 34.85 percent, RM 88,046 and 4.99, respectively.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains.

ASPEK-ASPEK TANAMAN BERSEPADU ROTAN (*CALAMUS MANAN* MIQ.) DI DALAM LADANG GETAH (*HEVEA BRASILIENSIS* WILLD.) DI MALAYSIA

Oleh

WIN MYINT

Disember 2000

Pengerusi: **Profesor Dato' Nik Muhamad bin Nik Ab. Majid, Ph.D**

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Tanaman bersepadu antara rotan dengan getah matang adalah satu sistem yang baru. Kajian ini telah dijalankan di ladang rotan yang berumur 10 tahun yang mana pokok getah telah ditanam bersama ketika berusia 6 tahun. Kajian ini tertumpu kepada pemeliharaan tanah, tumbesaran rotan dan getah serta pulangan dari segi ekonomi. Kajian ini menggabungkan 4 eksperimen dan analisa ekonomi.

Eksperimen pertama menunjukkan kesan tanaman rotan di kawasan yang di pilih dari segi ciri-ciri tanah. Keputusan menunjukkan kesan yang tidak ketara tetapi ia berupaya dalam pemulihan ruang rongga, kandungan kelembapan, keasidan tanah (pH), dan kapasiti pertukaran kation (CEC). Di samping itu, terdapat juga peningkatan dalam jumlah Fosporus (P), Magnesium (Mg) dan Natrium (Na) yang ketara.

Eksperimen kedua mengenai analisa daun memperlihatkan bahawa tiada kesan negatif yang ketara terhadap nutrient daun pada pokok getah disebabkan oleh tanaman bersepadu. Di samping itu, paras nutrient daun rotan adalah menunjukkan perbezaan tidak bererti berbanding getah. Eksperimen ketiga juga membuktikan kesan tidak ketara pada pertumbuhan pokok getah pada ukuran diameter paras dada (dbh) dan tinggi batang utama disebabkan oleh tanaman bersepadu.

Eksperimen keempat merekodkan kadar tumbesaran rotan adalah 2.4 meter per tahun. Kajian membuktikan bahawa; (i) secara ketara rotan memerlukan pengairan yang lebih baik bagi pertumbuhan diameter, (ii) kurang persaingan dalam mendapatkan cahaya adalah penting bagi pembesaran dari segi panjang batang. Disamping itu, suatu kajian mengenai kemampuan menggantung daripada tanaman rotan mendapati bahawa 19.2 peratus daripada tanaman menjalar di atas tanah sepenuhnya, 24.4 peratus dan 56.4 peratus dapat menggantung kepada pokok getah masing-masing lebih daripada selengah dan kurang daripada selengah dari panjangnya.

Akhir sekali, analisa ekonomi menunjukkan bahawa pertumbuhan *C. manan* ketika getah berumur 6 tahun dan penuaian 10 tahun kemudian adalah lebih ekonomik, memberi IRR, NPV dan nisbah B/C masing-masing 34.85 peratus, RM 8,737, dan 4.99. Project adalah baik dalam aspek keuangan memberi IRR, NPV dan nisbah B/C masing-masing 23.52 peratus, RM 3,406 dan 2.28. Projek ini lebih sensitif kepada perubahan harga rotan berbanding perubahan kos penanaman rotan. Penuaian pada umur 10 tahun adalah pilihan terbaik yang memberikan pulangan

ekonomi yang tinggi. Analisa ekonomi terhadap tanaman bersepadu rotan untuk penghasilan berkekalan menunjukkan keupayaan ekonomi mencapai IRR, NPV dan nisbah B/C masing-masing pada 34.85 peratus, RM 88,046 dan 4.99.

ACKNOWLEDGEMENTS

First and foremost I would like to express my sincere and deepest thanks to Professor Dato' Dr. Nik Muhamad bin Nik Ab. Majid, the Chairman of my supervisory committee, for his invaluable guidance, suggestions and encouragement throughout the duration of my study. I also thank my supervisory committee members, Associate Professor Mohd Zin Jusoh, Dr. Khamurudin bin Mohd Noor and Dr. Awang Noor Abd. Ghani for their invaluable suggestions and comments on my thesis.

I am greatly indebted to the Malaysian Government and the Director-General of the Public Service Department, for granting me the scholarship under the Malaysian Technical Co-operation Program (MTCP).

My grateful acknowledgement is due to the Minister for the Ministry of Forestry, and the Director-General of the Forest Department, Myanmar for approving my study leave in Malaysia.

I wish to express my sincere thanks to my teachers, Retired Director U Mehn Ko Ko Gyi and Deputy Director U Saw El Dah, the former Principal of the Central Forestry Development Training Centre (CFDTC) for their encouragement to pursue this study.

I also acknowledge the permission by the Rubber Industry and Smallholders Development Authority (RISDA) to use the rubber estate at Bukit Ibol, Dengkil, Selangor for the experiments. My thanks are also due to Assoc. Prof. Dr. Ghizan, Salleh, Faculty of Agriculture and Dr. Awang Noor Abd. Ghani, Faculty of Forestry, Universiti Putra Malaysia for their lectures on Advanced Statistical Methods and ~~the~~ Economic Evaluation of Forestry Projects, respectively. My sincere appreciation goes to the Dean, all lecturers and staff of the Faculty of Forestry, Universiti Putra Malaysia for their help during the study period. Thanks are also extended to Dr. Mohamad Azani Alias and Mr. Muzammal Johan for their assistance during data collection and laboratory work.

Finally, my heartfelt thanks and love are extended to my parents U Pe Maung and Daw Khin Po, my wife Daw Khin Thet Wai, my son Mg Myo Zarni Myint and my daughter Ma Ei Myatno Khin, who are my source of inspiration, for their love, sacrifice, patience and continuous moral support during the entire study period.

I certify that an Examination Committee met on 8th December 2000 to conduct the final examination of Win Myint on his Master Science thesis entitled "Some Aspects of Intercropping Rattan (*Calamus manan* Miq.) with Rubber (*Hevea brasiliensis* Willd.) in Malaysia" in accordance with Universiti Putra Malaysia (Higher Degree) Act 1980 and Universiti Putra Malaysia (Higher Degree) Regulations 1981. The committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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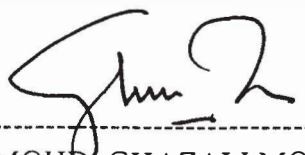

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

(WIN MYINT)

Date: ٢٠١٢٥٩

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LIST OF ABBREVIATIONS

B/C	Benefit Cost Ratio
BARI	Bangladesh Agricultural Research Institute
FAO	Food and Agriculture Organization
FRIM	Forest Research Institute Malaysia
ICRAF	International Centre of Research in Agroforestry
IDRC	International Development Research Centre, Canada
INB	Incremental Net benefit
IRR	Internal Rate of Return
ITTO	International Tropical Timber Organization
NPV	Net Present Value
RAPA	Regional Office for Asia and the Pacific
RIC	Rattan Information Centre
RISDA	Rubber Industry Smallholders Development Authority
RRIM	Rubber Research Institute Malaysia
SAFODA	Sabah Forestry Development Authority
SIDA	Swedish International Development Agency
USAID	United States Agency for International Development

CHAPTER I

INTRODUCTION

Furniture manufactured from rubber wood and rattan has gained in popularity during the past decade or so. Rubber wood is by-product of rubber plantation after latex extraction period and rattan is the stem of a spiny climbing palm naturally grown in tropical rain forests. In the past, rubber trees were recognized as merely an agricultural crop and rattans were regarded as a minor forest product. Nowadays, they are popular alternatives for some traditional timber products; rubber wood as one of the major timber resources and rattan has become one of the most attractive materials in furniture production.

Rubber tree in Malaysia originated from the Amazon forest of Brazil, South America and it was introduced to Malaysia during the late nineteenth century (Hong, 1995). It was initially planted in arboretum for display and later in plantation to extract latex for commercial purpose. The Southeast Asian region is now the largest source of natural rubber in the world. The area under rubber plantations in the world has been estimated at 9 million hectares, and 80 percent of which are in southeast Asia (Albaladejo, 1997). The four major natural rubber producing countries are Indonesia, Malaysia, Thailand, Nigeria.

The rubber industry has played an important role in the socio-economic development of Malaysia. The total area under rubber plantation in Malaysia was

1.5 million hectares in 1999 and of which about 80 percent were found in Peninsular Malaysia. In 1999, the total production of natural rubber was 0.77 million tones and the export value of rubber products was RM 6.02 billion (Malaysia Rubber Board, 2000). Besides, the rubber industry has succeeded in new dimension of rubber wood utilization during the last decade.

The global market of rubber wood today is in excess of US$ 1 billion and the potential is increasing and untapped (Albaladejo, 1997). According to the RRIM annual report, the export value of rubber wood furniture from Malaysia increased rapidly each year from a mere RM 4.5 million in 1980 to RM 1.92 billion in 1997 (RRIM, 1997).

In terms of social aspect, the rubber industry also creates jobs and a source of living for the local people. Out of 1.5 million hectares of rubber plantations in Peninsular Malaysia, about 80 percent representing 1.2 million hectares, are smallholdings owned by about 500,000 households and the rest are owned by the commercial estate sector. The size of smallholdings varies from 0.5 to 5 hectares. A total of half a million people work in the rubber smallholdings and 116,000 workers are employed in the rubber estates. These figures represent 45.5 percent of total employment in the agricultural sector.

The rubber industry however, has faced some difficult times. For example, the declining rubber price during the 1980s had discouraged rubber cultivators and some had converted the rubber plantations into oil palm plantations. Coupled with

the rapid development in the industrial sector, labor shortage has also contributed to the decrease in the rubber planting area. This has resulted in uncertainty of rubber wood supply for the increasing rubber wood-based industries.

In fact, rubber cultivation as an integrated system still has much potential in socio-economic development of the country. All rubber wood used by the industries come from rubber plantations planted for latex production. Therefore, rubber wood is considered as a secondary product of rubber plantations and it has been a bonus to plantation owners. In the normal planting density, rubber trees occupy only 25 percent of the total land area in a rubber plantation (Wan Mohamad and Abraham, 1976). The remaining 75 percent could be integrated with agroforestry practice in order to maximize land productivity and to enable rubber smallholders to earn additional income. It is common that inter-planting of some cash crops in rubber plantations in the initial stage of up to 2 or 3 years old, but there is no more inter-planting when the rubber trees are matured.

The word 'rattan' originated from the Malay word 'rotan' meaning the stem of a climbing palm (Abd. Rauf, 1982). Rattans are spiny climbing plants belonging to the subfamily *Calamoidae* of the palm family, *Palmae*. The number of species recorded in the world is 600 belonging to 13 genera (Uhl and Dransfield, 1987). Its natural habitat is the tropical forest across Asia, Southeast Asia and Central and West Africa (Albaladejo, 1997). Rattan has been traditionally utilized by the rural people in making furniture, weaving materials and many varieties of items for their home and farm uses. Thus rattan is closely related to rural civilization and of

sociological importance. However, global trade of rattan and rattan products, furniture in particular, has increased in the last two decades or so. Annual global trade value dramatically increased from US $ 1.2 billion in 1987 (PERKASA, 1987) to US $ 6.5 billion in 1997 (Prebble, 1997).

This trade boom has had diverse impacts on the socio-economic of the local people of producing countries and on rattan resources and its species diversity as well. Coupled with expanding rattan industry, heavy exploitation of raw rattan to meet the demand has led to the depletion of the natural resource and nearly an extinction of some of the rattan species. Consequently, it led to serious shortage of rattan and also affected the half million people engaged in rattan collection, processing and manufacturing in Southeast Asia (Aminuddin, 1992). With the awareness of this threat, rattan producing countries such as Indonesia, Malaysia, Philippines and Thailand took measures to ban the export of the raw rattan in order to encourage downstream processing (Aminuddin and Nur Supardi, 1991).

Peninsular Malaysia alone is reported to have 107 species of rattan belonging to 8 genera. Of these about 20 species are being used commercially by the rattan industry (Aminuddin, 1990). The most sought-after species is the large diameter (>18 mm) cane, "rotan manau" (*Calamus manan*) which is commonly used in the furniture industry. The other commercially important small diameter (>18 mm) cane is "rotan sega" (*Calamus caesius*). *C. manan* naturally grows mainly in Peninsular Malaysia, Sumatra and Kalimantan in Indonesia (Aminuddin and Nur Supardi, 1991).