UNIVERSITI PUTRA MALAYSIA

TREE GROWTH AND FINANCIAL EVALUATION OF AGROFORESTRY SYSTEM IN KAMPUNG TEBUK PULAI, SABAK BERNAM, SELANGOR

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By

JULSUN @ JOSEPH SIKUI

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

March 2005

Specially Dedicated To My Late Mother, Angela Jingkiep Lojimoh

You Gave Me Life
Gave Me Your Heart
And Your Shoulder
When I Needed To Cry

You Gave Me Hope
When All My Hope Is Gone
Wings So My Dreams Can Fly

And I Haven't Told You Enough
Haven't Been Good Enough
Making You See.....

My Love For You
Will Live In My Heart
Until Eternity's Through

I See Your Smile
In The Eyes Of My Child
I Am Who I Am
Mama Thanks To You

You Gave Me Your Word
Gave Me Your Voice
You Gave Me Everything

Each Breath Of My Life
You Believe, When I Can't Remember How
You Teach My Faith To Survive

And I Never Can Do Enough
Never Thank You Enough
For All That You Are

I Know The Treasure
I'm Filled With Grace
Whenever I See Your Face

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

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March 2005

Chairman: Professor Dato' Nik Muhamad Nik Abd. Majid, PhD

Faculty: Forestry

A study was conducted at Kg. Tebuk Pulai, Sabak Bernam, Selangor to assess the growth performance and financial aspects, evaluate the financial component and also to determine the optimum combination of agroforestry system practised by the farmers. There are three farms involved in the study with the holding size of two hectares each. The farms were planted with teak trees as the major component and practised different types of agroforestry system. This study involved collection of data on growth of teak and Tongkat Ali and other information obtained through informal interviews with the farmers. The results of this study are explained in terms of assessment on growth performance and financial aspects of three different agroforestry systems, evaluation of financial component and also determination of the optimum combination of agroforestry system. In terms of growth performance, the diameter and height growth of teak trees in the three farms are significantly different ($P \leq 0.05$). Trees in Farm C performed the best followed by trees in Farms A and B. Farms A and B had a total of 1122 and 2173 teak trees, respectively and most of the trees are in the diameter class ranging from 12-14cm for both farms. For Farm C, a total of 1651 teak trees were

recorded and most of them occurred in the diameter class range of 14-16cm. The total volume projected in Farms A, B and C is 111.9m^3/ha, 92.2m^3/ha, 120.6m^3/ha with the mean growth of 17.4m, 16.4m and 20.0m, respectively. Similarly, the basal diameter and height of Tongkat Ali seedlings in Farm C were significantly higher ($P \leq 0.05$) than those in Farm B. Farms B and C had 1522 and 1976 Tongkat Ali seedlings, respectively. Most of the seedlings in Farm B are in the basal diameter class range of 1.1-2.0cm with a total of 276.80kg of root weight and in Farm C most of the seedlings are in the basal diameter class range of 3.1-4.0cm with a root weight of 783.20kg. The project financial appraisal as "Type B With Project Approach" of Farm C was projected as the most economically viable project among the three farms giving the highest return to the farmer. The agroforestry system introduced under agrosilvopastoral in this farm (Scenario III) shows the IRR, NPV and B/C Ratio of 34.5%, RM150,100.91 and 1.12, respectively. If the project implemented as "Without Project Approach" and "Type A With Project Approach", Farm C is still the most economically viable project. Although, the project implemented in Farms A and B offers another option, they are still considered economically viable to be implemented as the results are acceptable for project analysis requirement. Under Scenario I, Farm A shows the IRR, NPV and B/C Ratio of 19.9%, RM27,648.05 and 3.08, while Farm B has 23.6%, RM32,469.12 and 4.05, respectively. The farmers of Farms A and B will maximize the return at a 15-year rotation and the value are decreasing with the increases in the number of years.

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

PERTUMBUHAN POKOK DAN PENAKSIRAN KEWANGAN SISTEM PERHUTANANTANI DI KAMPUNG TEBUK PULAI SABAK BERNAM, SELANGOR

Oleh

JULSUN @ JOSEPH SIKUI

Mac 2005

Pengerusi: Prof. Dato' Nik Muhamad Nik Abd. Majid, PhD

Fakulti: Perhutanan

Satu kajian telah dijalankan keatas tiga kawasan ladang petani di Kg. Tebuk Pulai, Sabak Bernam, Selangor untuk menilai tahap pertumbuhan dan aspek kewangan, taksiran keatas komponen kewangan dan juga penentuan kombinasi sistem perhutanantani yang optimum yang diusahakan oleh petani. Kawasan ladang meliputi dua hektar setiap satu yang ditanam dengan Jati sebagai tanaman utama dan mengamalkan sistem perhutanantani yang berbeza-beza. Kajian ini meliputi pengumpulan data pertumbuhan pokok Jati dan Tongkat Ali, dan juga pengumpulan maklumat secara temuramah tidak rasmi dengan petani yang terlibat dalam kajian. Hasil kajian merangkumi tiga bahagian iaitu penilaian tahap pertumbuhan dan aspek kewangan keatas tiga sistem perhutanantani, penaksiran komponen kewangan dan juga penentuan kombinasi sistem perhutanantani yang optimum. Dari segi tahap pertumbuhan diameter dan ketinggian pokok Jati bagi tiga ladang, ia menunjukkan perbezaan yang ketara ($P \leq 0.05$). Pertumbuhan di Ladang C adalah yang terbaik diikuti dengan Ladang A and B. Ladang A dan B masing-masing mempunyai bilangan 1122 dan 2173 pokok Jati. Kebanyakkan berada dalam

kelas diameter 12-14cm. Bagi Ladang C, sebanyak 1651 bilangan pokok direkodkan dan kebanyakkan berada dalam kelas diameter 14-16cm. Jumlah isipadu unjuran bagi Ladang A, B dan C adalah 111.9m^3/ha, 92.2m^3/ha, 120.6m^3/ha dengan min pertumbuhan 17.4m, 16.4m dan 20.0m. Perbezaan diameter pangkal dan ketinggian anak pokok Tongkat Ali di Ladang C adalah sangat ketara ($P \leq 0.05$) berbanding dengan ladang B. Sebanyak 1522 dan 1976 anak pokok Tongkat Ali direkodkan di Ladang B dan C. Kebanyakkan anak pokok di Ladang B adalah berada dalam kelas diameter pangkal 1.1-2.0cm dengan jumlah berat akar sebanyak 276.80kg dan di Ladang C, kebanyakkan anak pokok berada dalam kelas diameter pangkal 3.1-4.0 dengan jumlah berat akar sebanyak 783.20kg. Taksiran kewangan dengan "Pendekatan Jenis B dengan Projek" menunjukkan Ladang C adalah yang paling menguntungkan petani. Sistem perhutanantani-ternakan yang diperkenalkan di ladang ini (Gambaran III) menunjukkan IRR, NPV dan Nisbah B/C sebanyak 34.5%, RM150,100.91 dan 1.12. Sekiranya projek ini dijalankan dengan "Pendekatan Tanpa Projek" dan "Pendekatan Jenis A dengan Projek", Ladang C masih merupakan projek yang ekonomik. Sungguhpun projek yang diusahakan di Ladang A dan B adalah sebagai alternatif, ianya masih dianggap ekonomik untuk diusahakan kerana memenuhi syarat analisis kewangan projek. Bagi Gambaran I, Ladang A menunjukkan IRR, NPV dan Nisbah B/C sebanyak 19.9%, RM27,648.05 dan 3.08, manakala Ladang B mempunyai 23.6%, RM32,469.12 dan 4.05, masing-masing. Projek perhutanantani yang diusahakan petani diladang A dan B akan dapat memaksimumkan pulangan pada 15 tahun kitaran dan nilai pulangan ini akan susut dengan peningkatan bilangan tahun perlaksanaan.

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LIST OF ABBREVIATIONS

B/C Ratio	Benefit-Cost Ratio
CATIE	Tropical Agricultural Research and Higher Education Center
DBH	Diameter at Breast Height
FDSM	Forestry Department of Sabah
FELCRA	Federal Land Consolidation and Rehabilitation Authority
FELDA	Federal Land Development Authority
FRI	Forest Research Institute
FRIM	Forest Research Institute Malaysia
GDP	Gross Domestic Product
ICRAF	The International Center for Research in Agroforestry
INB	Incremental Net Benefit
IRR	Internal Rate of Return
JPS	Drainage and Irrigation Department
MARDI	Malaysian Agricultural Research and Development Institute
MIRA	Manejo de Información sobre Recursos Arbóreas
MPOB	Malaysia Palm Oil Board
MPTS	Multipurpose Tree Species
NAP3	The Third National Agricultural Policy
NGO	Non-Governmental Organization
NPV	Net Present Value
PBP	Pay Back Period
RISDA	Rubber Industry Smallholder Development Authority
RRIM	Rubber Research Institute Malaysia
SALT	Slopping Agricultural Land Technology

CHAPTER 1

INTRODUCTION

1.1 General Background

Malaysia is one of the most successful developing countries in the world. One of the major contributors to economic development of the country is the agriculture and forestry sectors. These sectors have been the driving force behind the economic growth of the country over the last four decades. It was used to finance the development of the country, which progressively led to the transformation of the economy towards industrialization. In terms of gross domestic product (GDP) in purchaser' values at 1987 prices, for a year 1990, 1998 to 2000, agricultural sector component still one of the major contributor to the country's economic revenues with trend increasing consistently (Table 1.1).

This country is blessed with relatively large tracts of natural forest which is a highly complex ecosystem and is considered as having a very rich biodiversity. This has made the forestry sector one of the top foreign exchange earners for Malaysia, and there is a growing awareness of the vital role forestry is playing in the socio-economic development and environmental protection of the country.

Table 1.1: Gross Domestic Product (RM Million) of Agriculture and Forestry Activity in Purchaser' Values, At 1987 Prices, Malaysia, 1990, 1998 – 2000

Item	1990	1998	1999	2000
Agriculture and Livestock Production	10,579	11,531	12,422	12,226
Forestry and Logging	5,194	3,648	3,237	3,092
Fishing	1,534	2,236	2,335	2,369
GDP in Purchasers' Values	105,977	182,219	192,712	209,365
Agricultural Sector Component	**17,307**	**17,415**	**17,994**	**17,687**
Agricultural Sector Component in Percentage	**16.3**	**9.6**	**9.3**	**8.4**

Source: Department of Statistics, Malaysia, 2000.

Rapid population growth in the country has undoubtedly posed many socio-economic and environmental problems causing unabated need for food, fodder, energy and wood. Thus, there exists an increasing pressure on the two main renewable resources that is forestry and agriculture which are related in many aspects but apparently, incapable of meeting the increasing demand even though there is functional allocation of land for both purposes. Such problems, coupled with urbanization, industrialization and other aspects of socio-economic development, resulted in rapid deforestation leading to serious degradation of the ecosystem and diminution of arable land areas. Moreover, there also exists land use conflict between agriculture and forestry, amidst the need for rural development and growing environmental issues.

Agriculture and forestry sectors are also facing major rural land use challenges, including increasing scarcity of timber products and

environmental degradation on fragile lands. In 2000, the total export value of wood and wood-based products was RM17.6 billion or 4.7 percent of the country's total export value (Anonymous, 2001). Further exploitation of forest land area also contributed to environmental issues such as decreasing in the total number of natural forest lands. Tables 1.2 and 1.3 shows the remaining

Table 1.2: Distribution and Extent of Major Forest Types in Malaysia 2003 (Million ha.)

Region	Land Area	Dipterocarp Forest	Swamp Forest	Mangrove Forest	Plantation Forest	Total Forest Land	Percentage Total of Forest Land
Peninsular Malaysia	13.16	5.40	0.30	0.10	0.08	5.88	44.70
Sabah	7.37	3.83	0.12	0.34	0.11	4.40	59.70
Sarawak	12.30	7.92	1.12	0.14	0.06	9.24	75.10
Malaysia	32.83	17.15	1.54	0.58	0.25	19.52	59.50

Source: Forestry Department Peninsular Malaysia, 2003.

Table 1.3: Permanent Reserved Forest (PRFs) in Malaysia 2003 (Million ha.)

Region	Protection Forest	Production Forest	Total Land Area Under PFE	Percentage of Total Land Area
Peninsular Malaysia	1.52	3.18	4.70	35.70
Sabah	0.59	3.00	3.59	48.70
Sarawak	1.10	5.00	6.10	49.60
Malaysia	3.21	11.18	14.39	43.80

Source: Forestry Department Peninsular Malaysia, 2003.

distribution and extent of major forest types and permanent reserved forest in Malaysia. In order to protect and avoid further exploitation of the remaining forest land, action plan have to be considered to develop better solution for land development strategies.

One of the responses to these problems is the development and promotion of agroforestry practise to be implemented in the country. Agroforestry, which integrates forest management, food crop production and environmental conservation appears to be a promising alternative system of land use. The objective of agroforestry is to maximize land usage and economic return especially to the rural communities (Wan Razali and Abd. Razak, 1987), and reducing shifting cultivation in Permanent Forest Estate (Morningstar and Knight, 1990).

In general, agroforestry as it is being researched and practised today is not new but it is a modification of systems that have been used by farmers for hundreds of years. In Malaysia it has been practised on a trial basis since 1930 and it was only being encouraged since the Fourth Malaysian Plan (1981-1985), due to the realization of the importance of both agriculture and forestry sectors (Nor Aini and Jalil, 1989).