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Financial Analysis for Selected Land Use Options in Malaysian Agroforestry System

Ahmad Fauzi Puasa
Huda Farhana Mohamad Muslim
Najib Lotfy Arshad
Forest Research Institute Malaysia
Kepong, 52109, Selangor
Email: fauzi@frim.gov.my

ABSTRACT

Agroforestry or farm forestry is a production technique that combines agriculture and forestry on the same piece of land to fully utilise the natural resources of sunlight, water and nutrition. This study focuses on developing several agroforestry cropping systems and land use options, and secondly, estimating the costs and benefits of each of the cropping system. Results show that cost depends on the cropping system design. To some extent, soil erosion and carbon-sink were incorporated in the analysis as well. Based on the costs and benefits estimated, the most profitable cropping pattern and land use options were chosen. Agroforestry projects can contribute to the supply of woods as well as food to the country. The success of agroforestry is largely determined by the extent to which individual forest and agricultural components can be integrated to benefit rather than hinder one another. The choice of trees and crop species combinations are important when setting up the system.

Keywords: *farm forestry, investment, income, production cost,*

Introduction

The growing demand for food and woods in the international market are expected to increase due to increasing world population. These will cause

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short supply of foods and woods in the near future. Adopting agroforestry system might be one of the solutions to solve these problems.

Agroforestry is a combination of agriculture and forestry technologies to foster integrated, optimal and sustainable land-use. Agroforestry is a production technique that combines both agriculture and forestry on the same piece of land to fully utilise the resources of sunlight, water and nutrition. In addition, agroforestry land-use system introduces the complication of purposely integrating different tree species with annual crops and/or livestock. The purpose is to get higher productivity, higher economic returns and better social benefits or a sustained basis than the monoculture activity on the same unit of land. King (1987) raised this in tracing history of agroforestry and pointed out that the *taungya* system was developed from the practical need to incorporate annual cropping with the establishment of teak plantation. In a larger scale, agroforestry practices are intentional combination of trees with crops and/or livestock that involves intensive management of the interactions between the components as an integrated agroecosystem. These key characteristics are the essence of agroforestry that distinguish it from other farming or forestry practices.

Despite the fact that agroforestry is an important method of farming to sustain the food and wood supply, the response from farmers in implementing the system has not been encouraging. The main drawbacks are high initial capital, long gestation period, difficulty to secure loan, and difficulties in getting suitable areas. Another problem is inadequate information in this area for the farmers to follow (Gorden & Bentley 1990). These have generated the interest of many scientists to initiate agroforestry research from small to large, complex national and multinational programme such as International Council for Research on Agroforestry (ICRAF) base in Nirobi; the Indian Council for Agriculture Research (ICAR); Multipurpose Tree species Research Network, sponsored by the Forestry and Fuel Wood Research and Development Project (F/FRED).

This paper highlights selected agroforestry systems of which the financial analysis is the main focus. A long gestation period for the forestry and a short gestation period for agriculture crops, when combined, could produce an interesting financial analysis as compared to other farming system. This article is expected to provide useful information for farmers as a guide if they are interested to venture into agroforestry in the Malaysian context.

The Rational of Implementing Agroforestry System

The food bills, as reported by Ministry of International Trade and Industry, show a gap between supply and demand which increases each year. In 1988, the import food bills increased from RM4.6 billion in 1990 to RM10 billion in 1997. Major food types such as rice, vegetables, fruits and beef registered the highest increase. Rice import escalated from 330,000 to 580,000 tones, vegetables from 350,000 to 690,000 tones and beef from 41000 to 71000 tones (Najib Lotfy 1999). This implies that extra measures need to be taken to increase food production. Agroforestry is one of the ways to solve this problem.

Similar problem is encountered in the forestry sector – the supply of timber and timber products have been on the decreasing scale from year to year. Thang (1985) contended that Malaysia was expected to face log supply deficit of by the end of 1995. According to Thang, for the period of 1996 to 2000, the supply was expected to deficit by 1.08 million m^3 and this deficit in log supply had gone up to 2.43 million m^3 for the period 2001 to 2005 and will go up to 3.71 million m^3 for the period 2006 to 2010. The details of log production and domestic demand are shown in Table 1.

Table 1: Projected Supply and Domestics Demand in Peninsular Malaysia 1984 - 2010

Period	Average annual log production (million m^3)	Average annual domestic demand (million m^3)	Average annual supplus (+)/deficit (–) (million m^3)
1984 – 85	5.98	3.00	+ 2.98
1986 – 90	6.72	3.43	+ 3.29
1991 – 95	6.38	4.32	+ 2.06
1996 – 00	4.45	5.53	– 1.08
2001 – 05	4.45	6.88	– 2.43
2006 – 10	4.45	8.16	– 3.71

Source: Thang (1985)

In order to ensure an adequate supply of raw materials for the downstream industries, the Malaysian government has banned the export of logs from Peninsular Malaysia and allows only timber products (processed or semi processed) to be exported. Under the Rio Convention, the country has implemented several strategies, of which, among others, are sustainable forest management, enrichment of degraded forest and the reduction in the annual coupe. These strategies have directly or indirectly reduced the timber logging. The consequence of such change, is the shortage of timber supply for the wood based industry. It has been estimated that from 2010, the shortfall in demand will be around 12.3 million m^3 per year (Abdul Razak et al. 2000). This has caused even more volume of deficit of timber supply as forecast by Thang. As a developing country, we cannot run from tapping on our available resources in order to construct our country. Apart from that, some countries have attributed the loss of forest due to relentless pressure from growing population, land hunger by small farmers, and household demand of wood fuel and forage. Sadly, many accessible forests in the developing countries have already given way to agriculture, new starlight towns and other forms of land use at a fast rate, creating a conflict between agricultural production and forest management. Based on these reasons, the government offers varieties of incentive to small farmers or big players encouraging them to plant in a large scale of good quality timbers. Nevertheless, up to this moment very few responses have been received from the small farmers as well as the big players. Poor response from the farmers is mainly due to high initial cost and long gestation period.

Forestry developing agroforestry system is the most suitable answer to solve the above problem not only in Malaysia but also for the rest of the world.

The Current Status and Future Potential

Commercial agroforestry was first initiated in Malaysia in the 1920's, where rubber trees were planted in coffee plantation (Najib Lotfy et al. 1999). However, this exercise was not successful because of the market value for rubber was far better than coffee, leading farmers to neglect coffee plantation. There are other agroforestry options available that allow the planting of various agricultural crops, animal rearing and

cultivation of timber and non-timber species. The right combination might give better return for the farmers. This refers to the maximising of the use of land space for sunlight, the right distribution of labour forces available, better supplies of food chains in the agriculture and animals husbandry practices and stabilised markets. There are six types agroforestry options, which were highlighted by Mahmud (1997a; 1997b; 1997c) and Mahmud et al. (1998) that are suitable for forest plantation as cited in detail by Najib and Mahmud (1999). The agroforestry systems are as follows:

i. inter row planting
ii. hedge planting
iii. block planting
iv. random planting
v. perimeter or border planting
vi. taungya

The most popular agroforestry system implemented in Malaysia are inter-row, hedge and block planting. Smallholders are gradually accepting other options due to limited land area.

In 1997, the Ministry of Agriculture introduced Intergrated Development Phase II, which is an agroforestry project in Pahang Barat. About 3,000 ha of smallholders' orchard land had been proposed for agroforestry project by integrating forest species with dokong, salak, waterapple, jackfruit and banana. At the same time, another 1,000 ha of rubber smallholders land had been proposed to be integrated with durian and salak (Department of Agriculture Malaysia 1997).

Generally, there are huge potentials for the Agroforestry development in Malaysia based on the availability of idle land in the country, which was estimated about 2.5 million ha (Table 2). Table 2 also includes data on idle paddy lands which is estimated at 37000 ha in Peninsular Malaysia excluded Sabah and Sarawak, marginal state land and estate excluding forest reserve.

Table 2: Summary Area Available for Agroforestry Development

State	State Land	Alienated Land	Other Reserve	Total
Kedah	2,271	814	513	3,598
Perlis				–
Penang				–
Perak	10,269	16,352		26,621
Selangor	5,143	817		5,960
N. Sembilan	2,894			2,894
Melaka				–
Johor	38,902	12,864		51,766
Pahang	36,180	43,421	63	79,664
Terengganu	21,084	44,740		65,824
Kelantan	18,550	27,630		46,180
Sabah	337,414	428,557		765,971
Sarawak	na	na	1,459,854	1,459,854
Total	472,707	575,195	1,460,430	2,508,332

(Source: FRIM and FDPM (1996)

Several Land Use Options for Agroforestry Development

One of the potential areas for agroforestry development is the plantation of orchard trees which is suitable for agriculture crops. Many small Malaysian farmers are keen to plant orchard trees on their lands. Most of the orchard plants are, however, quite old and, improperly managed. To some extent, the orchard farms are left idle and unproductive. The orchard trees could produce timber as well as supply food for the country. The inter-crops planting from the agroforestry system could provide extra food supply. Rubber land is another posibility that could be introduced under the agroforestry system in a large scale, which could give similar output as orchard farm produced. The designing of cropping pattern is based on the soil suitability, agro-climate and water source from the area, which follows Wong's (1986) soil suitability class. Some agroforestry options that could be adopted for orchard farm are as outlined below (Figures 1 - 5):

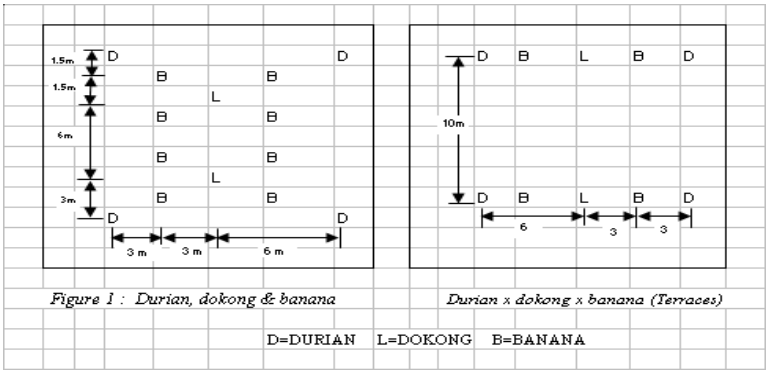

Figure 1 : Durian, dokong & banana

Durian x dokong x banana (Terraces)

D=DURIAN L=DOKONG B=BANANA

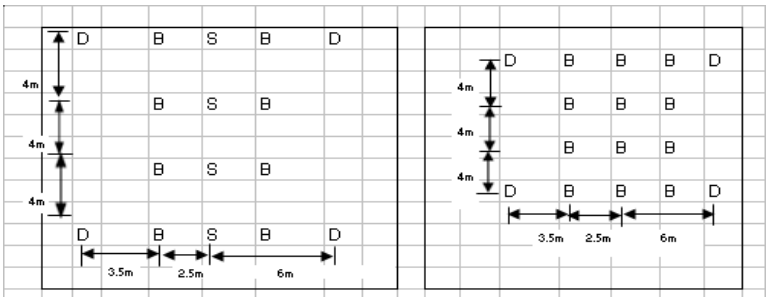

Figure 2: Durian x Salak x Banana

Figure 2 a) Durian and Banana

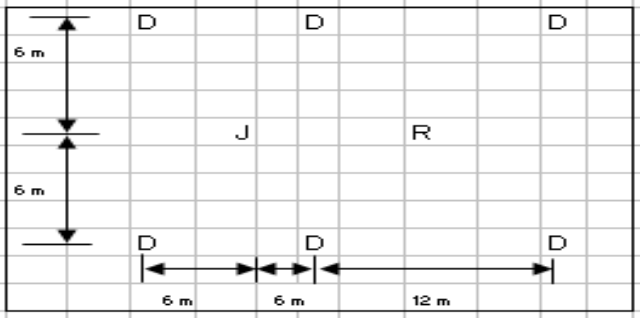

Figure 3 : Durian, Jackfruit and Rambutan

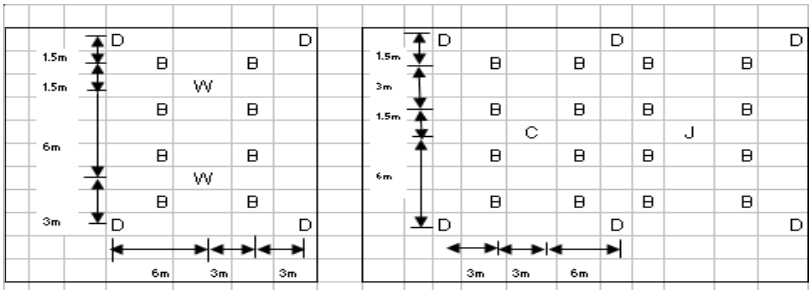

Figure 4 :Durian , Waterapple & Banana

Durian x Waterapple x Banana *Durian x Cempedak x Jackfruit x Banana*

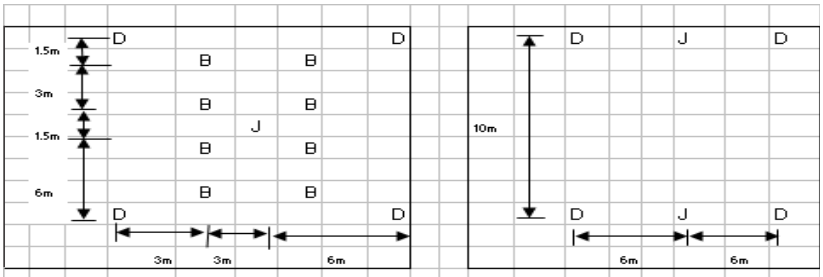

Figure 5 : Durian , Jackfruit & Banana *Durian x Jackfruit (Terrace)*

D= DURIAN J= JACKFRUIT B= BANANA

Data of Financial Analysis

Financial analysis is a tool that uses current price data to evaluate the performance of a proposed project. The analysis is based on information from the cash flow budget for any project. It is found that high expenditure is made for management forests, whether natural resources activities, plantations, agroforestry system and other activities. The role of the project analysis is mainly toward diagnosing weaknesses in an existing system and to recommend implementation for further consideration.

Moreover, the information of the cash flow could also be used for project planning where the viability of the project needs to be justified. If the project planning is not viable, implementation should not proceed. This paper discusses the use of concept such as nett present value, benefit cost ratio and internal rate of return to justify any agroforestry projects, whether it is feasible or otherwise.

The authors of this paper were involved in a feasibility study in Pahang Barat Integrated project Phase II. The data from this study were used in formulating suitable cropping pattern for agroforestry projects. There were 12 study areas which had been chosen in developing the agroforestry project with suitable cropping patterns based on soil, agro-climate factors, water source, farmers preference and market forces, which are different from one to another. The recommended cropping patterns for each of the areas are shown in Table 3. Based on the cropping pattern, the result of financial analysis for each of the agroforestry options were computed.

The financial analysis for several agroforestry projects is shown in Table 3. It is found that the cropping pattern which consists of durian, waterapple and banana in Cemperoh I in Pahang has produced the highest IRR as compared to the rest of the agroforestry projects in the list. The Cemperoh I Agroforestry Project is expected to earn about RM 17,650/ ha/yr (RM1,470.83/ha/month). The nett present value for the project is about RM12.1 million (25 years period). The benefit cost ratio is 3.93, which is really good. The pay back period is about 7 years, which implies that all the revenue from the project could pay back all the cost in the 7th year.

Generally, Table 3 shows that most agroforestry projects are highly viable, with IRR ranging from 23% to the 41% and the nett present value ranges from RM3.5 million to RM20.7 million for 25 years period. The annual income per hectare is estimated between RM11,700 to RM 24,800/ya/ha (or RM 975 to RM 2,667/ month/ha).

It is very clear that, agroforestry projects considered here are financially better compared to monoculture crop such as Acacia Mangium with 14.4% Internal Rate Return and RM5.1 million Nett Present Value and 1.38 benefit cost ratio with 15 years rotation (Najib Lotfy et al. (1999), Krishnapillay et al. (1998)). Rubber plantation alone does not project the financial analysis earning about 11.1% of IRR which RM1.2 million nett of present value and 1.1 benefit cost ratio through and breakeven analysis for about 19 years (Najib et al. 1998).

Discussion

Agroforestry project seems to be one of the answers for maximising the farmers income through the optimisation of land use. In fact, the application of agroforestry system in Malaysia will increase land

Table 3: Financial Analysis for Agroforestry Projects (25 years)

No	Location of Project	Cropping Patterns	Net Farm Income/ ha/yr	NPV	IRR	B/C	B P (yr)
1	Cemperoh 1	1. (Durian x Waterapple x Banana) 2. (Durian x Banana)	17,650.60	12,100 814.45	41.40%	3.93	7
2	Pareh	1. (Durian x Jackfruit x Rambutan) 2. (Durian x Banana) 3. (Durian plateform)	13,800.42	4,440,3 23.64	34.02%	3.42	10
3	Betau	1. (Durian x Dokong x Banana) 2. (Durian on Tereces) 3. (Durian x Salak x Banana) 4. Cempedak x Dokong)	15,505.17	20,738, 844.78	33.11%	3.41	10
4	Cemperoh 2	1. (Durian x Waterapple x Banana) 2. (Durian on terraces)	14,368.84	9,118,4 77.73	30.25%	2.82	10
5	Batu 9, Kerambit	1. (Durian x Dokong x Banana) 2. (Durian - Terraces)	11,711.26	9,274,7 86.78	29.02%	3.39	10
6	Padang Kela/ Sbg. Kela	1. (Durian x Dokong x Banana) 2. (Durian x Jackfruit) 3. (Durian x Dokong on Terraces)	21,368.74	5,453,1 95.90	28.23%	3.01	10

7	Keruat/ Sg. Mum	1. (Durian x Dokong x Banana) 2. (Durian x Dokong) 3. Dokong x Salak x Banana)	24,798.33	5,807,101.19	28.17%	2.89	9
8	Jeram Besu	1. (Durian x Dokong on Terraces)	22,751.10	3,499,407.44	25.99%	2.98	10
9	Sg. Terap	1. (Durian x Waterapple x Banana) 2. (Durian x Dokong x Banana on Terraces) 3. (Durian x Dokong on Terraces)	20,886.68	3,417,329.83	5.95%	2.64	10
10	Paya Keladi	1. (Durian x Dokong x Banana) 2. (Waterapple)	19,300.22	4,328,341.09	25.67%	2.58	10
11	Berembang	1. (Durian x Jackfruit on Terraces)	13,465.64	3,280,403.61	23.76%	2.9	10
12	Kuala Seru	1. (Durian x Dokong x Banana) 2. (Durian x Salak x Banana)	18,928.14	5,763,736.66	23.34%	1.74	10
	Average		17,877.93	7,268,563.59	29.08%	2.98	9.67

productivity, thus, increasing national food supply and timber and non-timber products manufacture. If agroforestry project could be implemented on an idle alienated land for 575,195 ha and using estimated income generated RM1,470.83/month/ha, this could generate about RM846 million per month for the country.

This paper has portrayed several suitable cropping patterns that could be employed in an orchard farm inter crop with other agricultural crops. Designing the planting system is very important, because we need to consider the availability of sunlight, soil suitability and topography, climatic condition for that particular area. Drainage system is also very important if the areas used have high volume of rainfall through out the year. Without prdrainage the crop will not survive. Wong's (1986) soil-crop suitability classification for Peninsular Malaysia (revised) has discussed in detail on crop suitability.

In addition, agroforestry has important roles to forest environment and social activities of the forest dwellers. It improves biodiversity; increases biomass production and provides better microclimate.

Conclusion

Agroforestry seems to be the answer in solving land scarcity to increase national food supply, timber and non-timber products manufacturing for the country. This combination of forest tree and agriculture crop will narrow down the gestation period for forest sector and agricultural crops and provide early cash flow. This is very important for projects to be more viable and feasible before it could be to be implemented. If the agroforestry could be implemented on the idle and marginal land, this could increase income of the farmers as well as for the country.

The idea of agroforestry project is very important. In the near future, the central agency should seriously look into this matter and a detailed study should be done to enable the project to be materialised. In fact, it is inline with the NEP3 and the Koyata Protocal.

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