Relative Profitability of Different Coconut–Based Farming Systems Prevailing in the Puttalam Area

A.M.I. MUHSIN[1], M.T. N. FERNANDO[2] and A.M.T.P. ATHAUDA[1]

[1]*Department of Agribusiness management, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura, Gonawila (NWP).*

[2]*Agronomy Division, Coconut Research Institute,Lunuwila.*

ABSTRACT

A study was carried out to identify the relative profitability of different coconut–based farming systems practised by farmers in Puttalam area, the factors influencing their profitability and constraints hindering the performance of the coconut-based farming systems. Data was colleted by conducting a survey from farmers in the sample. Benefit cost ratio was calculated to identify the profitability of the different coconut-based farming systems. Sensitivity analysis was carried out to evaluate sensitivity of profit to different risk levels. A profit function was estimated in a multiple regression framework.

Results showed that the coconut-based farming systems are profitable even at 15 percent simultaneous increased cost and decreased benefit scenario. The regression results revealed that cost of fertilizer is a significant factor that influences the profit of coconut monocropping. Cost of fertilizer, labour cost, number of nuts and land extent are the factors that significantly influence the profit of coconut-based livestock farming system. Meanwhile the labour wage is a significant factor that influences the profit of coconut-based cashew farming system. Constraints faced by farmers of the coconut-based farming systems were mite pest problem, high cost of inputs and seasonal fluctuation in market price. Coconut-based farming systems are the feasible solution to increase the unit income of coconut land.

KEYWORDS: Profitability, Benefit Cost Ratio, Constraints, Sensitivity Analysis

INTRODUCTION

Coconut (*Cocos nucifera*.L) is a traditional plantation crop grown in Sri Lanka. The coconut palm plays an important role in the economy of Sri Lanka.

Coconut-based farming system (CBFS) is a system or practice in coconut production in which the available farm resources like soil, water, rainfall, farm labour and other agricultural inputs (seeds, fertilizer, agro-chemicals) are utilized to produce both nuts, food and non-food agricultural products from the farm in a profitable way (Magat, 1999).

Coconut, being a widely spaced crop with its rooting pattern and canopy coverage offers much scope for integrating a variety of crop combinations in the inter spaces. The basic natural resources such as soil and sunlight available in a coconut garden are not fully utilized under mono cropping. In a coconut holding spaced at 7.5meter, nearly 75 percent of the land area is not utilized by the palms. Therefore, the active root zone of coconut is confined to a radius of 2 meter from the bole and coconut roots forage only in 25 percent of the land surface laterally. Therefore the remaining 75 percent of the land area could be profitably exploited for raising subsidiary crops. The orientation of leaves allows part of incident solar radiation to pass though the canopy and fall on the ground. As much as 56 percent of sunlight is transmitted through the canopy during the peak hours in palms aged around 25 years. The diffused sunlight facilitates growing a number of shade tolerant crops in the inter spaces enabling better use of natural resources.

Based on the growth habit of the palm and the amount of light transmitted through the canopy, the life span of coconut palm could be divided into phases. While selecting the crop combinations in a coconut based cropping system, it should be ensured that the selected crops are compatible with the system.

Inter or mixed cropping and mixed farming in coconut plantation helps the farmers to get sustainable income. In the era of WTO and free trading, competitiveness is more important which can come though increased productivity and lesser cost of production. Intercropping is the solution to get more returns from a unit holding (Rethinam, 2001).

Studies reveal that in a square planting system, 96% of the land planted to non-bearing coconut plants are unutilised; and in the case of mature palms, 85% are unutilized (Dar, 1994). These spaces under coconut are potential resources for increasing land productivity and income through alternative diversification schemes. These alternatives may include intercropping, crop-livestock integration or other coconut-based farming or production systems, which are compatible not only with the coconut but also with the farm's unique biophysical, socio-economic and environmental conditions.

In coconut-based farming system (CBFS), all the management practices and component production systems should be able to contribute and maintain high productivity, profitability and sustainability of the coconut farm. CBFS promotes the integration of economic activities in the farm to achieve high productivity and income.

CBFS enables efficient utilization of land. It is estimated that over 50 percent of available land under coconut can be utilized more productively if CBFS were adopted. In the context of fluctuating prices of copra and coconut oil, CBFS is a feasible alternative

and an opportunity to shift into cash production for many smallholders who are still in the subsistence mode of coconut farming. CBFS promotes better and more efficient utilization of farm labour. It is estimated that only 50 to 60 days a year are devoted for the maintenance of a monocrop coconut farm. In the context of coconut replanting, CBFS minimizes the loss in the income due to lags in coconut production and ensures ready income to the farming family while the replanted coconut palms are not yet in full production. CBFS promotes better and more efficient utilization of water, sunlight, farm inputs and capital. CBFS allows farm enterprise diversification, which is a risk-minimized strategy (Romulo, 2001).

The objectives of this study were to identify the relative profitability of different coconut-based farming systems and factors influencing the profitability of these farming systems. Further it evaluates constraints hindering the performance of the coconut-based farming systems.

METHODOLOGY

01. Data Collection

Using a pretested questionnaire data was collected from farmers in Puttalam district from February to May 2005. 40 farmers were selected for the study. Areas covered were Mudalaipali, Muthuwal, Kandakkuly, Thalawila, Nuraicholai, Kalpitiya, Karatheevu and Elvankulam.

02. Analysis

Farmers interviewed during the survey were classified into three groups according to the type of farming systems. They are coconut monocropping (sole coconut), coconut-based livestock farming system, and coconut-based cashew farming system.

Benefit cost analysis was carried out for different coconut-based farming systems. Benefit Cost Ratio (BCR) was calculated as follows,

$$BCR = \frac{\text{Present value of benefits}}{\text{Present value of costs}}$$

Benefit items identified in coconut-based farming systems were coconut nuts, woods, husk, shells, meat, milk, manure & cashew nuts. Cost items were rent for land, labour cost, farm machineries (tractor), fertilizer; agro chemicals, irrigation, fuel and electricity.

The calculated BCR values were used to identify the profitability of the different coconut-based farming systems.

To examine the industry viability, sensitivity analysis was carried out at 10%, 15% and 25% increased cost level and 10%, 15% and 25% decreased benefit levels for each coconut-based farming system.

The profit of the farming systems depends on many factors such as price of coconut, cost for fertilizer, labour cost, number of nuts, land extent and rent for the land. Based on these factors an econometric model for the profit of farming systems can be constructed as follows,

$$\pi = f(x_1, x_2, x_3, x_4, x_5, x_6)$$

Where,

π	=	Profit in Rs.
x_1	=	Price of coconut in Rs.
x_2	=	Cost for fertilizer in Rs.
x_3	=	Labour cost in Rs.
x_4	=	Numbers of nuts
x_5	=	Land extent in acre
x_6	=	Rent for the Land in Rs.

Factors that influenced the profit of the coconut-based farming systems were tested by different types of models such as linear, log- linear, log-log forms. The stability of the models were judged based on coefficient of determination (R^2), sign of the parameter estimates, consistent to the theoretical expectations and by the significance of variables.

Constraints faced by the coconut farmers in production and marketing of products were identified during the survey and they were listed according to their relative importance.

RESULTS AND DISCUSSION

a) Economic Feasibility of the Different Coconut-Based Farming Systems

The benefit cost ratio should be greater than one for a project to be profitable. Calculated benefit cost ratios, for each coconut-based farming system were greater than one (Table1). Therefore these three farming systems are profitable. Out of three farming systems, coconut-based cashew farming system is more feasible as it records the highest profits. High cashew nuts demand and low pest and disease incident increase the profit of coconut-based cashew.

Table 1. Benefit cost Ratio of different coconut-based farming systems per acre for one year:

	Farming System		
	Sole coconut	Coconut + livestock	Coconut + cashew
Present value Benefits (Rs)	28,065	36,379	42,135
Present value costs (Rs)	20,722	22,064	23,883
BCR	1.35	1.65	1.76

b) Sensitivity Analysis

The Benefit cost Ratios for coconut mono crop was 1.11, 1.00 and 0.812, for coconut-based livestock farming system was 1.35, 1.22 and 0.99, for coconut-based cashew farming system was 1.44, 1.30 and 1.06 respectively, at 10%, 15% and 25% increased cost levels and decreased benefit levels (Table 2). These values explain the profitability at different risk levels and it further explains the viability of the industry under adverse market conditions. Therefore the

coconut-based farming systems are profitable at 15% simultaneous increased cost and decreased benefit scenario. Both coconut-based livestock farming system and coconut-based cashew farming systems are less vulnerable to risks than coconut mono cropping system.

Table 2. Sensitivity of Benefit cost Ratios for increased costs and reduced benefits:

Farming System	Benefit / cost (PV)		
	Cost + 10% Benefit – 10%	Cost + 15% Benefit – 15%	Cost + 25% Benefit – 25%
Sole coconut	1.11	1.00	0.81
Coconut + livestock	1.35	1.22	0.99
Coconut + cashew	1.44	1.30	1.06

c) Regression Analysis of Coconut- Based Farming Systems

I. Regression analysis of coconut mono cropping

The log-log model showed a better statistical insight (Table 3). The regression model for coconut mono cropping explained 77% of the variation in the profit by the specified explanatory variables in the model. It further indicated that the cost of fertilizer was significant at the 5% probability level and showed a positive relationship.

Table 3. Estimations of the profit function for coconut mono cropping system:

Variable	Estimated Coefficient	*t*-value	*p*-value
Constant	-7.77	-1.25	0.2591
Price of coconut	2.80	1.15	0.2935
Cost of fertilizer	0.81	2.91	0.0270*
Number of nuts	0.38	1.56	0.1708

R^2 =0.7677, Adjusted R^2 = 0.6506 *Significant at 5%

II. Regression analysis of coconut-based livestock farming systems

A log- log model showed a better statistical insight (Table 4). The regression model for coconut-based livestock farming system explained 99% of the variation in the profit by specified explanatory variables in the model. It further indicated that the price of coconut and number of nuts were significant at the 5% probability level and showed a positive relationship. Cost of fertilizer, labour cost and land extent showed a negative relationship and these variables were significant at the 5% probability level. Inter cultivation cost showed a positive relationship and it was significant at the 10% probability level.

Table 4. Estimation of the profit function for coconut - based livestock farming:

Variable	Estimated Coefficient	*t*-value	*p*-value
Constant	-1.76	-1.95	0.1466
Price of coconut	1.98	3.85	0.0309*
Cost of fertilizer	-0.67	-4.39	0.0219*
Labour cost	-0.62	-6.67	0.0069*
Number of nuts	2.29	13.90	0.0008*
Inter cultivation	1.04	2.45	0.0918**
Land extent	-0.89	-3.93	0.0292*

R^2 = 0.9978, Adjusted R^2 = 0.9933 *Significant at 5% **Significant at 10%

III. Regression analysis of coconut-based cashew farming system

A log-log modal showed a better statistical insight (table 5). The regression modal for coconut – based cashew farming system explained 99% of the variation in the profit by specified explanatory variables in the model. It further indicated that the labour wage was significant at the 5% probability level and showed a negative relationship. The number of nuts showed positive relationship and it was significant at the 10% probability level.

Table 5. Estimation of the profit function for coconut - based cashew farming system:

Variable	Estimated Coefficient	*t*-value	*p*-value
Constant	-2.82	-0.61	0.5739
Price of coconut	1.45	1.94	0.1249
Cost of fertilizer	0.64	1.48	0.2117
Labour wage	-1.02	-6.36	0.0031*
Number of nuts	1.54	2.16	0.0965**
Land extent	-0.16	-0.38	0.7245

R^2 = 0.9903, Adjusted R^2 = 0.9783 *Significant at 5% **Significant at 10%

d) Constraints of Cultivation And Marketing of Coconut-Based Farming Systems

Among the identified, mite pest attack was the major problem in Puttalam district (Table 6). High cost of inputs like fertilizer, agro chemical and seedlings were significant problem for coconut-based farming systems. None of the coconut cultivators received any input subsidy. As a result of seasonal fluctuation in market price, farm income varied during

the year. Labour scarcity was the major cause for high labour cost in each coconut-based farming system especially in coconut-based cashew farming system.

Table 6. Constraints hindering the performance of coconut-based farming systems:

Constraints	Farmers reporting %
Mite pest problem	76%
High price of inputs	74%
Seasonal fluctuation in market price	55%
High labour cost	48%
Non availability of farm input	38%
Lack of subsidy schemes	37%
Low management	25%
Absence of proper market	10%

For large-scale cultivation, obtaining of good quality planting materials in required quantity was difficult. Most of the farmers did not practice good management practices. Absence of proper marketing system was a major issue prevailing in Puttalam district. The middleman involvement was high in marketing channels.

CONCLUSIONS

The results of the study revealed that the coconut monocropping, coconut-based livestock farming system and coconut-based cashew farming system are profitable. Out of three farming system coconut-based cashew farming system is more feasible. Both coconut-based livestock and coconut-based cashew are less vulnerable to risks than coconut monocropping system.

The cost of fertilizer is the significant variable that influences the profit of coconut monocropping system. The price of coconut, cost of fertilizer, labour cost, number of nuts and land extent are the significant variables that influence the profit of coconut-based livestock farming system. Meanwhile labour wage is the significant variable that influences the profit of coconut-based cashew farming system.

Constraints hindering the performance of the coconut-based farming systems were mite pest problem, high cost of inputs and seasonal fluctuation in market price.

In the present context of shrinking of coconut land due to urbanization and industrialization, the coconut-based farming systems are solution to increase the profitability of coconut land.

ACKNOWLEDGEMENTS

Authors record sincere thanks to Prof. S.J.B.A. Jayasekara, Dean, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura, for the support and advice in conducting this study. Sincere thanks are also due to Dr. Weerakkody, The Director, Computer Unit, Wayamba University of Sri Lanka, Makandura for providing statistical guidance.

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