An Economic Analysis of Cost of Production of Coconut (*Cocos nucifera*) as Affected by Different Land Size Classes andTypes of Management in Kurunegala District

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ABSTRACT

A study was carried out in Kurunegala district to estimate the cost of production (COP) and profitability for different types of management and different land size categories, to compare with The Central Bank published value in 2003. The other objectives of this study were estimation of percentage contribution of major cost items with respect to the total cost and the percentage family labour contribution to profitability. Results showed that COP is affected by land size, while profitability is affected by both land size and management level. Even though the land category L1 (≤ 2ac), L2 (>2ac to ≤ 10ac) and L3 (>10ac to ≤ 50ac) were not significantly different, the lowest COP (Rs 3.81/nut) was obtained for the land size of L2. The highest COP was obtained for the land category. L4 (Rs 4.2/nut) (> 50ac) which was significantly different from other land categories. Profitability values obtained for different types of management levels were significantly different and the highest profitability was recorded from the intensive management level (Rs. 29,478.00/ha/year). With respect to land category, L1, L2, and L4 were not significantly different for profitability, while L3 was significantly different from the others. The highest profitability was obtained from the land category L4 (Rs. 20,847.00/ha/ac). Percentages of family labour contribution in low management, semi – intensive and intensive management were 15.69%, 5.23% and 4.80% respectively, under L1 land category. The most crucial factor affecting the profitability of intensive and semi – intensive management is the fertilizer cost while harvesting cost is for the low management. Results of the study indicated that 25% of COP values obtained for different sizes of land categories and management levels were significantly different from the values published by the Central Bank in 2003.

KEY WORDS: Cost of Production,of Coconut, Family Labour Contribution, Land size, Profitability.

INTRODUCTION

Coconut palm is a very versatile plant, which is very valuable to the farmers in the tropical world. All parts of this palm is used for the daily needs of the people and plays a significant role in providing environmental benefit's, such as preventing soil and coastal erosion and adding nutrient through recycling. Coconut is currently grown in nearly ninety countries in the world. In Sri Lanka, coconut cultivation was started in middle 19th century. Today, Sri Lanka is the fourth largest coconut producing country in the world. Total land area of cultivation under coconut in Sri Lanka was nearly 439,000 ha in year 2004 (Anon, 2004). National coconut production has remained stagnated at around 2,557 million nuts during the past several decades (Anon, 2004). Average productivity of coconut is estimated to be in the region of 457,000 nuts/ha/year. Cost of production of coconut was Rs. 4.10 / nut in year 2003 (Anon, 2003).

Coconut sector of Sri Lanka is very important for the national economy in terms of vast employment generation potential, income, export and import substitution. Coconuts contribute 2% to the Gross Domestic Production (GDP) and 3.4% of foreign exchange earnings. It provides a livelihood for about 5000,000 people both in direct and indirect employment (Liyanage, 1999)

The government uses the national average cost of production estimates of coconut production for many planning purposes of the sector, such as for fertilizer subsidy scheduling, loan schemes, extension programs *etc.* The Department of Census and Statistics computes the national average of Cost Of Production (COP) using the data collected from a mail survey of a selected sample of growers. According to De Silva (1988), it is a very aggregate level estimate and biased towards estates sector, which represents one fourth of the area under coconut in Sri Lanka. For instance, nearly half of the costs of the national COP are estimated based on general charges, but in practice such an overhead expenditure category does not exist in smallholdings. Hence, the national level estimation of COP for the entire coconut sector is biased towards the estate sector. Therefore, the COP estimates need to be developed to each of coconut cultivation groups separately, which warrants that a certain policy can be applied to a given desegregated group. However, no studies have been conducted to identify the variation of COP across a diverse array of coconut farmers. Therefore, this study attempts to determine the COP variation in coconut production as affected by different land size classes and types of management in Kurunegala district of Sri Lanka, with the following specific objectives;

I. Monitor the profitability and the cost of production structure in relation to land category and types of management
II. Identify the most profitable combination of management type and land category
III. Identify the major cost items of cost of production in each aggregate category of land and types of management
IV. iv. Examine the degree of variation of national aggregate cost of production figure (2003) with respect to the empirically derived from this study

METHODOLOGY

Data were collected from a selected sample of farmers in Kurunegala district. Coconut Research Institute in Lunuwila selected those farmers and monitored for a period of one year, from 10th October 2002 to 9th October 2003. Those farmers were categorized according to the land size and management level. Four land size classes were identified, namely ≤ 2ac (L1), > 2ac to ≤10ac (L2), >10ac to ≤50ac (L3) and >50ac (L4) to represent four scales of farm operations. Three levels of management, namely low, semi - intensive and intensive were identified in each of the above land size classes based on the following criteria (Table 1).

Table 1. Definitions of management levels

Low management	Semi intensive management	Intensive management
Manuaring is not practiced together with any other practice.	Manuaring is practiced together with any other practice; Moisture conservation Crop protection Irrigation	100% of management practices are adopted. Such as; Manuaring Moisture conservation Crop protection Irrigation

Based on resources, sample size was decided to be 110 coconut holdings, which had been allocated within Kurunegala and Kuliyapitiya coconut cultivation regions as shown in Table 2.

Table 2. Allocation of sampling unites

		Kurunegala	Kuliyapitiya	Total
L1	L	6	6	12
	S	6	5	11
	I	6	4	10
L2	L	6	6	12
	S	6	5	11
	I	6	4	10
L3	L	5	6	11
	S	6	5	11
	I	6	4	10
L4	L	2	2	4
	S	2	2	4
	I	2	2	4
Total		59	51	110

Note: L =Low S=Semi intensive I = Intensive
L1 = <2ac L2 = 2ac-10ac L3 = 10ac-50ac L4 = >50ac

Data were gathered on following topics by using field record books of the selected farmers.

- Cost spent on inputs (fertilizer), weeding, crop protection, moisture conservation, soil conservation, fencing, harvesting and other activities
- Number of nuts harvested during one year
- Sales price of one nut
- Price of one kilo of copra
- Number of bearing palms in one ac.
- Number of rejected nuts
- Overhead expense

Profitability and (COP) were estimated for each of the land category and management category separately. Analysis of variance techniques were performed at the levels of land and level of management category to identify the existence of any significant difference on COP and profitability. Major cost items were calculated as percentage to the total cost with respect to each land category, management type and combination of both. One sample t - tests were used to compare the national average COP for coconut in 2003 published by The Central Bank with COP obtained from this research.

RESULTS AND DISCUSSION

Cost of Production

Cost items identified during the study were, harvesting (Rs/ha/year), fertilizer (Rs/ha/year), cultural practices (Rs/ha/year) and overhead expenses (Rs/ha/year). Based on the above cost factors COP was calculated (Table 3)

Table 3. Average cost of production (Rs/nut) for coconut in Kurunegala district for 2003

	L1	L2	L3	L4	Average
Low Management	4.78	3.53	4.37	5.29	4.49
Semi - intensive Management	3.16	4.10	3.91	4.30	3.80
Intensive Management	3.79	3.82	4.27	3.02	3.90
Average	3.89	3.81	4.18	4.42	

Source: Farmer survey (2003)

According to the result of Analysis of Variance Procedure (Table 4) the only factor which affected on COP was the land category.

Table 4. Analysis of variance for COP

Source	F Value	Pr>F	
Management	0.80	0.4523	
Land category	16.65	<0.0001	**
Management× Land	0.87	0.5207	

*R^2 = 0.366744 CV % = 32.44534 ** Significant< 0.05*

There was no significant effect of management level and contribution effect of types of management and land size classes on COP. Therefore, in this study, it was unable to predict the management level and the best mix of land and types of management combination on COP. Dancun's Multiple Range Test (DMRT) was used to identify the best land category for the COP (Table 5).

Table 5. Results of mean separation for COP

Land category	Mean COP (Rs/nut) **
L1	3.89[a]
L2	3.81[a]
L3	4.18[a]
L4	4.42[b]

***The means with same letters are not significantly different*

Dancun's Multiple Range Test showed that the COP values for L1, L2 and L3 were not significantly different. However L4 was significantly different from the above land categories (L1, L2 and L3). The results showed that lowest COP has been maintained by the farmers who have less than 50ac.

Even though the management types are not significant on COP, when increasing the management level up to the semi - intensive management, cost of production decreases, while increasing again in the intensive management. The reason for higher COP under low management was the low level of yield.

The lowest COP value (Rs.3.02/nut) obtained for L4 land category under intensive management may be because the economy of scale while the low management recorded the highest (Rs.5.29 /nut) cost of production with L4 land category. However when the biggest lands are poorly managed, it results the highest COP. Implicit in these finding is that the lowest COP could be achieved when the biggest lands are well managed whereas the opposite is the case when the same category of lands are poorly managed.

Profitability

Profitability was calculated for each group by getting the difference between the total revenue (Rs/ha/year) and the total cost (Rs/ha/year) (Table 9)

Analysis of variance procedure was carried out to find out the effect of land size and management type on profitability. The results indicated that the profitability was affected significantly by land size as well as management type (Table 6).

There was no significant combination effect of types of management and land size classes on profitability. Therefore this study is unable to predict the best combination of land size and types of management for profitability.

Dancun's Multiple Range Test was used to identify the best land category and types of management on profitability. (Table 7 and Table 8).

The result shows that the land categories of L1, L2 and L4 are not significantly different with respect to the profitability (Table 7). It indicates that the higher profitability has been obtained by the land categories of L1, L2 and L4.

Table 6. Analysis of variance for profitability

Source	F Value	Pr>F	
Management	19.49	0.0001	**
Land category	4.10	0.0087	**
Management × Land category	1.90	0.0891	

*R^2 = 0.389956 CV% = 59.71310 ** Significant< 0.05*

According to the survey results L2, L3 and L4 land categories have recorded greater amount of overhead expenses (production overheads + administrative overheads). Specially L2 and L3 land categories were unable to cover overhead expenses by using economics of scale advantage. Therefore, L2 and L3 had lower profitability than L1. After moving from L3 to L4 it clearly shows economics of scale advantage able to exceed the overhead expenses.

Table 7. Results of mean separation for land categories on profitability

Land category	Mean profitability **(Rs/ha/yr)
L1	20,767.33[a]
L2	20,706.00[a]
L3	18,326.00[b]
L4	20,847.00[a]

Table 8. Results of mean separation for management types on profitability

Management type	Mean profitability **(Rs/ha/yr)
Low	12,216.00[c]
Semi - intensive	18736.75[b]
Intensive	29,478.00[a]

***The means with same letters are not significantly different*

The result shows the management types, low management, semi-intensive and intensive management are significantly different with respect to the profitability. It indicates that a higher profitability (Rs.29,478.00/ha/year) has been obtained by the intensive management (Table 8). However, when the biggest land categories are well managed, they are the land categories which generate the greatest profits, whereas the polar opposite is the case when they are poorly maintained, implying that the profitability of land categories are highly sensitive to level of management. Hence, neglecting bigger lands would involve greater opportunity cost than neglecting any other land category, which calls for renewed management attention on bigger land categories.

Even though the combination of land and management categories are not significant with profitability, it is interested to note that intensive management with L4 land category recorded the highest profitability (Rs.33,330.00/ha/year) while low management with L2 land category recorded the lowest profitability (Rs.10650.00/ha/year) (Table 9). Percentage of family labour contribution to the profitability was calculated under L1 (less than 2ac) land category with respect to low management, semi – intensive and intensive management (Table 10). The highest percentage was given by the low management while lowest percentage recorded by the intensive management. This result reveals that, under low management category labour contribution to profitability is 15.69% when semi – intensive is (5.23%) and low management is (4.80%). This result reveals that family labour contribution to profitability is high in low management. Therefore, estates which are under low management have greater opportunity for family labour employment.

Table 9. Average profitability of coconut cultivation in Kurunegala district in 2003(Rs/ha/year)

	L1	L2	L3	L4	Average
Low management	11,620.00	14,062.00	12,533.00	10,656.00	12,218.00
Semi-intensive management	21,751.00	16,288.00	18,353.00	18,555.00	18736.75
Intensive management	28,931.00	31,828.00	23,824.00	33,330.00	29,478.00
Average	20,767.33	20,706.00	18,236.00	20,847.00	

Source: Farmer survey (2003)

Table 10. Variation of family labour use under L1 land category

Management level	Profitability (Rs/ha/year)	Family labour (Rs/ha/year)	% of family labour Contribution to net profitability
Low	11,621.69	1,823.09	15.69
semi - intensive	21,752.49	1,659.09	5.23
Intensive	28,931.82	1,389.63	4.80

Major Cost Components as a Percentage of Total Cost

The most significant cost components were identified with respect to land categories and types of management as percentages of the total cost. The cost for weeding, harvesting, fertilizers, moisture conservation and other costs were total variable cost which is equal to sum of the above cost components considered for the analysis (Table11).

Fertilizer cost played a major role under intensive and semi intensive management irrespective of land category followed by harvesting cost and weeding cost (Figure 01). Therefore, by reducing fertilizer cost for semi intensive and intensive management, it might be possible to reduce the cost of production. However, profitability is greatly affected by the application of fertilizer. Fertilizer improves the productivity of coconut to a greater extent. Therefore, it is not recommended to reduce the application of fertilizer. Instead, fertilizer cost can be minimized by applying organic fertilizer in place of the inorganic fertilizer. The other alternative is the Bio farming or sustainable farming. Which provides ample opportunities for cost reduction in managing the coconut garden while enhancing the profitability per hectare. This practice could reduce by almost 50% the cost involved in maintaining the coconut plantation. Provision of a feasible fertilizer subsidy scheme could be the other alternative to reduce the fertilizer cost.

Cost for weeding, harvesting, fencing and moisture conservation were reduced with increasing management level up to intensive level. The intensive management has relatively higher number of field practices followed by semi intensive and low management. Therefore, proportionate contribution to the total cost from each cost components were relatively lower than that in semi intensive management followed by low management.

With respect to the land category alone, harvesting cost decreased when the land size increased. L1 land category recorded the highest cost component for harvesting due to the use of climbers for harvesting instead of pickers (Figure 2).

Comparison between COP Values Obtained From the current study and published by the Central Bank in 2003

One sample t-tests were used to compare the national aggregate COP value (Rs.4.10/nut) with The COP values obtained from this research (Table 12).

Table 12. t - test results for cost of production values

	Mean	Standard deviation
M1L1	4.58	2.206
M1L2	3.68	2.071
M1L3	4.37	2.037
M1L4	5.29	1.268***
M2L1	3.16	1.582***
M2L2	4.09	1.927
M2L3	3.90	1.373
M2L4	4.29	1.997
M3L1	3.78	1.307
M3L2	3.81	1.427
M3L3	4.19	1.440
M3L4	3.02	.1344***

Variables significant at the 0.05 levels are indicated by * sign.**
M1=Low management M2=Semi –intensive management
M3=Intensive management

Table 11. Significant cost components of coconut cultivation in Kurunegala district in 2003 (As a percentage of the total cost)

Cost component	Low management				Semi – intensive management				Intensive management			
%	L1	L2	L3	L4	L1	L2	L3	L4	L1	L2	L3	L4
Fertilizer	0.00	0.00	0.00	0.00	23.31	31.25	25.30	33.20	35.41	34.31	33.29	30.50
Harvesting	49.70	36.51	23.50	20.00	35.44	24.57	18.30	15.70	31.32	25.20	18.00	13.85
Weeding	23.52	29.07	28.00	13.60	20.28	14.80	14.30	9.10	15.36	13.99	12.02	9.30
fencing	10.99	8.49	3.05	3.00	4.10	3.25	2.00	1.47	8.30	5.20	3.85	2.84
Moisture conservation	0.00	0.00	0.00	0.00	14.36	8.32	7.52	5.96	7.10	6.48	5.22	5.36
Other cost	15.79	13.53	2.85	14.30	2.51	3.71	5.58	6.27	2.51	0.72	7.02	8.35
Total (variable cost)	100	87.60	57.40	50.90	100	85.90	73.00	71.70	100	85.90	79.40	70.20

Source: Farmer survey (2003)

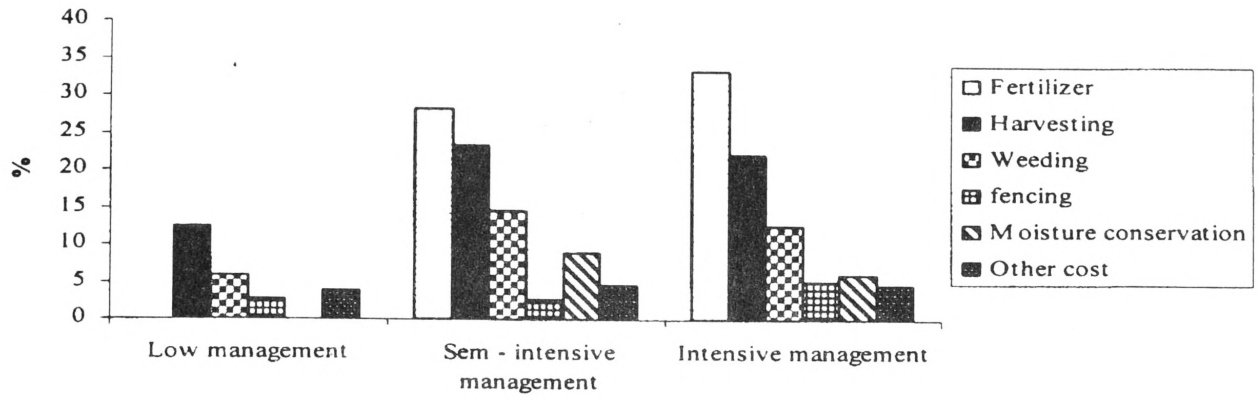

Figure 1. Percentage of cost Vs management

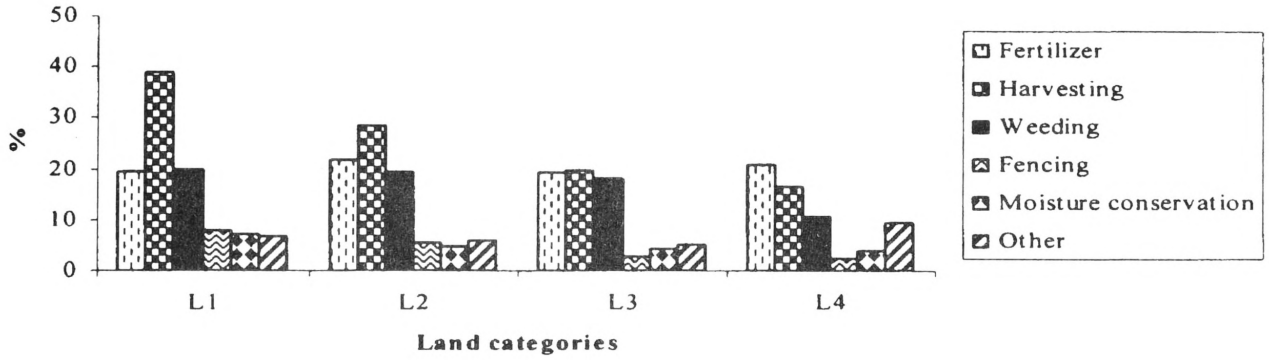

Figure 2. Percentage distribution of cost components by Land categories

Twenty five percent of the COP values obtained for different land and management levels were significantly different from the values published by the Central Bank in year 2003. The Department of Census and Statistics compute the national average COP using the data collected from a mail survey of a selected sample of growers which represent only one fourth of the area under coconut in Sri Lanka. It reveals that the national level estimation of COP for the coconut sector is biased to make decision on different subsidiary schemes. Therefore, policy makers have to consider each coconut cultivation group with respect to management and land sizes when deciding the subsidiary scheme for coconut.

CONCLUSIONS

According to the results COP was affected by land size while profitability was affected by both land size and management level. Results of the study indicated that, 25% of COP values obtained for different type of land categories and management levels were significantly different from the value published by the Central Bank in 2003. It reveals the national level estimation of COP for the coconut sector is unbiased to make decision on different subsidiary schemes. Therefore policy makers have to consider each of coconut cultivation groups with respect to management and land sizes when deciding the subsidiary scheme for coconut.

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REFERENCES

Anon. (2003). Central Bank Annual Report of Sri Lanka, Colombo: Sri Lanka

Anon. (2004). Central Bank Annual Report of Sri Lanka, Colombo: Sri Lanka

Coconut Development Authority (1993). Sri Lanka coconut statistics, 1993.

De Silva, S. (1988). Methodology development for economic analysis in the coconut sector: Case studies from Sri Lanka. APCC Occasional Publication series, NO2.

Liyanage. M .De .S. (1999). Scientific Guide of Coconut Cultivation. 1-3 ,13, 102-110.