

**A DISCIPLINED APPROACH TO THE
DEVELOPMENT OF THE PRODUCTIVITY
OF COCONUT LANDS**

U.V.H. PERERA

DIAN PUSLITBANGBUN

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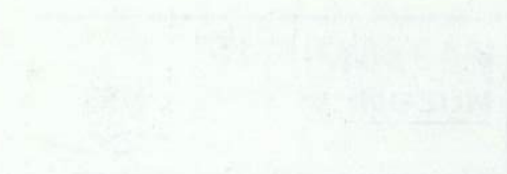
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Asian and Pacific Coconut Community



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The views expressed in this publication are not necessarily those of the authorities of the country concerned nor that of the APCC Secretariat.

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In this publication an attempt is made to explore the different options available to ensure continuity of the commercial cultivation of coconut at reasonable degree of returns to the producer. Here, a number of economic activities or any combination of them that could be conducted in monocropped coconut lands has been identified. Comparison has also been made on return per unit of land under them at various type of absentee management, unit size of land and production of coconut.

Mr. U. V. H. Perera, author of this monograph served the Coconut Development Authority for more than 25 years first as its Economist and then as the Director Economic Research. The study accordingly is based on Sri Lanka.

My thanks go to Mrs. J.C. Suharto of the Secretariat for editing and preparing the monograph for
U.V.H. PERERA

P.G. PUNCHIHEWA Ph.D
Executive Director

October 1997



APCC

Asian and Pacific Coconut Community

FOREWORD

The knowledge to improve the productivity of coconut lands to reasonable economic levels has been available for more than half a century. However the industry has lagged behind in putting this knowledge into practical use. The return to the coconut farmer from his land continued to remain low goading him to dispose of it either for non-agricultural purpose or turn it to an alternate crop.

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P.G. PUNCHIHEWA Ph.D.

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PREFACE

This booklet was prepared in response to a request by the Executive Director of the Asian and Pacific Coconut Community (APCC) in May 1996. Since I retired from the active service in the Coconut Development Authority in March 1996, more time was available to reflect calmly upon our past development activities. This book finally was a result of these reflections from time to time. The views expressed here may not coincide with the official views of the government institutions in coconut and nor do they claim universal applicability.

The thesis of this book is that new forms of management of coconut lands in place of non-farming absentee owner management is essential if coconut were to survive as an economic crop under free enterprise. Though the concepts of individual ownership prevails under the new system, the management has to move away from highly individualistic owner managers who possess only part time interest in coconut cultivation.

Rural level management organizations have to come up in coconut areas, possessing knowledge, interest in agriculture and entrepreneurial capability. Such a system involves, new discipline and development consciousness, which are not yet permeated to the grass root level. Hence the name of this book. The basic tasks of future extension will be to play the role of changing agent to initiate the growth of such organizations and to facilitate the development of enterprise.

The knowledge to improve the productivity to reasonable economic levels has been available for more than half a century. Though there has been delay in this new knowledge reaching the farmer in the practical form he requires it, the institutions dealing in extension, have improved their approach and strategies, with the acquiring of experience. The knowledge has not been a constraint to the improvement of productivity in coconut. But the material conditions in the world has changed, and with it, the relative importance of commodities and their factors of production, resulting in the dethronement of coconut from its former status as the 'Consols of the East'. Increasing population and consequent urbanization, though important factors in creating new demand, have resulted in fragmentation of land to uneconomic sizes and escalation of land prices. Speculation has replaced the agricultural interests in land. Coconut is indispensable to countries such as Sri Lanka because of its nutritional support to daily diet, in addition to its environmental friendliness and export income. The continuity of coconut is nationally desirable. When all its advantages are considered, a perfect substitute for coconut is yet to be found.

The nationalization of land as the remedial measure has failed to release the productive forces in the coconut sector. The failure was basically in the management: a form of management which benefits from the dynamism of the private initiative and free from the overhead burdens of centralized management, is essential, if coconut is to maintain its competitiveness. Some practically possible management approaches, are discussed in this book.

I wish to thank Mr. P.G. Punchihewa, the Executive Director of the Asian and Pacific Coconut Community for the publication of the book, and Mr. S. Jayawickrema, Director, Market Development and Research of the Coconut Development Authority, who helped me in many ways in producing this book.

U.V.H. PERERA

The Depression, malaria epidemics of unprecedented extent of the Second World War and the consequent strategic importance of coconut as a war material were definitely factors that impeded the expansion of coconut. But the crucial factor that halted the expansion was the non-availability of land in large scale. The sale of crown lands by auction under which over 1 million acres were disposed of in the previous century was stopped in 1916 and the interests of the peasants gradually began to dominate the Government. Since the Land Development Act of 1936, large scale expansion of coconut was no longer possible. Markets continued to be favourable all around 60s, and the increased production had to be sought from the existing extent which required more intensive cultivation and regeneration of the extent. Consequently subsidised artificial fertilizer application scheme was introduced in 1956, followed later by various subsidy schemes introduced for replanting, rehabilitation, intercropping, etc. The developments of the late 60s and early 70s, which brought in increased competition for coconut oil from substitutes resulted in declining prices and necessitated a fresh look at coconut cultivation as a monocrop. Apart from competition, there were other factors which contributed towards rising cost of production, viz.

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CHAPTER 1

Introduction

The coconut was once known as the 'Consols of the East'. It was a safe and attractive investment for many a British and indigenous planter since the last quarter of the previous century until the Great Depression of the 1930s. The markets expanded consequent upon the new found uses for it in the edible and industrial fields and the extent under coconut kept pace with the market expansion, reaching one million acres in 1930.

The coconut was the worst affected tree crop during the Depression and many indigenous coconut planters experienced difficulties, being unable to honour their debts. The Government intervened in setting up separate institutional framework to ameliorate the conditions of the coconut cultivators. The need for collection action was increasingly felt among the smallholder and middle class cultivators giving the necessary impetus to the birth of the cooperative movement in coconut cultivation and processing. The situation improved during and after the Second World War and many desiccated coconut and fibre mills were opened up. But the extent under coconut stagnated around one million acre mark since 30s. Several factors contributed towards this stagnation.

The Depression, malaria epidemics of unprecedented severity, onset of the Second World War and the consequent strategic importance of rubber as a war material were definitely factors that impeded the expansion of coconut. But the crucial factor that halted the expansion was the non-availability of suitable lands in large scale. The sale of crown lands by auction under which nearly 1.5 million acres were disposed of in the previous century was stopped in 1916 and the interests of the peasants gradually began to dominate the land policy of the Government. Since the Land Development Act of 1936, large scale expansion of coconut was no longer possible. Markets continued to be favourable till around 60s, and the increased production had to be sought from the existing extent which required more intensive cultivation and regeneration of the extent. Consequently subsidised artificial fertilizer application scheme was introduced in 1956, followed later by various subsidy schemes introduced for replanting, rehabilitation, intercropping, etc. The developments of the late 60s and early 70s, which brought in increased competition for coconut oil from substitutes resulted in declining prices and necessitated a fresh look at coconut cultivation as a monocrop. Apart from competition, there were other factors which contributed towards rising cost of production, viz,



- a. Unprecedented rise in land values for property development due to increase in the population, urbanisation and consequent land fragmentation
- b. Scarcity of labour
- c. Inability to sustain the cost and price support schemes introduced by the Government in the past.

The extent under coconut is contracting at a rapidly increasing rate, giving way to housing projects. The market value of land suitable for housing has risen above Rs. 2 million an acre, as against Rs. 400 to Rs. 500 per acre in the 30s. The interest earned in saving deposits at an average interest of 12% p.a. from the sale proceeds from an acre would work out to Rs. 240,999 as against an average income of Rs. 18,000 (at Rs. 6 per nut on 3000 nuts) from the sale of coconuts.

The coconut proprietors, particularly absentee owners, sell their lands to property development companies who intern block out the land into 20 perch (1/8 of an acre) lots to be sold for housing.

The scarcity of labour, more specifically, pluckers and dehuskers is yet another factor adversely affecting the sector. The wages have risen.

Apart from the financial burden to the Government, the development role of the subsidies in a competitive economic system is increasingly being questioned. The fertiliser subsidy introduced in 1956 was stopped by end of 1990. However, in the case of replanting and rehabilitations, it would be incorrect to identify the assistance as a subsidy payment as it is financed by a cess on the export of coconut products. The exports absorb about 20-25% of the coconut production in the country. The nuts diverted to domestic foodnut consumption cannot be made to pay a development cess due to administrative difficulties of collecting it. But the local consumption helps to keep the coconut prices at high levels by competing for the supply of nuts to the processing sector. In a country such as Sri Lanka where the coconut is an essential items of daily diet, the demand remains inelastic (except for the incremental demand due to population growth) and provides a ready market to the primary producer. Though the situation is advantageous to the coconut producer, it reduces the competitive ability of the processor in the international market. The international demand is not inelastic as is the case in local demand for food nuts.

Despite the comparative advantage of assured market for the cultivator, the coconut sector is threatened with gradual contraction due to rising land values and rise in cost of production. The land has a very high scarcity value in Sri Lanka and it serves the owner far better financially when sold than when devoted to coconut cultivation.

It is the object of this essay to explore whether any options are available to ensure the continuity of the commercial cultivation of coconut at a reasonable degree of return to the producer, so as to prevent him from selling his land for non-agricultural use.

Methodology

The ubiquitous home garden with its plethora of useful crops including coconut and king coconut is a self-sustainable and ecologically desirable unit. It can always be made to pay as it serves the dual purposes of residence and sustenance. There are farmers in Sri Lanka who cultivate their home gardens very intensively and who are very successful at it financially. However, the question of its alternative uses does not arise and hence need not be considered in the foregoing comparative evaluations.

The economic activities that could be conducted in monocropped coconut lands are:

- (1) tapping for sap
- (2) intercropping and associate cropping
- (3) primary processing
- (4) animal husbandry

or any combinations of above.

As an initial step it is proposed to compare the return per unit of land under the above variants at various types of absentee management, unit size of land and production of coconut. The behaviour of overheads under each variant will serve as a useful guide in determining minimum economic size of a unit under absentee ownership. The possibilities of joint or cooperative management of land and marketing will be explored in order to enhance management efficiency and profitability.

a. Unprecedented rise in land values for property development due to increase in the population, urbanisation and consequent land fragmentation

b. Scarcity of labour

c. Inability to sustain the cost and price support schemes introduced by the Government in the past.

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CHAPTER 2

Constraints

The constraints and inhabitants to profitable cultivation of coconut are many, but could be basically classified as natural and socio-economic. The natural factors that limit production are climate, soil suitability, palm health and generic limitations.

Out of the 416,000 ha of total extent under coconut, the area with high potential could roughly be estimated as follows: The flat wet zone area constitutes about 26% (110,000) ha, while another 12% comprises wet but hilly sloping lands around 8% (32,000 ha) of the total extent. The biggest area under coconut falls into the intermediate zone with 53% (220,000 ha) of the total extent. The wet hills and the dry zone are not very conducive to coconut cultivation because of natural limitations imposed by the climate, soil type and terrain. Coconut grows upto an elevation of 2.150 feet provided the temperature does not exceed 20 C. A well distributed rainfall of 40-50 inches per annum and deep sandy loam soil in flat terrain would be ideal for the productive cultivation of coconut.

The major soil types in the coconut areas are

Soil type	% area under coconut
Gravel	31.05
Clay	26.59
Sandy Loam	18.34
Sand	13.37
Combination of two types	10.65

Source: Sample Survey of Coconut Cultivations 1970
Department of Census and Statistics

The coconut area with high potential constitute the wet flat lowlands and the intermediate zone covering the South Western coastal belt and the coconut triangle altogether consisting 79% (332,000 ha) of the total extent. If we exclude the home gardens in this area, the area with high productive potential could be estimated at about 60% or 270,000 ha. However, this area is rapidly being urbanized and the opportunity cost of land is much higher than in other coconut area, and consequently is under the threat of rapid fragmentation. The commercial plantations in this area would cover about 160,000 hectares.

The total coconut production in the country since 1981 has ranged from low of 1,937 million nuts (in 1988) to a high of 3,039 million nuts (in 1986). Since the fertilizer consumption has remained more or less constant at a very low level during the period (around 36,000 MT covering 16% of total extent), the fluctuations in the production, could directly be attributed to the vagaries of weather. The average annual production works out to 2,400 nuts per acre. Even under the limitations imposed by the natural factors, the local cultivars are capable of yielding at least 4,000 nuts per acre per year under good management. Demonstrative examples are not lacking. The research knowledge and the indigenous experience to achieve satisfactory production levels existed since 1950s. Extension maybe considered as a weak link in the process. But the knowledge and assistance could be obtained by articulate planters. There are coconut estates yielding 7,000 nuts per acre per annum. Yet many a land lies neglected and a status quo of lethargy and indifference prevail among land owners, and for many of these lands, the rainfall and natural fertility of the soil are the only factors that contribute to production. They are fortunate in that no diseases of unknown etiology sap the yield potential.

The reasons for the failure to realize the true productive potential of the coconut lands are to be found in the socio-economic conditions. In the final analysis, the sustainability of coconut depends on the economics of production.

The profitability of coconut depends on cost of production and income. The cost of production depends on (a) cost of the factors of production and overheads. The type of management, ownership pattern and size of land are factors basically affect the overhead costs. The home gardens and resident holdings do not incur security and other overheads.

The majority of the private coconut holdings in Sri Lanka are owned by absentee landlords through successive inheritance over several generations. There are very few farmers among them. The land is held by inheritance, as an index of social prestige or as a saleable asset of rising value. The majority of landowners are at their best, part time farmers with major sources of income for livelihood earned by being professionals such as doctors, lawyers and government servants or traders, etc. Apart from a few gentlemen farmers, the rest can be identified as landed proprietors. In the majority of the cases, the land is looked after by a caretaker, who attends to security of the crop and the engagement of labour for work in the land. The management by the caretaker is the most prevalent type of management in small coconut estates owned by absentee owners.

100	100	100	100	TOTAL
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This rudimentary form of management coupled with part time interest in farming by the owner, is not very conducive to the development of the productive potential of the land or to the release of productive forces in the economy. Adoption of useful cultural practices, intensive land utilization, primary level processing, good labour relationships, development of socio-productive relationships with surrounding villages, adaptive farm level research, symbiosis with the society and the environment are the hallmark of good management. But they are the very characteristics that are conspicuous by their absence.

Non-farming absentee ownership, caretaker management, monocropping and the size of holding are the four major factors that constrain the release of productive potential of the land. It is essential at the outset to determine the economic size of the holding under absentee ownership, and caretaker management and monocropped cultivation of local cultivars for an already bearing inherited land. The caretaker management though rudimentary incurs an overhead. Usually he is paid a monthly salary. He does not incur expenses for the coconut he uses for consumption and for his firewood. The salary and expenses of the caretaker, expenses involved in visits by the owner, implements and maintenance would constitute the overheads.

The minimum economic plot size under different types of management, cultivation practices and intensity of land could be arrived at through an analysis of the respective costs of production. The legal land ceiling for a private individual in Sri Lanka is 100 acres (40.5 ha). The distribution of coconut lands as per Census of Agriculture, 1982 was as follows.

Size class acres	Holdings		Area	
	No.	%	Hectares	%
Less than 10	676250	96	252592	60.7
10 Less than 20	17290	2.5	39571	1
20 less than 30	6853)	38166)
30 less than 50	1787)	21099)
50 less than 100	1432)	25780)
100 & above	836)	38893)
TOTAL	704448	100	416091	100

The holdings below 10 acres (4 ha) constitute 96%, covering 61% out of the total extent. They comprise non-commercial cultivations covering home gardens. The proportion of this type of holdings have now increased due to fragmentation. According to the recent estimates of the Coconut Development Authority, about 1,000 acres are being annually converted into homestead plots of less than quarter acre in extent.

The extent between 10 to 100 acres, comprising about 4% of the total number of holdings covers about 39% of the hectareage. These are the commercial plantations, owned by absentee owners and by companies.

It is the continued sustainability of this sector that is of primary interest which depends on their commercial viability.

Table 1
Standard Variable Cost of Production per Acre per Annum, 1966 for Monocropped Tall Variety at 30 years of age

Variable Cost and Margin per Acre : Rs.				
Input Intensity	Coconuts	Total	Incremental	Margin
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9
10	10	10	10	10
11	11	11	11	11
12	12	12	12	12
13	13	13	13	13
14	14	14	14	14
15	15	15	15	15
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47	47	47	47	47
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49	49	49	49	49
50	50	50	50	50
51	51	51	51	51
52	52	52	52	52
53	53	53	53	53
54	54	54	54	54
55	55	55	55	55
56	56	56	56	56
57	57	57	57	57
58	58	58	58	58
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89	89	89	89	89
90	90	90	90	90
91	91	91	91	91
92	92	92	92	92
93	93	93	93	93
94	94	94	94	94
95	95	95	95	95
96	96	96	96	96
97	97	97	97	97
98	98	98	98	98
99	99	99	99	99
100	100	100	100	100
Total variable cost		4800		

CHAPTER 3

Economics of Coconut Production

The majority of the existing stock of palms in the country is of tall variety, with an average economic life of about 60 years. At the outset it is proposed to study the unit cost of production for this variety, at a standard level of cultural practices, for inherited bearing lands of around 30 years. At standard inputs, the unit variable cost can be expected to remain constant, irrespective of the size class of the land. Three size classes of lands are selected for the purpose of analyzing the behaviour of overheads. The size classes are (A) -----to 30 acres, (B) 20-60 acres and © 60 to 100 acres.

Table 1

Standard Variable Cost of Production per Acre per Annum, 1996, for Monocropped Tall Variety at 30 years of age

		Sri Lanka Rupees
1	Fertilizer	
1.	at 3 1/2 kg. per palm for 64 palms at	2050
1	Rs. 9,150 per MT	
1.	transport of fertilizer for 25 mills radius	200
2		
1.	application at Rs 5 per palm	320
3		
1.	one year interest on fertilizing cost 22%	565
4	p.a.	
Sub Total		3135
2	Crop work : plucking, collecting, counting	520
3	Control of pests, diseases and weeds	325
4	Other cultural practices: soil & moisture conservation	500
5	Maintenance of roads, fences, implements and buildings	320
Total variable cost		4800

The fertilizer usage constitute 65% of the total variable cost. An average incremental yield of 1,000 coconuts are expected in the succeeding year, by fertilizer application. At current prices of fertilizer, and coconuts (Rs. 5.50 at farm gate), 570 coconuts are required to cover the cost. There are coconut lands, which are fortunate enough to be free from pest and diseases and weeds, so that owners do not incur expenses on their account. The absence of fertilizer application (organic or inorganic) and the absence of cultural practices are the characteristics of neglected plantations. A neglected plantation, if the palms are healthy and in optimum bearing age may yield less than 1,000 nuts. Unfertilized lands, but with the adoption of other cultural practices, may yield annual crops ranging from 1,000 to 2,000 nuts per acre.

The average production at standard inputs is around 3,000 nuts per acre. The variable unit cost per nut and the margin per acre at different levels of input intensities are worked out below.

Table 2

Variable Cost and Margin per Acre : Rs.					
Input Intensity	Coconuts per Acre p.a	Total Variable Costs Rs.	Income at Rs. 5.50 per nut	Margin Rs.	
i	No fertilizer, no cultural practices	1000	840	5500	4650
ii	No fertilizer but with other cultural practices	1000 to 2000 av.:1500	1665	8250	6585
iii	Fertilizer and cultural practices	3000	4800	16500	11700

Since the variable cost per acre remains constant irrespective of the size class of land, the next step is to study the behaviour of overheads over the size class of land.

	Nuts/acre	Income/Rs
I	1,000	5,500
II	1,500	8,250
III	3,000	16,500

For this purpose, the following land classes, and management intensities are considered.

LAND Class A : 10 to 30 ac. One caretaker

LAND Class B : 30 to 60 ac. two caretakers

LAND Class C : 60 to 100 ac two caretakers and one manager

The overhead expenses for the above categories are estimated below.

Overhead Expenses : Per Annum : Rs.			
Item	A 10 - 30 acres	B 30 - 60 acres	C 60 - 100 acres
1 Salaries			
1.1 Caretakers at 4,500 per month	54,000	108,000	108,000
1.2 Manager at Rs. 6,000 per month	-	-	72,000
1.3 Benefits on salaries at 15 %	8,100	16,200	27,000
1.4 Coconut for use 90 nuts per head at Rs. 5.50 per nut	500	1,000	1,500
2 Owner visits : 12 at Rs.200 per visit	2,400	2,400	2,400
3 Maintenance watch huts, store & buildings	1,500	2,500	5,000
4 Incidental Expenses	1,000	1,500	2,500
Total	67,500	131,600	218,400

The overheads per acre, and the total cost of production at the three input intensities indicated on Table (2), are worked out below at 10 acre intervals.

Table 4.

C.O.P. by Size Class and Input Intensity : Rs./Acre

Size acres	Overhead s	Variable Costs			Total C.O.P.		
		I	II	III	I	II	III
10	6,750	840	1,665	4,800	7,590	8,415	11,550
20	3,375	"	"	"	4,215	5,040	8,175
30	2,250	"	"	"	3,090	3,915	7,050
40	3,290	"	"	"	4,130	4,955	8,090
50	2,632	"	"	"	3,472	4,297	7,432
60	2,193	"	"	"	3,033	3,858	6,993
70	3,120	"	"	"	3,950	4,785	7,920
80	2,730	"	"	"	3,570	4,395	7,530
90	2,427	"	"	"	3,267	4,092	7,227
100	2,184	"	"	"	3,024	3,849	6,984

1. - No fertilizer, no cultural practices

2. - No fertilizer, but with cultural practices

3. - Fertilizer and cultural practices

The incomes per acre at current price of Rs.5.50 per nut for the three input intensities are:

	Nuts/acre	Income/Rs
I	1,000	5,500
II	1,500	8,250
III	3,000	16,500

Deducting the respective c.o.p.s. from income, the following margins per acre are arrived at:

Table 5.

Margin per Acre: Rs.

Size acres	I	II	III	Class III	
				% Profit on C.O.P.	Total income Rs.
10	(2,090)	(165)	4,950	43	49,500
20	1,285	3,210	8,325	101	166,500
30	2,410	4,335	9,450	134	283,500
40	1,370	3,295	8,410	104	336,400
50	2,028	3,953	9,068	122	453,500
60	2,467	4,392	9,507	136	570,420
70	1,550	3,465	8,580	108	600,600
80	1,930	3,855	8,970	119	717,600
90	2,233	4,158	9,273	128	834,570
100	2,476	4,401	9,516	136	951,600

() -> loss

Input Intensity, Size Class and Profitability Under Monocropping and Absentee Ownership

The financial performance of the lands are summarized in Table 5. The following conclusions could be drawn from the results in the table.

1. The profitability per acre increases with the increasing size class of the land. The lower ratio of profits at 40 acres and 70 acres, over the previous size class are due to additional overheads incurred by engaging an additional caretaker and a manager. The percentage of profit over cost of production, increases from 43% to 10 acres to 136% at 100 acres.

8,250	1,200	II
16,200	3,000	III

2. It is seen from the table that well managed lands (class III) yields much higher profits per acre than the lands of other two categories. A further process of averaging shows that, on the whole, a class III land generates a profitability 2 ½ times more than that of a class II land and 5 1/2 times more than that of a class I land.
3. At size class of 10 acres, neglected lands result in a loss. Even the neglected lands, yield some profits, by grace of nature, for 20 acres and above. 10 acre land gives a profit of Rs. 4,950 per acre, when fertilizer is applied.

Given the fact that good management results in higher profits, we have to delve deeper into economics in order to find out why so many lands lie neglected. We could surmise that the following are some of the more weighty considerations that motivate and direct the activities of the absentee owners.

- (a) Nett income per acre versus total nett income from the land. We have seen that, even a 10 acre land yields a profit of 43% on c.o.p. under good management. But what is important is the total nett profit generated by the land. The total nett income derived from a 10 acre land is Rs. 49,500 which works out to Rs. 4.125 per month. This income is not sufficient to cover the living expenses of the owner. Except for the fact that he owns a saleable asset of increasing value, his income from land is less than that of his caretaker. The total wages and benefits of his caretaker works to about Rs. 5,000 per month. At a minimum wage of Rs. 150 per day, the income of a manual worker works out to Rs. 54,750 per annum. In order to obtain a nett income sufficient to support reasonable living standard and allow savings for the development of land and its regeneration, the owner should receive at least thrice the above income. He should possess at least 20 acres under monocrop conditions. At a low total income, an owner may be reluctant to devote time and money for a land less than 20 acres in extent.
- (b) The neglect of lands, in most cases can happen when the main source of income of an absentee owner is non-agricultural in nature. He has only partial interest in land. The neglect of lands may occur with the successive generation, when the children find more lucrative employment in other private enterprise or in paid jobs with a more secure and higher income than could be earned from coconut cultivation. In fact very few of the sons of pioneering cultivators,

have adopted agriculture for their livelihood. Even if they have a more than a passing interest in agriculture, they may not be willing to sacrifice a fixed income derived from paid jobs for changing fortunes of agriculture.

(c) Fluctuating prices are one of the major factors in coconut farming. The financial profitability has been calculated at a farm gate price of Rs. 5.50 per coconut. This is a fairly favourable price. It has been calculated that the farm gate price that covers the cost of fertilizer application is Rs. 3.13 per nut, at an incremental annual yield of 1000 nuts per acre. If the weather conditions are favourable in the current year, it will result in high national production in the succeeding year and there occurs a slump in prices. Though we have solved the technological problems of production, we are not in a position to solve the economic problems of production. At very high levels of production, when the local demand is satiated, there will be a very large surplus available for exports, and the prices will reach very low levels, under which, fertilizer application becomes no longer economic. It should be pointed out that, only around quarter of the extent under coconut receives constant fertilizer application. There are low cost producers, who, through their crop per acre is less than that of well managed lands, could manage to more than cover their cost of production at low prices. There is a fair degree of financial risk in fertilizer practice in a tree crop commodity such as coconut, with an average one year time lag between application of fertilizer and its response, and where the supply is not controllable. In an annual crop such as paddy, one could always temporarily leave the land fallow. But in coconut the only option available is to abandon fertilizer application temporarily.

(d) Another factor that leads to neglect of small coconut lands owned by absentee owners, is the inordinately high prices of land. For those who hold the land as an asset of rising value with the intention of disposing them at a future date, the agricultural condition of the land is not important. In any case, palms may be uprooted, when the land is fragmented for housing construction. In the current land markets, lands are purchased by those who can afford, in order to gain from the rising value of land. Thus the capital is directed not to agriculture, but to more lucrative pursuits.

The management of land also has become more difficult with the scarcity of skilled workers such as pluckers and huskers. With the rising level of education, the younger generation is moving away from what are considered as socially degrading jobs, nor would they tolerate their parents continuing in such jobs.

There are other social problems such as stealing, unclear title etc, which inhibits intensive land development. But for the four reasons given above, which are economic in nature can be considered as the most important inhibitors to the development of the coconut lands.

At this juncture, it is opportune to explore as to what possible management and organizational methods are available to reduce the overheads under monocropped conditions.

It has already been pointed out that at least 20 acres of monocropped coconut (with fertilizer application) are necessary to ensure a sufficient nett income for a reasonable living and for the maintenance of the land at a standard level of inputs. It is seen from table 4 that security overheads are halved at 20 acres and the margin over c.o.p. increases by 168% (from Rs. 4950 to 8,325 per acre).

If parcels below 10 acres are in contiguous blocks, or at least situated reasonably close by, the following management options could be considered.

- (a) Join hands with other owners for supervision and marketing. Such a system could reduce the number of owner visits and may ensure more bargaining power to the smallholders.
- (b) Legal lease of land to individuals/recognized societies/organizations in the locality, provided they have developed ability, and interest in cultivation, management and marketing.

The development of village level management organizations to cater for such management ventures will become an essential pre-requisite for the success of the scheme. The problems of security and scarcity of labour could more easily be tackled by such localized organizations.

Sri Lanka has a long history of cooperative activities in coconut processing. It is worthwhile to explore the possibilities of establishing localized land management units under the aegis of the coconut cooperatives.

These and other possibilities will be further discussed, after exploring the economics of intensive land use and farm level processing.

CHAPTER 4

Intensification of land use under coconut: Farming systems

The intensification of land use by the introduction of farming systems has been accepted as the contributory factor of the first order to increase the return per unit of coconut land.

The increased nett income results from

- (a) Additional income from intercrops
- (b) spreading of overheads
- (c) reduction in variable costs involved in cultural practices such as weeding, harrowing, etc.
- (d) increased coconut crop from neglected lands due to constant attention and inputs directed to intercrops.

Coconut palms is a bad land user. The root zone of coconut is smaller than its canopy zone. Only around 25% of the soil mass is utilized under monoculture. Despite the large canopy, the mature coconut palm intercepts only 44% of the solar radiation during the peak light period (10:00 to 16:00 hr).

The intercrops can effectively utilize the penetrating light upto about 5 years and beyond 25 years of the age of the palms.

Successful intercropping has been practiced in home gardens from ancient times, though not in large commercial scale. The Coconut Research Institute has identified around 290,000 acres (117,408 ha) of coconut lands as agronomically suitable for intercropping based on criteria such as rainfall, soil type and age structure of the palms. (Coconut based Cropping Systems: CRI, June 1988) assistance schemes by the Coconut Cultivation Board were in operation since 1978 for growing perennial intercrops such as coffee, pepper and cacao.

Successful intercropping, apart from the agronomic considerations, requires,

- a. constant attention
- b. market awareness
- c. high labour inputs
- d. knowledge and experience and,
- e. more capital inputs.

Higher the return, higher the capital involvement. In order that both the coconut and intercrops thrive, it is essential that there should be no competition between the coconut and intercrops for moisture, light and nutrients. If this basic tenet is not observed, the results can be disastrous to both coconut and intercrops, and the loss of effort and money to the owner.

The management of coconut is relatively much easier than the management of farming systems, and the labour inputs are minimal. The basic question is, whether the absentee owner with part time interest can be considered as the appropriate persons to engage in mixed farming. The caretaker is not the ideal person to manage his intercrops. Those owners who have an interest in agriculture and keen enough to learn may manage mix cropping successfully, if they expect to each the major part of their income from land.

We have already seen that, at least 20 acres of coconut under micro culture are required to earn a satisfactory income. The increased income from the adoption of farming systems, will result in the economic plot size being much smaller. In the following analysis, the returns from some popular intercrops are added to that from coconut in order to study its effect on the economic size of the parcel.

It is not aimed here to make an exhaustive study of all the possible cropping systems under coconut. Only a few systems are discussed and the price is high. The price is high because of the high cost of labour and the high cost of the intercrops. The other crops are selected for their high returns and low labour requirements. The price of the intercrops is high because of the high cost of labour and the high cost of the intercrops. The other crops are selected for their high returns and low labour requirements.

In the following table, cost and returns of some selected intercrops per acre of coconut are worked out. The next step is to introduce a cropping system on a well managed 10 acre coconut land. Out of the many combinations possible, the following combination of annual food crops is selected as an example.

Some of the intercrops grown under coconut in Sri Lanka are indicated in the following table.

Table 7

Popular Intercrops

	Age of palms		
	Upto 5 Year	25 - 50 yrs	50 and over
1	Banana	Coffee	Pine apple
2	Pine apple	Coca	Banana
3	Passion Fruit	Pepper	Papaw
4	Ginger	Yams	Passion fruit
5	Turmeric	Ginger	Chilies
6	Papaw	Turmeric	Yams
7	Pasture	Pine apple	Pasture
8	Chilies	Banana	Cloves
9	Vegetables	Papaw	Citrus
10	Yams	Cloves	
11	Betel		
12	Groundnuts		
13	Cowpea		

Out of the above intercrops, banana and pineapple are easily marketable and the price is not subjected to fluctuations. The other crops are subjected to price fluctuations. Crops such as betel, vegetables and chillies require intensive attention and irrigation. Intensive crops are not grown on large scale.

In the following table, cost and returns of some selected intercrops per acre of coconut are worked out.



Table 8
Cost and Returns: Rs. Per acre of coconuts

Crop	Man-days required	Total variable cost	Output	Gross Income	Gross Margin
Annuals					
1 Sweet Potato	41	9,445	3MT	18,000	8,555
2 Manioc	20	10,920	7MT	56,000	45,080
3 Ginger	147	84,495	6MT	360,000	275,505
4 Kiriala (Santhosama)	180	33,000	5MT	75,000	42,000
Semi-Perennials					
5 Pine apple					
yr.	1	63 (48,505)	-	-	-
			fruits		
	2	112 25,450	6,000	46,560	21,110
	3	114 22,300	10,000	73,500	51,200
	4	114 22,350	11,000	82,500	60,150
	5	112 22,400	120,000	84,000	61,600
6 Banana					
	1	46 16,766	0.74 MT	7,400	(9,366)
	2	21 7,627	1478MT	16,252	8,625
	3	23 7,877	1478 MT	16,252	8,625
	4	23 7,877	1478 MT	16,252	8,375
	5	23 7,877	1478 MT	9,290	1,413
() Negative					

Source: Based on crop budgets prepared by Mr. Buddhi Jayasuriya, Manager Projects; Coconut Cultivation Board.

It is not aimed here to make an exhaustive study of all the possible cropping systems under coconut. Our aim here is to find out, how the increased returns from intercrops, improves the viability of the coconut. The six crops indicated in the table are popular, could be grown under rainfed conditions and involve relatively less labour. We have already seen that a 10 acre monoculture land does not generate sufficient income for a living.

The next step is to introduce a cropping system and study its effect on total nett income, on a well managed 10 acre coconut land . Out of the many combinations possible, the following combination of annual food crops is selected as an example.

Sweet potatoes : 2 acres under coconut
 Manioc : 3 " "
 Kiriala : 2 " "
 Ginger : 3 " "

 10
 ===

Table 9

Annual cost and returns per annum : Rs.10 acre farming system

Crop	Total	Income	Gross Margin
1 Coconut	48,000	165,000	117,000
2 Sweet Potatoes -2 acres	18,890	36,000	17,110
3 Manioc - 3 acres	32,760	168,000	135,240
4 Kiriala - 2 acres	66,000	150,000	84,000
5 Ginger - 3 acres	253,000	1,080,000	826,500
	419,150	1,599,000	1,179,850

Less		
6	Over heads : Mono culture coconuts (one caretaker etc.)	67,500
7	Interest on short term capital : (22% p.a. on Rs. 420,000 for 10 months)	770,000
8	Additional management for intercrops at Rs. 5,000 per month	60,000
9	Nett margin per 10 acres	975,350
10	Nett Return per acre	97,535

The introduction of the cropping system has increased the nett return available to the owner from Rs. 49,500 to Rs. 97,535 after allowing for additional overheads for intercropping. His nett return has doubled in the example. The combination of crops in the example, are relatively easy to manage. However, allowance has been made to engage an additional person for the management of intercrops, at the level of a diploma holder in agriculture. Such a person could manage, much more than 10 acres of intercrops.

For 20 acres of well managed coconut, we could double the respective intercropped area, and see the effect of spreading of the overheads.

Returns of the cropping system at 20 acres of coconuts.

1. Gross return from coconuts and intercrops Rs. 1,179,850 x 2	2,359,700
2. Overheads on coconuts	67,500
3. Interest on short term capital	144,000
4. Additional overheads on intercrops	<u>60,000</u>
5. Nett return for 2 acres	<u><u>2,088,200</u></u>
6. Net return per acre	<u><u>104,410</u></u>

The doubling of the extent has resulted in increasing the nett return upto Rs. 104,000. The total nett income from 20 acres, per month works out to Rs. 174,000. In the case of 10 acres, the nett income per month is Rs. 81,279 as against Rs. 4,125 in the case of monoculture. Although the income is not generated on a monthly basis as in the case in a professional job, the income levels are attractive enough to support a comfortable living and to provide for development needs.

Apart from the risks involved due to price instability and very severe droughts, the cropping system given above is not sustainable annually, as the same crops cannot be cultivated in the same land, over and over again.

However, this is not an insurmountable difficulty, since many suitable farming systems are available, incorporating annuals, perennial, animal husbandry, bee keeping etc. There are further possibilities of cultivating more exotic crops. What has been proved is that intensive farming can generate much higher incomes than most of the monthly paid jobs, to those who have the inclination, ability, knowledge and enterprise to earn a living from the soil.

The returns from monoculture could be further improved upon by adopting tapping for sap. Tapping the palms for fermented toddy for the distillation of arrack is legally confined to a limited area along the western coastal belt. In this area, palms for tapping are leased to licensed toddy contractors at rates averaging at Rs. 350 per palm. The contractor will have to fertilize trees at his expense. The total lease money represents a net income to the owner, at Rs. 22,400 (64 palms) net margins ranging from Rs. 4,950 to Rs. 9,500 per acre of coconut.

Usually a tapping unit is considered as 100 palms, constituting one aerial rope way (atura), which could be tapped by one tapper. Tapping for sweet toddy (unfermented toddy) for the production of treacle (coconut honey) or for vinegar could be adopted under license in non-tapping areas.

Tapping 100 palms (about 1 ½ acres) for sweet toddy is incorporated into our previous example, in order to study the improvement in the net income.

Table 10

Cost and Return for tapping 100 palms for sweet toddy :

1.	Implements : Tapping box, tapping knives, wooden mallets, barrels and buckets.	6,000
2.	Clay pots : 200 at Rs. 12/-	2,400
3.	Aerial rope way : (multistand double rope way)	5,000
4.	Roping up and repairs.	3,000
5.	Husk laddering of selected palms	1,500
6.	Seasoning of flower and tying up	1,000
7.	Prevention of fermentation : limit of pots	1,000

8.	Tapping wages at Rs. 7.50 per gallon x 10,000 gallons	75,000
9.	Boiling up of sweet toddy to make syrup (110 degrees for 30 mns.) 40 gallons per day (firewood, husk and fronds available in estate)	-
10.	Four vats for boiling and ladles	4,000
11.	10,800 bottles at Rs. 10	108,000
12.	Wages : 4 persons working at 3 hours/day at Rs. 150 per day per person, for 270 days	60,750
13.	Sales expenses at Rs 2 per bottle	21,600
	Sub Total	289,750
14.	Interest on initial capital cost of Rs. 30,000 at 22 p.a. for 3 months	1,650
15.	Supervision at Rs. 100 per day	27,000
	Total Cost	318,400
16.	Cost per bottle	29.48
17.	Sales income : at Rs. 45 per bottle	486,000
18.	Income	167,600
19.	Less - Income from coconut from 200 palms : 4688 nuts at Rs. 5.50 per nut	25,784
20.	Incremental nett income	141,816

The tapping project has increased his nett income per annum by Rs. 142,000

The final nett income position is as follows.

	<u>10 acres</u>	<u>20 acres</u>
1. Monoculture	49,500	166,500
2. with monoculture and intercropping	975,350	2,088,200
3. with intercropping and tapping	1,117,350	2,372,200

* 100 palms tapped

** 200 palms tapped

The income per acre in a 10 acre land is Rs. 111,735 and at 20 acres, it increases to Rs. 118,610 in the third option. The monthly nett incomes (though no accrued monthly) from the total land are Rs. 93,113 and Rs. 197,683 respectively.

The incomes earned from intensive farming are much more attractive than those earned in monthly paid professions. However, the risks and troubles inherent in farming and escalating land prices are the major factors that inhibit the growth of agricultural enterprise. Trading enterprises, though risky, yield higher profits, and is a popular option for investment, in preference to agriculture.

It has already been pointed out that the sale prices of land ranges above one million rupees per acre resulting in an interest income of Rs. 160,000 per acre at an average rate of 16% p.a. for savings. Short term saving rates range from 11 to 14% p.a. We have already shown that an easily manageable farm model for 20 acres can generate as much as Rs. 119,000 p.a. per acre, representing an interest rate of 12% p.a. on land value.

More intensive farm models at higher level of size classes, will result in much higher incomes per acre. The income generation ability per unit could further be augmented by adopting agro processing for coconuts and other products of the farm, at farm level or at economic levels of combined acreages.

5. Husk laddering of selected palms	1,500
6. Seasoning of flower and tying up	1,000
7. Prevention of fermentation : limit of pots	1,000

CHAPTER 5

Farm Level Processing and Value Addition

A fair degree of specialization prevails in the processing and marketing sectors of coconut. The production of copra, coconut oil, desiccated coconut, charcoal, brown fibre, fibre products, timber products and sap products are the traditional activities of processing in the coconut sector. Though most of the traders and coconut processors are coconut land owners, their major source of income comes from the processing activities. Therefore, their efforts and resources are directed to processing enterprises than to intensive farming.

Intensive farming requires specialized skills as well. Specialization in the processing sector has helped to maintain the quality of the product and has reduced the risks of failures. Many entrepreneurs would prefer to concentrate their economic activities to a few selected fields where they have skills and other comparative advantages. The characteristic of specialization is clearly seen in the trading activities as well. The owner managed small industrialists concentrate on processing, leaving export trade to the more specialized trading and export firms. Historical reasons played an important role in this process of specialization. Concurrent with the specialization, the reverse process of the trading firms entering into industrial processing and a gradual process of vertical integration are also clearly marked in the industrial evolution.

Many coconut industries in Sri Lanka were pioneered by the big trading firms of coconut products, the process beginning in the colonial past. The well known and the most successful example is the pioneering of the desiccated coconut industry in Sri Lanka by J.H. Vevasseur and Co. in 1890s.

Another well known example is the opening up of the coconut triangle by the indigenous entrepreneurs in Sri Lanka during the 19th century utilizing the capital accumulated from trading and service activities such as arrack renting and transport services. In both cases, accumulated capital, the entrepreneurship were available. Emulating the pioneering examples of Ms. Vevasseur and others, the more enterprising among the coconut planters entered into processing of coconut oil, desiccated coconut and fibre. However, for them at that time there was no felt need to go into more intensive cultivation of their coconut lands. Coconut was, the only crop they were interested, in the processing of which they earned ample profits.

The cooperative movement in the coconut was the product of the Great Depression of the 30s, and the cooperative spirit of a few pioneers. The movement started with copra processing, for which the support of the government gave impetus and subsequent to the Second World War, entered into processing of coconut oil, desiccated coconut and brown fibre. The movement has not expanded beyond a certain stage and has not yet entered the export trade. It is much easier for a trading firm which has already acquired expertise in trading and having established markets to go in for vertical integration by acquiring of coconut estates and starting processing industries than vice versa. A local industrialist would find it extremely difficult to enter into established markets on his own effort.

Cooperative sector in coconut

The coconut cooperative sector in Sri Lanka currently consists of 10 cooperative societies engaging in coconut processing. There are 3,191 members owning coconut lands covering 27,432 acres (11,106 ha). Five societies among them own 7 desiccated coconut factories. The cooperative share of the desiccated coconut exports is about 15%. The other products processed are, copra, coconut oil, charcoal, fibre, brushes and soap. The cooperative sector has not entered into export trade or trading in coconuts in the local market.

A careful examination of the small scale industrial development in the past, reveals that the two basic factors that contribute towards development are, capital accumulation and the presence of entrepreneurship. Even if the capital could be organized through financing institutions, no industrial development could start without the presence of entrepreneurship. In the final analysis, human resources development directed to improve entrepreneurial abilities becomes the pre-requisite of first order for further development.

Sources of capital accumulation in coconut

Mixed farming, coconut trading and traditional farm level processing could serve as source of capital accumulation to develop further income generating activities in the coconut sector. The present low income generating capacity of coconut does not result in sufficient savings for its sustenance. We have already shown the profit potential to be achieved through mixed farming.

Coconut Trading

The coconut crop arising from the holdings owned by the cooperative members is around 82 million nuts, constituting 8% of the total coconut crop of the country. The rest of the coconuts apart from on farm consumption, passes

through the hands of private traders, who purchase coconuts from the landowners and supply to household consumption and processing industries. More than half the coconut production is utilized as household food nuts. The marketing channels are long, and on the average, coconut at retail level is sold at double the price at the farm gate. Though the system on the whole works to the disadvantage of the smallholder due to the lack of his bargaining power, it has to be admitted that the trader performs useful functions very efficiently. He is available as a source of credit in an emergency and he maintains the quality of nuts supplied, by a process of selection. The high incomes of the wholesale nut traders arise on profit margins at a very high turnover. The coconut crop is harvested bi-monthly and the income flows of a monoculture farmer is controlled by the period of harvesting. The average margin of a wholesale dealer is around 15-20% on his turnover. A food nut wholesaler supplying a lorry load of coconut weekly, (8,000 dehusked nuts per 5 ton lorry) at current farm gate price of Rs. 5.50 per nut, spends Rs. 2.3 million to purchase 416,000 coconuts per annum and earns around Rs. 343,000 as profit (Rs. 6,600 per week). He handles 416,000 nuts per annum, which is equivalent to the harvest of coconuts from 139 acres (56 ha) of fertilized land. It requires 36 acres of well managed coconut to earn an equivalent annual profits. A small coconut trader would require at least one acre of land to store his coconuts, and a lorry for transport. He can start his operations with an initial circulating capital of about Rs. 100,000. A copra kiln is a useful adjunct to any nut trader. His investment requirements are much less than that of a land of 36 acres. The cooperatives have yet not entered this field of activity as it requires intensive daily attention, and involves competition with private nut traders who are more attentive and are in a position to give informal loans to landowners at spot notice.

Copra Processing

Good quality copra, has always been associated with big coconut estates and has claimed premiums over other commercial grades. The possession of a copra kiln is advantageous to an estate on account of (a) value addition to the product, (b) spreading of managerial overheads, (c) retention of coconut water and shells in the estate and (d) the increased storeability of the product. The owner also increases the options available in the disposal of nuts, depending on comparative prices of food nuts and coconut oil.

The average commercial grade copra is one and half times more valuable than the coconut and in the case of edible grade white copra, is twice as valuable as the coconuts. However, the scope of copra production in Sri Lanka has been reduced over the years due to the shortage of coconuts. A copra kiln of 5 tonne output per week utilizes 1.3 million nuts to keep it fully occupied, and requires a feeder area of 433 acres (175 ha) of coconut.

It would be more advantageous to operate such a centralized kiln, than operating smaller kilns in very estate, provided nuts are transported dehusked. The husks should remain in the estate to be used in mulching and moisture conservation. The annual trading budget for a traditional copra kiln of 260 MT capacity is worked out below.

Table 11

Trading Budget : Copra Processing

Annual output : 260 MT of which

- (a) estate copra 80 percent
208 MT
- (b) average grades 20 percent
52 MT

260 MT

Capital Costs

- Coconut water tank and rough cemented Compound 100,000
- Kiln 300,000
- Copra store 100,000
- 600,000
=====

Variable costs

1. coconuts, 1.3 million at Rs. 5.50 per nut 7,150,000
2. Transport of dehusked nuts : 163 lorry loads at Rs. 500 per load 81,500
3. Dehusking : at Rs. 150 per 1000 nuts 195,000
4. Copra curing : splitting coconuts, loading and unloading kiln, turning, firing, removal of shells, selsection and bagging : contract rate of Rs. 175 per 1000 nuts 227,500
5. Bags : at Rs. 20/bag/yr 12,000
6. Consumables : cane baskets etc. 10,000

7.	Sales & Transport costs	
7.1	52 lorry loads transported to colombo at Rs. 1,200/ per load	62,400
7.2	Brokerage and lot fees etc. Rs 10.MT	2,600
		<u>7,741,000</u>
8.	Overheads	
8.1	Salary of copra supervision 50% allocation at Rs. 3000 per month	36,000
8.2	maintenance	25,000
8.3	Depreciation 2/12 percent p.a.	15,000
	Total overheads	<u>76,000</u>
	8.4 Total Cost	<u>7,817,000</u>
9.	Sales Income	
9.1	Superior grades : at Rs. 41,500 / MT	8,632,000
9.2	Ordinary grades at Rs. 33,000/MT	1,716,000
9.3	Extra income from 50 percent of shells at Rs. 200 per 1000 percent	130,000
10.	Total sales income	<u>10,478,000</u>
11.	Nett Profit	<u>2,661,000</u>

A centralized copra kiln for a feeder area of 433 acres, yields an additional nett profit of Rs. 6.145 per acre of coconut, If established in a bigger estate, no additional overheads on account of security and management need be incurred.

As the production of charcoal by open pit method in estates, results in environmental pollution, the production has to be done through the utilization of

Waste Heat Recovery units. The economics and the other advantages of using Waste Heat Recovery technology have already been discussed elsewhere. (Please refer 'Energy Consumption in Coconut Processing by G. Breag, J. Cropley and A. Marter. Proceedings of the XXXIII Cocotech Meeting 17-21 July 1995-APCC pages 113-133).

The attractions of the traditional process of making copra are its simplicity and the low capital involvement. The surplus shells over the energy requirements for copra drying were converted into charcoal by using the pit method. The W.H.R. technology can be successfully used for the production of high quality copra through the use of the energy released in carbonization of shells, and the technology is virtually pollution free. The traditional process of copra making utilizes 0.4 tonnes of shells as energy source. The remaining 0.6 tonnes of shells is converted into 0.15 tonnes of charcoal by pit method, with 7.275 MJ of heat lost to the atmosphere, creating pollution.

The traditional copra kiln in our example, producing 260 MT of copra, releases sufficient shells to produce 65 MT of charcoal (20,000 fall shells = 1 MT of charcoal). However, 40% of these shells are burned to generate the heat for copra curing. The W.H.R. process converts the entire shells to charcoal, and utilizes the heat generated in carbonization to dry copra, thus resulting in an incremental production of 26 MT of charcoal, valued at Rs. 234,000 p.a. The capital costs and overheads would be higher than that of the traditional process. Considering the fact that the production of charcoal should be free of pollution, if it is to continue, and the fact that it results in improved quality for copra and charcoal, copra production cannot afford to adopt traditional process in the future.

Coconut Oil

The big coconut oil mills are concentrated in and around Colombo, the cost of production is high and they have to compete with the smaller mills situated more closer to the source of copra. There is excess milling capacity in the country, and the proliferation of small baby expellers in the country since 1980s has aggravated the situation. The quality of oil has deteriorated not so much as a result of the baby expeller, as the bad quality of copra produced in small kilns. There appears to be no necessity to carry the production of coconut oil to the estate level in view of the excess capacity in the country.

Fibre Milling

The number of fibre mills in operation has decreased over time, though there is no apparent reduction in the quantity of fibre produced. This has occurred due to the unhygienic working conditions, scarcity of workers, and low profitability. More efficient mills have remained in operation. The processing of fiber as it is practiced in Sri Lanka, prevents the utilization of the husks in the estate as a means of moisture conservation. It is not the fibre strand that is required for moisture conservation, but the fibre dust. Mountains of the fibre dust accumulate at the mill sites. A market has opened up in the recent times for the export of fibre dust. What is more important is the fact that fibre dust should remain in the estate to be used in moisture conservation and as a source of potash to the soil. A standard size traditional fibre mill utilizes husks of 10,00 nuts per day, requiring a feeder area of 870 acres (352 ha) and produces 325 MT fibre p.a. The wet weight of fibre dust accumulated at the mill is around 585 MT involving 117 lorry loads for its removal. The site of a fibre mill has to be selected based on the availability of 3 phase electricity and water for retting of husks. As such we find fibre mills concentrated around more favourable locations, in the coconut areas. Under the present technology, farm level processing of fibre is not a worthwhile economic activity.

The tapping of coconut sweet toddy in order to produce coconut honey or vinegar, is a very attractive option for farm level processing as has been already discussed in the previous chapter.

The addition of value at farm level or in central locations in the feeder area need not be confined solely to coconut products.

The practice of animal husbandry under coconut requires efficient collecting centres. The conversion of milk to curd has been successfully practiced at farm level from the ancient times.

Some of the intercropped produce such as pineapple and passion fruits are purchased by canning factories and manufacturers of cordials and other bottled beverages. But intercrops such as ginger and turmeric could easily be dried at farm level, thereby increasing their farm gate values. Drying such products at farm level enhance storage capability and protects the farmer from the normal price decline during harvesting time. The appropriate location of processing is determined by the requirements of the processing technology adopted and the availability of services such as power and the presence of skills that are required.

Waste What has been attempted in this chapter is to show some profitable avenues available for farm level processing or in centralized locations in the feeder area. Intensification of economic activities at farm level requires capital, entrepreneurship, knowledge and skills. From a historical perspective, it was the commercial capital acquired in trading, that was later ploughed back into industries. Mixed farming and some traditional farm level processing activities generate additional incomes and savings, building up a sound base for further intensification of farm level activities at higher levels of technology.

Coconut Oil

The practice of animal husbandry under coconut requires efficient collecting centres. The conversion of milk to curd has been successfully practiced at farm level from an ancient time. The cost of production is high and they have to compete with the curd more closer to the source of copra. There is excess milling capacity in the country, some of the finer topped products such as biscuits and pastries are purchased by catering firms and manufacturers of confectionery and other confectionery. But farmers produce curd and biscuits could easily be made at farm level thereby increasing their farm gate prices. Drying and products at farm level enhance storage capability and protect the farmer from the normal price decline during harvesting time. The appropriate location of processing is determined by the requirements of the processing technology adopted and the availability of services such as power and the presence of skills that are required.

CHAPTER 6

Animal Husbandry in Coconut Lands

One promising variant in the mixed farming system is to combine pasture growing with cattle rearing. Sheep, goats, pigs and poultry are the other types of farming that could be undertaken. However, raising pigs, poultry and even goats could be practiced under more restricted space conditions than available in coconut land. It would still be preferable to practice large scale farming of goats, pigs and poultry for reasons of sanitation and the utilization of farm yard manure. Apart from the large commercial farms supplying eggs and meat, small scale raising of such animals is found to be popular, in North Western Coastal belt.

Cattle raising has been practiced in coconut lands for a long time, though not on commercial scale. More often than not, in mature, monocrop coconut lands, the cattle is treated as a means of weed control and as a source of manure. In these lands, inferior indigenous cattle, graze on the natural grass cover under the coconut under a system of open grazing. The cattle more often than not, turn out to be a pest, eating the natural grass to the very root, thereby causing soil erosion, and it is a debatable point, whether the constant trampling of cattle hardens up the soil or loosens it up. Another practice adopted is tethered grazing where the animal could graze within the radius of the rope. Some estate owners allow the villagers to tether their cattle in coconut land, to obtain the benefit of manure. The animal does not add additional nutrition to the soil as such, but converts the wide spread herbage into a more readily nitrogen requirements of the palm. About 46 palms (out of 64 palms/acre) or 72 percent of the palms could thus be manured in a year.

The point to consider is whether the natural grass cover in an acre of monocropped coconut provided adequate sustenance for two animals, taking into consideration, the seasonal drought periods occurring in January- February, and in July - August. The early research at the Coconut Research Institute points to the fact that such natural grass cover has a carrying capacity of 2.3 hectares per animal. This it would required about 5 acres to adequately support one animal for one year. Thus an animal could only provide manure for 7% of an acre, sustaining itself on the natural grass cover. Clearly its diet has to be supplemented, from more drought resistant tree fodder from Gliridia (*Gliridia Sepium*) and the recently introduced ipil - ipil (*Leucaena Leucoce Phala*). Both these tree could be grown along fences or in rows. They are also important as providers of green manure to the coconut. CRI estimates that, 30 Kg of Gliridia loppings will provide the entire nitrogen requirement and 20% of the potassium and phosphorous requirement of

an adult palm. It would appear that Gliridia is a better option for providing manure than cattle under tree or tethered grazing on natural grass. Moreover it has been found that the natural grass is less responsive to fertilizer application.

All animal dung are rich in Nitrogen. The equivalent rates of organic manure, compared to urea (46% N) are indicated below.

· KG				
Urea Kg.	Cattle Manure	Goat Manure	Poultry Droppings	Fresh Gliridia Leaves
0.5	25	10	20	20
0.7	30	12	25	25
0.8	35	15	30	30

Source : *Coconut Cultivation, Mahindapala, R, Pinto J.L.J.G*
Coconut Research Institute, Sri Lanka

The problem faced by the big estates, is whether equivalent bulk in farm yard manure is obtainable in addition to the high transport and labour costs involved.

The decision to allocate a given unit of monocropped coconut land of suitable ago as between animal husbandry and intercropping, in the final analysis, resolves itself on the grounds of commercial profitability in the case of an individual owner, clearly, setting aside 5 acres of grown up coconut land, for one animal on free grazing on natural grass cover is not an attractive economic proposition.

There was a time in the past when such economic considerations were irrelevant due to the particular relationship that prevailed between agriculture and animal husbandry.

In the ancient times the cattle provided the motive power in paddy cultivation and in transport, and by necessity, agriculture was inseparable from animal husbandry . The question of comparative profitability as between animal husbandry and intercropping did not arise. The agricultural output was basically for home consumption and in a non-cash economy, costing was not an important factor. A home garden had all the useful crops grown on it, and in addition had cattle, providing milk and helping in agriculture. Beef eating was not a socially accepted habit. Milk products such as ghee, clarified butter and curd were always

taken along with rice meals. In the nutrients for his crops and sufficient land for open grazing was available. This mixed farming system had a natural balance at a low level of productivity, but provided the food needs of a limited population at a high level of productivity.

The diversification of animal husbandry from agriculture occurred over a long period of time due to the progressive depletion of open grazing grounds both by administration fiat during the British period, fragmentation and enclosing of land, introduction of mechanical power, growth of population and the rise of marketing economy.

It no longer became economically viable to raise one or two cows in a home garden due to problems of feeding and the need for daily attention, the labour usage being concentrated during planting and harvesting. Such agricultural pursuits could be carried out on part time basis, the owner being free to engage in other cash earning operations, But successful animal husbandry needs daily attention, and a minimum level of scale of operation. Thus it has to be engaged as a full time operation for a living.

Let us consider the minimum effort minimum cost option for a unit of 5 acre coconut land.

Characteristics : Free grazing, natural grass, no concentrate feeding, indigenous cattle.

Low productive (Sinhala) cow, purchased at Rs. 12,000/=

Milk output per 250 day lactation	90 Gallons or 405 Litres
Income from milk at Rs. 15/Litre	Rs. 6,075
Sale of Calf at the end of the year	Rs. 1,500
	Rs. 7,575
Labour input for milking, marketing and looking after the cow and the calf at one hour/day x at Rs. 200/day x 365 days	Rs. 9,125
Interest on the purchase price of cow at 15% pa	Rs. 1,800
Estimated total cost	Rs. 10,925
Estimated Loss	Rs. 3,350

(a sales value has not been imputed to grass)

This minimum cost solution turns out to be a loss, if labour is imputed a cost. Intercropping in a 5 acre plot could bring much higher profits, but at higher capital, labour and management inputs.

It has been estimated that growing manioc (cassava) could bring in following results.

Cost of planting, fertilizer application.

Weeding and harvesting 5 acre plot at Rs. 30,000/acre	Rs. 150,000
Sales income at 10,000 kilos/acre at Rs. 6/Kilo	Rs. 300,000
Profit	Rs. 150,000

However, it should be pointed out that this cultivation is not sustainable over long period, and causes much more soil erosion than raising a cow in the land.

The next step is to evaluate the available upgrading options the grass, animal, and management with a view to improve productivity and profits.

Though cattle is found in many a coconut land, cattle rearing integrated with improved pasture farming is of very rare occurrence. The factors to consider in a farming mix of cattle and pasture are :

- a) effect of pasture on the productivity of coconut.
- b) effect of coconut on the yield and the nutritive value of the pasture.
- c) efficiency of the animal to convert the pasture into animal products

The early experiments at the Coconut Research Institute on mixed farming related to growing improved pastures with improved stock. The low economic exploitation of the natural grass and its low response to fertilizer have been recognized at the inception of these experiments. The CRI has been very successful in introducing improved varieties of pastures, which are shade tolerant, fertilizer responsive and with no ill effects on coconut. The yield obtained with the application of 200 Kg. of Nitrogen/ha are given below on dry matter basis.

Species	DM/Kg/Ha/Yr
Bracharia miliformis (named CORI grass)	15,426
Digitanij decumbence	15,824
Setaria anceps	14,268
Paspalum notatum	13,193
Paspalum plicatulum	12,824
Eurocloa Mozambicensis	11,598
Paspalum commersonii	10,812
Brancharia mutica	10,666
Panicum coloratum	8,919

*Source : Integration of animal production and other crops into the coconut cropping system.
Ferdinandez D.E.F
Coconut Research Institute of Sri Lanka*

Substantial yield increases have been obtained at moderately high levels of Nitrogen application in the case of B. Miliformis and D. Decumbence, enabling these pastures to sustain 3.3 animals/ha - an increase in the carrying capacity by 7½ times over the natural grass cover found under coconut.

Pasture farming prevents soil erosion in slope lands and improves the soil due to increased permeability of root growth, and the building up of organic matter. It is best to plant pastures in the beginning of the rainy season. Vegetative propagation by planting cuttings at 15 to 20,000 cuttings/ha. After the initial harrowing of land and the removal of weeds, it is recommended to broadcast, 50 kg of saphpos phosphate per acre, and 100 kg of sulphate of ammonia and 50 kg of Muriate of potash, two weeks after planting. The pasture could be cut down to 6 inches in 6 weeks during rainy season, and once in 9 weeks during the dry season. Since cut and remove method depletes the soil at a faster rate than open grazing. It is advisable to recycle the dung to plots of cut grass in rotation.

It is now possible to evaluate the commercial performance of our model/under improved pastures.

The new characteristics are :		
(1)	5 acre (2.3 ha) coconut land	
(2)	Improved pasture farming	
(3)	Stall feeding by cut and carry method	
(4)	No change in the breed of animal	
(5)	Carrying capacity 7 cows	
The capital investment could increase as follow		
(1)	Establishing the 5 acre pasture plot	
	1.1 harrowing at Rs. 1200/acre	Rs. 6,000
	1.2 Fertilizer application (1 MT- average price)	Rs. 12,000
	1.3 Planting up & cuttings	Rs. 6,000
		Rs. 24,000
(2)	Water supply (well, pump, tank, hose etc.)	Rs. 35,000
(3)	Sheds for cows & calves (with rough cemented sloping floor & drains)	Rs. 25,000
(4)	Purchase price of 7 cows at Rs. 12,000	Rs. 84,000
	TOTAL	Rs. 168,000
Income and Running Expenses		
(1)	Sale of milk : 4056/cow x Rs. 15/L x 7	Rs. 42,525
(2)	Sale of 7 calves at the end of year at Rs 1,500 x 7	Rs. 10,500
	INCOME	Rs. 53,025
Expenses		
(3)	One person at Rs. 3,000/month	Rs. 36,000
(4)	Veterinary services, insurance etc.	Rs. 5,000
	Variable expenses	Rs. 41,000
(5) Overheads		
	5.1 Interest on capital at 15% p.a	Rs. 25,200
	5.2 Depreciation at 5% on shed & pump	Rs. 2,500
		Rs. 27,700

If one were to engage hired labour, our improved version results in an estimated loss of Rs. 15,675 per year. However, if the owner uses own labour, he earns an income of Rs. 20,325/yr, which works out to Rs. 1697/month, which is less than the maximum wage earned by a labourer.

The above example clearly establishes the fact that improving the animal carrying capacity per unit of land would not be worth while, without increasing the productive capacity of the animal.

The success of cattle rearing for milk depends finally on the efficiency of the animal to convert feed into milk. Various attempt have been made to improve the local herd by cross breeding with Indian animals as well as with temperate breeds such as Jersey, Frisian and Ayreshere, The increase in milk yield due to hybrid vigour in the F1 generation has found to be progressively declining in the subsequent generations. Therefore, in order to stabilize the hybrid vigour, three way rotational cross breeding programme has been introduced involving Sinhala (local), Sindhi (Indian) and Frisian breeds. As far back as 1952, pioneer cross breeding experiments using exotic breeds as the Jersey and Friesian on a foundation herd of Sinhala cows gave striking yield in the F1 generation at 270 to 323 gallons per location per cow. The milk yield increases to more than 3 times that of a Sinhala cow. The commercial viability of our third option could thus be worked out on the basis of improved pasture and hybrid herd of 7 cows at 3 times the milk yield of the indigenous cow.

We also could consider in addition the further possibilities of improving the nutritive value of the feed by introducing leguminous feed mixed with improved pastures. Apart from the economic factors discussed previously, the value of a feed finally depends on the animal preference. The mixed feed of legumes with pasture has been found to be acceptable to the animal.

The role of legumes mixed with pastures is important in Nitrogen fixing and in improving the digestibility of grass. They increase the protein content of the feed as well. Research at CRI has shown that legume centrosema pubecens fixes considerable quantitatives of Nitrogen and mixes well with grasses such as B. Miliformis, pangola and Guinea grass. The suitable legumes which could be grown as ground cover are :

- * pueraria phaseoloides (puero)
- * calapogonium mucunoides (Calopo)
- * centrosema ppubescense (Centro)
- * Macropitilum atropurpureum (Surato)

Sale of calves - at Rs. 3,000/each	42,000
TOTAL INCOMING	297,150

Studies also have been conducted on the mixing characteristics and animal preference of legumes such as ipil - ipil and gliardia, which could be grown as bush covers. These bush covers could be grown along fences or in rows and withstand the drought tolerably well.

Feeding of concentrates is very expensive and various studies have shown that increasing the concentrate does not bring in proportionate increase in the milk yield, and also could show adverse result on the quality of milk due to changes in fatty acids. It would be more economical to provide improved nutrition through mixed herbage, reducing the dependence on concentrates to the minimum.

Let us now evaluate the third option, available to a coconut land owner of 5 acres, who is willing to engage in milk production. The purchase of hybrid varieties of cows will increase the capital cost. More intensive management is essential. However, one person could still attend to all the activities in the diary farm of 7 cows.

The new characteristics of the third option are :

- * 5 acre farm with improved pastures and legumes.
- * milk yield at 3 times that of the indigenous stock.
- * stall feeding.
- * carrying capacity : 7 cows.

Capital Investment		In Rs
1.	Establishing 5 acre pasture cum legume farm	25,000
2.	Water supply	35,000
3.	Sheds	25,000
4.	Purchase of cows at Rs. 20,000/each	140,000
TOTAL		225,000
Income and Running Expenses		
1.	Income	
	1.1 Sale of milk 1215 L/cow x Rs. 15/L x 7	127,575
	1.2 Sale of 7 calves at Rs. 3,000/each	21,000
TOTAL		148,575
2.	Expenses	
	2.1 One person at Rs. 3,000/month	36,000
	2.2 Veterinary services, insurance etc.	10,000
TOTAL		46,000

3.	Overheads	
	3.1 Depreciation on pump & shed at 5% p.a.	2,500
	3.2 Interest on capital at 15% p.a.	33,750
		36,250
	TOTAL EXPENSES	82,250
	PROFIT	66,325
4.	Return on incremental capital (cost of land not included)	29%
5.	Break-even capacity	44.4%
6.	Pay back period (capital/profit + depreciation)	3.27 years

The overhead works out to 44% of the total expenditure. The dairy should at least work at 44.4% of the milk production to break-even. Of the 3 models the model of scientific dairy farming with improved pasture and improved breed turns out to be economic. At this juncture, it would be pertinent to study the returns to scale due to possible spreading of overheads. Suffice for the occasion to work out the profitability of a 10 acre farm. Though capital costs of establishing pasture, construction of sheds and the purchase cost of cows will double, there will be no need to increase the cost of water supply, as it could cater to 14 cows or more. On the running expenses, labour cost and services also will double. The new scenario would work out as follows.

Capital cost		In Rs
1.	Establish 10 acre pasture farm	50,000
2.	Construction of sheds	50,000
3.	Purchase of 14 cows at Rs. 20,000/each	280,000
4.	Water supply	35,000
	TOTAL	415,000
Income and Running Expenses		
1.	Income	
	1.1 Sale of milk - 1215 L/cow x Rs. 15 x 14	255,150
	1.2 Sale of calves - at Rs. 3,000/each	42,000
	TOTAL INCOMING	297,150

2.	Expenses	
	2.1 Two persons at Rs. 3,000/each	72,000
	2.2 Services	20,000
	TOTAL	92,000
3.	Overheads	
	3.1 Depreciation on pump & sheds - 5% p.a.	3,250
	3.2 Interest on capital : at 15% p.a.	62,250
	TOTAL	65,500
	TOTAL EXPENSES	157,500
	PROFIT	139,650
4.	Return on Capital	33.65%
5.	Payback period (capital/profit + depreciation) Rs 415,000/142,900	2.9 years
6.	Break-even capacity	40%

The salient economic features of the two units of scale, of the identical model are summarized below.

	5 Acre Unit	10 Acre Unit
No. of cows	7	14
Capital cost	Rs. 225,000	Rs. 415,000
Profits	Rs. 66,325	Rs. 139,650
Return of capital	29%	33.65%
Pay back period	3.27 yrs	2.9 yrs
Break even capacity	44.4%	40%
Ration of overheads to total cost of production	44%	41.6%

The doubling of capacity has resulted in a capital increase by 1.84 times, and the profits have increased by 2.1 times. The returns to scale are not very impressive.

Two common risks to both cattle husbandry and intercropping are drought and disease. Cattle rearing suffers less from drought than intercrops. In the case of prolonged droughts, cattle could be fed with concentrates and tree fodder. However, a minimum supply of water is essential for drinking and washing. Cattle

are more prone to disease, particularly the more exotic breeds. Two virulent diseases of cattle are hoof and mouth disease and rinderpest which are highly infectious and could develop into epidemic proportions. The cattle diseases are treated by Veterinary Service Department which functions under the Ministry of Agriculture. A network of veterinary field staff functioning headed by a veterinary surgeon is found at district level and advice is obtainable at the Agriculture Service Centre of the Area.

Animal husbandry and pasture farming if accompanied with controlled grazing or stall feeding and the growing of leguminous crops, is more beneficial to coconut lands, than the continuous growing of some intercorps. It also prevents soil erosion.

The most important factor in favour of animal husbandry is the price stability of animal products when compared to price fluctuations found in some seasonal crops.

The coconut triangle has a much higher potential for the development of animal husbandry on commercial basis than the other areas of the country. One-third of the national herd is found in the coconut triangle. It has a high population density and a ready and an increasing market. Though the consumption of fresh milk at village level has declined due to break up of ancient balance between Agriculture and cattle husbandry, the consumption of locally produced and imported powdered milk has increased. The commercial food establishments are now increasingly catering to satisfactory infrastructure with respect to animal husbandry covering all its aspects such as milk collection, facilities for artificial insemination, extension and veterinary services.

The state institutions dealing in various aspects of animal husbandry and milk production are Ministry of Agriculture, National Livestock Board, National Milk Board, Coconut Cultivation Board and the Coconut Research Board. Apart from the state institutions, commercial establishments are found engaged in egg and meat production, production of concentrate feed, and in the production of spray dried milk powder.

Two major constraints to the development of animal husbandry are :

- * Absentee landlordism in big estates.
- * high initial capital cost involved in establishing animal husbandry on a commercial basis.
- * need to devote full time attention to the task.
- * risk of disease.

As mentioned previously, scientific and commercial animal husbandry requires full time attention. It is not a suitable vocation for part time agriculturists and absentee landlords. Although it involves high initial capital outlay, we have already seen from the evaluation in our models, that after allowing for 15 % interest per annum on capital, the project gives a minimum return of 29% on the investment. The invested capital could be recovered in less than 3 ½ years. Such projects should be attractive to lending institutions.

A further attraction is now found in the possibility of bio-gas production. The first unit was tested by the Industrial Development Board in 1974. Proven technology with updated versions are now available. The dung from seven cows is capable of providing all the necessary energy for cooking and electricity in the household and dairy unit.

Given the tolerably satisfactory infrastructure now available in the coconut triangle, the impetus to animal husbandry has to now come from the organization of coconut holders. One success story demonstrates what the smallholder could achieve by organizing themselves. The example referred to is the "Milk Producers Cooperative Societies Union in Chilopoda" in the Centre of the coconut triangle. This union comprises 118 primary societies constituting about 8000 milk producers who are resident in their coconut holding. Apart from milk, they produce curd and butter, yoghurt and ghee. In addition to the collecting and marketing facilities provided to the members, the union has successfully assisted in the provision of services such as :

- * Securing the assistance of Government Veterinary Department.
- * Organizing the imparting of Scientific knowledge to members of the industry.
- * providing credit facilities
- * and facilitating the upgrading of stock

Time is now opportune for the large estate owners to organise themselves for the animal husbandry or to make their lands available to those who are capable and desirous of making animal husbandry a full time vocation for living.

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