

# ECONOMIC ANALYSIS OF COCONUT-BASED MIXED FARMING SYSTEMS

BY

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## ABSTRACT

Coconut-Based Mixed Farming System which evolved from the Central Plantation Crops Research Institute is one of the technologies recommended for sustainable coconut production. The economic analysis of this system for the period 1989-90 to 1997-98, realized a net return between Rs. 49,700 to Rs. 126,900. The Cash Flow Analysis performed using a discount rate of 14% realized the Benefit-Cost Ratio (BCR) of 1.36, the Net Present Worth of the system was Rs.286,500,, the Internal Rate of Return was 27.44%, and, the Pay Back Period was five years.

## INTRODUCTION

Coconut is a smallholder's crop in India and more than 90% of the five million coconut holdings in the country are less than one ha in size. These smallholding coconut farms, often do not provide adequate income to the dependent families (Das, 1991). They do not provide gainful employment opportunities for the family labor throughout the year. However, there are possibilities for increasing the productivity and net returns from coconut stands by raising compatible subsidiary crops and integrating livestock (Gopalsundaram *et al.*, 1993). Adoption of coconut based farming systems is one of the ways to augment the productivity by improving soil characters and coconut nutrition (Maheswarappa *et al.*, 1998) as well as the income per unit area.

One such system was being maintained at the Central Plantation Crops Research Institute, Kasaragod. This paper aims to test the economic worthiness of investment in coconut based farming system model under optimum management conditions based on experimental data.

## MATERIALS AND METHODS

The study was based on the field experiment entitled, "Coconut Based Mixed Farming Systems" in sandy loam soil at the Central Plantation Crops Research Institute, Kasaragod from 1988-89 to 1997-98 in an 18 year old coconut garden in which pepper was trained on the coconut trunk and banana all along the border. Following were the livestock enterprises included in the system:

### Dairy Unit

Five to six Jersey and Holstein Friesian breed cows were maintained in the system.

### Poultry Unit

100 numbers of layers and 100 numbers of broiler (for each batch) birds were maintained in the system. In a year six batches of broilers were reared. 100 numbers of quail birds were also maintained.

### Biogas unit

Biogas unit of 3m<sup>3</sup> was installed for generating biogas. The cowdung slurry from the gas plant and cow shed wastes along with urine were recycled within the experimental area.

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## **Rabbits**

10 female and 4 male Russian chinchilla breeds were maintained.

## **Aquaculture (625 m<sup>2</sup> surface area):**

About 4-6 cm long fingerlings of four selected species viz. Catla (*Catla catla*), Rohu (*Sebeo rohita*), Mrighal (*Cirrhinus mrighala*) and Grass carp (*Ctenopharngdodon idellus*) were reared in the pond.

Input and output details were collected and the market prices prevailed during the corresponding years in northern Kerala were considered to work out the economics of the system. All the calculations were performed for one hectare. The fixed cost was reduced to an annuity using a discount rate of 14% considering the economic life span of the system as 10 years. Tabular analysis was performed to identify the individual share of factors of production in the total cost. Based on the total return and total cost, the net return was worked out for individual years. Cash flow analysis (Sairman *et al.*, 1999) was performed, using a discount rate of 14% and the economic viability of the system was assessed through economic indicators viz., Benefit-Cost Ratio, Net Present Worth, Internal Rate of Return and the Pay Back Period.

## **RESULTS AND DISCUSSIONS**

### **Costs**

The details on the cost of mixed farming system over years is furnished in Table 1. It could be inferred from the table 1989-1990 to 1997-98, among the different factors of production, the share of cattle feed and hired labor together had accounted between 56.33% to 75.72% of the total cost (Fig. 1). In addition, the entire system is maintained by 365 mandays for one male and one female labor. This system is labor intensive and under the present socio-economic conditions of state like Kerala, in which hired labor is both scarce and costly, the economic viability of this system could be improved, only through active participation by the family labor. Hence, it could be inferred that this model is more suitable for medium or larger coconut holdings with more number of persons depending on agriculture.

It could be further observed from Table 1 that the cost of poultry feed which was Rs. 4,930 during 1989-90, had increased to Rs. 18,610 during 1997-98 (+277.5%). The total cost of the system (including the annuity value) which was Rs. 134,800 during 1989-90, had increased to Rs. 167,000 during 1997-98 (+23.9%).

### **Returns**

The output data from the different components of the system is furnished in Table 2. From the table it was inferred that during the period 1989-90 to 1997-98, the total production of coconut had exhibited an increasing trend. The same in the case of milk was fluctuating since the number of milch cows had declined. This was mainly due to the reduction in the number of milch cows reared under this system, which declined to three from 1996-97 onwards. Pepper was removed from the system during 1993-94 since high mortality rate had occurred due to quick wilt disease. The yield performance of banana was not satisfactory till 1992-93; however, the same had significantly improved in later years. The yield performance of other livestock components like rabbitry, poultry, and fishery was optimum over the years.

The details on the returns over years from the coconut based mixed farming system are given in Table 3. It could be inferred from the table that the returns from coconut and milk was maximum accounting for 50-70% of the total (Fig. 2). The returns from coconut had increased from Rs. 50,361 during 1989-90 to Rs. 88,200 during 1997-98 (+ 75.1%). The share of coconut in the gross returns was stable over years. However, inter year fluctuations was there due to price fluctuations for coconut. In case of milk, the total returns had decreased from Rs. 92,071 to Rs. 78,576 (-14.7%) since the number of milch cows was reduced. The share of milk in the gross return exhibited a declining trend. The returns from broiler birds had exhibited an increasing trend, and the same, which was Rs. 10,600 during 1989-90, had increased to Rs. 70,800 during 1997-98 and its share in gross return had increased from 5.96% to 26.45%. The share of fish in the gross cost also exhibited an increasing trend. One of the major advantages of this system is that it produces and recycles organic manures like farm yard manure, biogas slurry and poultry manure at regular intervals. This could meet about 75% of the organic requirement for coconut and other subsidiary crops and their value was worth about 1% to 2.62% of the gross return. The realized gross returns had increased from Rs. 184,500 during 1989-90 to Rs. 293,900 (+59.29%) and the net returns from Rs. 49,700 to Rs 126,900 (+155.33%).

### **Cash Flow Analysis**

To assess the economic viability of this coconut based mixed farming system model, the cash-flow analysis was performed to work out the Benefit-Cost Ratio, Net Present Worth, Internal Rate of Return and Pay Back Period using a discount rate of 14%. The results are shown in Table 4. The Benefit-Cost Ratio (BCR), Net Present Worth were 1.36 and Rs. 276,520, respectively. This indicated that for every one Rupee of investment in this system, the additional returns was Rs.0.36 which confirmed that under well managed conditions, coconut based mixed farming system is economically viable. The NPW of about Rs. 286,520 further indicates that this system would be more profitable. The Internal Rate of Return was 27.44% indicating the economic worthiness of financing this system. The Pay Back Period of five years indicated that the total initial investment of 2.6 lakhs could be recovered in five years. These indicators confirmed the economic worthiness of investment in coconut- based mixed farming system.

This system is able to provide fodder grass for feeding the cows worth Rs. 4,800 to Rs. 6,400 per year and if value is not imputed to the cattle feed cost, the BCR could increase to 1.41 and the Net Present Worth to Rs. 315,400. However, there was change in the values of IRR and Pay Back Period.

### **SUMMARY**

The economic analysis of coconut-based mixed farming system for the period 1989-90 to 1997-98 under optimum management conditions was performed using the experimental data. It was observed that the total cost of the system, which was Rs. 134,800 during 1989-90, has increased to Rs. 167,000 during 1997-98. During the same period, the gross returns had increased from Rs. 184,500 to Rs. 293,900 and the net returns from Rs. 49,800 to Rs. 126,900. The cash flow analysis performed using a discount rate of 14% realized the Benefit-Cost Ratio (BCR) of 1.36 and the Net Present Worth of the system Rs. 286,520. The Internal Rate of Return was 27.44% and the Pay Back Period was five years. These results clearly indicate the economic viability of the system in medium and larger coconut holdings under irrigated conditions. Future research and developmental efforts should be initiated to understand and improve the existing status of coconut based farming systems under different agro-climatic and socio-economic environment of all the coconut growing states.

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**Table 1. Details on the Cost of Coconut Based Mixed Farming Systems in (ha (1989-90 to 1997-98)**

YEAR	Labour Feed	Cattle Feed	Poultry Feed	Vet. Medicine	Broiler Birds	Paddy Straw	Fert	Finge rings
1989-90	20,000	53,800	4,930	3,890	-	480	3,500	-
1990-91	20,000	49,180	9,340	1,780	-	2,370	3,670	-
1991-92	24,000	55,870	13,740	2,,350	3,900	2,640	3,800	1,150
1992-93	26,000	50,160	16,630	2,650	3,900	3,620	6,080	1,150
1993-94	26,000	68,680	16,690	4,930	1,000	2,500	6,130	1,200
1994-95	30,000	64,540	17,640	3,440	1,000	2,230	6,200	1,200
1995-96	30,000	63,080	34,240	2,610	3,000	5,500	6,300	1,250
1996-97	34,000	57,620	40,580	1,970	8,360	-	7,000	1,250
1997-98	40,000	40,190	18,610	1,880	5,220	3,000	7,200	1,300

YEAR	Fish Feed	Fodder Grasses	Irrigation	Miscellaneous	Total Cost	Annuity	Total*
1989-90	-	4,800	1,000	1,927	94,300	36,400	130,700
1990-91	-	5,200	1,000	114	93,500	36,400	129,900
1991-92	3,200	5,830	1,000	1,117	118,700	36,400	155,100
1992-93	3,200	5,940	1,500	1,159	122,000	36,400	158,400
1993-94	3,350	6,360	1,500	1,320	139,700	36,400	176,100
1994-95	3,350	6360	1,500	1,333	138,800	36,400	175,200
1995-96	3,400	6,360	2,000	1,514	159,300	36,400	195,700
1996-97	3,500	6,360	2,000	1,573	164,300	36,400	200,700
1997-98	3,500	6,360	2,000	1,229	130,600	36,400	167,000

\*Rounded total

**Table 2. Production of Different Components in Coconut Based Farming Systems**

Year	Coconut No.(1 ha)	Milk (litres)	Pepper kgs)	Banana kgs)	Quails (Nos.)	Hen egg (Nos.)
1989-90	16,787	13,153	90	530	100	7,990
1990-91	21,347	12,719	96	319	100	1,729
1991-92	16,733	9,305	62	608	112	965
1992-93	17,674	7,877	60	307	80	2,819
1993-94	18,404	10,873	-	320	86	2,696
1994-95	19,125	9,235	-	526	90	3,500
1995-96	19,388	10,701	-	502	100	2,887
1996-97	19,412	5,948	-	1,090	80	272
1997-98	19,600	6,543	-	885	80	-

Year	Quail egg (Nos.)	Rabbits (kgs)	Fish (kgs)	Green grass (kgs)	Poultry manure (kgs)	FYM (tones)
1989-90	3,768	87.5	-	4,800	2,000	15
1990-91	3,948	45	-	5,,200	2,500	16
1991-92	3,359	24	400	5,830	2,000	15
1992-93	4,084	28	400	5,940	2,500	16
1993-94	2,515	20	380	6,360	3,000	16
1994-95	1,100	10	400	6,360	3,000	16
1995-96	1,018	-	390	6,360	2,000	15
1996-97	2,077	-	380	6,360	2,000	14
1997-98	2,096	-	380	6,360	2,500	13

**Table 3. Details on Returns from Coconut Based Mixed Farming Systems in Rs./ha (1989-90 to 1997-98)**

YEAR	Coconut	Milk	Pepper	Banana	Broiler	Quail	Hen egg	Quail egg
1989-90	50,361	92,071	3,150	1,250	10,600	1,500	11,985	1,884
1990-91	64,041	89,033	3,360	981	7,975	1,500	2,594	1,974
1991-92	50,199	74,440	2,790	1,500	18,240	2,240	1,448	1,680
1992-93	61,859	63,016	2,700	2,304	10,745	1,600	4,229	4,084
1993-94	64,414	97,857	-	4,200	16,000	1,720	5,392	2,515
1994-95	76,500	92,350	-	4,000	28,930	1,800	7,000	1,100
1995-96	77,552	117,711	-	4,400	32,630	2,500	5,774	1,018
1996-97	87,354	71,376	-	4,800	76,300	2,000	544	2,596
1997-98	88,200	78,516	-	4,000	70,800	2,000	-	2,620

YEAR	Rabbit	Fish	FYM	Poult man	Fodder grasses	Biogas	Byprod others	Gross return*	Net return
1989-90	1,750	-	2,250	1,000	4,800	900	1,000	184,500	53,800
1990-91	900	-	3,875	1,250	5,200	1,000	4,600	188,300	58,400
1991-92	600	20,000	3,750	1,000	5,830	1,100	5,800	190,600	35,500
1992-93	980	21,100	3,750	1,875	5,940	1,300	6,400	191,900	33,500
1993-94	900	20,000	5,400	2,250	6,360	1,500	6,200	231,700	55,600
1994-95	500	20,000	5,100	2,250	6,360	1,500	6,900	254,300	79,100
1995-96	-	20,200	4,800	1,600	6,360	1,700	7,500	284,700	89,000
1996-97	-	21,500	6,000	1,600	6,360	2,000	7,700	290,100	89,400
1997-98	-	22,200	7,000	2,500	6,360	2,300	7,400	293,900	126,900

\* Rounded total

\*\* In case of FYM and Poultry Manure, the imputed value of quantity produced within the system was considered as return

**Table 4 Cash Flow Analysis of Coconut Based Mixed Farming Systems**

Years	Total Cost	Total Return	Discounted		
			Cost	Return	Margin
1989-90	134,800	184,500	118,246	161,842	43,596
1990-91	134,000	188,300	103,109	144,891	41,782
1991-92	155,100	190,600	104,688	115,150	10,462
1992-93	158,400	191,900	93,786	113,620	19,835
1993-94	176,100	231,700	91,461	120,338	28,877
1994-95	175,200	254,300	79,819	115,856	36,037
1995-96	195,700	284,700	78,209	113,777	35,568
996-97	200,700	290,100	70,357	101,697	31,340
1997-98	167,000	293,900	51,354	90,377	39,023
<b>Total</b>			<b>791,028</b>	<b>1,077,547</b>	<b>286,520</b>
<b>BCR</b>					<b>1.39</b>
<b>NPW</b>					<b>306,770</b>
<b>IRR</b>					<b>27.5</b>
<b>Pay Back</b>					<b>05</b>

