

## THE ECONOMICS OF COCOA MIXED CROPPING WITH COCONUTS IN INDIA

PRAFULLA K. DAS

### ABSTRACT

Cocoa was introduced for commercial cultivation in India after experiencing success in field experiments as a mixed crop with coconuts and arecanuts at CPCRI during the early seventies. After a brief period of accelerated growth the momentum of cocoa expansion was not only checked, but also the newly introduced crop was exposed to gross neglect owing to unremunerative prices and marketing constraints. A protective price policy for cocoa has now been executed as a remedial measure to cocoa crisis, and this study aims to find out whether this protection could motivate the farmers to adopt cocoa as a mixed crop with coconuts. The analysis reveals that the net return from cocoa grown in the interspaces of coconuts amounts to Rs. 2900/ha/year. The coconut-cocoa system as a whole promises a net return of Rs. 16,500/ha/year as against Rs. 7300/ha/year in the case of rainfed coconut monoculture. In view of this, the interplanting of cocoa with coconuts is found to be a very attractive proposition.

### INTRODUCTION

In the year 1963, the Central Plantation Crops Research Institute (CPCRI), Kasaragod first attempted raising the Criollo variety of cocoa as a mixed crop in coconut gardens. In the following year, a similar exploratory trial was carried out in arecanut gardens at CPCRI Regional Station, Vittal. However, these trials did not show much promise as the variety was found to be unsuitable

for a given environment. In the year 1970, another attempt was made for raising the Forestero variety of cocoa as a mixed crop in coconut/arecanut gardens in loamy soils at CPCRI, Kasaragod/Vittal. Having observed the encouraging performance of this variety, the farmers of Kerala, Karnataka and Tamil Nadu adopted this crop in their garden lands and presently cocoa is grown in some 29,000 ha mainly as a mixed crop in coconut and arecanut gardens.

In India, cocoa gained real momentum only in 1977 when its prices became very attractive and this accelerated phase continued only up to 1979. From the year 1980 the cocoa prices in India started declining on account of adverse fluctuations in the international markets, and this led to apprehension in certain quarters, particularly among growers, that with the accelerated rate of expansion of the cocoa area, the prices could further decline due to insufficient capacity for absorption by industry. By 1983, the area of expansion had not only come to a halt, but the crop was very neglected caused by unremunerative prices and marketing bottlenecks. In the recent past however, some corrective measures have been taken to remove the bottlenecks and condition the market to accept an upward revision of prices, so as to rehabilitate the cocoa sector in India, which holds a great promise for the future.

The objective of this study is to examine whether cocoa as a mixed crop with coconuts is economically viable under the present factor-product market situations in Kerala which alone accounts for about 83 per cent of cocoa area in India.

#### RESULTS AND DISCUSSION

Table 1-A shows the operation-wise and year-wise requirements of labour for coconuts as a monocrop as well as coconut with cocoa as a mixed crop. Similarly, Table 1-B shows the labour requirements for cocoa under the coconut based cropping system.

The requirements of material inputs for coconut as a monocrop and coconut with cocoa as a mixed crop operation-wise and year-wise are shown in Table 2-A, while Table 2-B deals with the material inputs for cocoa as a mixed crop in coconut gardens.

*Table 1-A. Estimated labour requirements for coconut as monocrop and as mixed crop with cocoa (Mandays/ha/year)*

Operations	Establishment period				Adult stage (per year)	
	Age of plantation in year				As mono-crop	As inter-crop with cocoa
	1	2	3	4-7 per year	8	4
Fencing and repairs	70	8	8	8	8	4
Land levelling and peg marking	55	—	—	—	—	—
Taking pits (175 Nos.)	35	—	—	—	—	—
Planting and gap filling	8	2	1	—	—	—
Shading and mulching	15	11	6	—	—	—
Manuring	16	18	20	22	24	16
Weeding/forking	10	20	25	30	36	12
Watering in summer	42	52	60	20	—	25
Spraying and other plant protection	3	4	6	7	12	12
<b>Total</b>	<b>254</b>	<b>115</b>	<b>126</b>	<b>87</b>	<b>80</b>	<b>69</b>

Table 1-B. Estimated labour requirements of cocoa under coconuts (Mandays/ha)

Operations	Age of cocoa in year						
	1	2	3	4	5	6	7 onwards
Peg marking and taking pits (400 Nos.)	37	—	—	—	—	—	—
Planting seedlings and gap filling	8	2	—	—	—	—	—
Manuring	10	12	14	16	16	16	16
Weeding and after-care	20	20	20	10	—	—	—
Irrigation	25	25	25	25	25	25	25
Plant protection	4	6	8	10	12	15	20
Pruning	—	—	—	2	4	6	10
Harvesting and carrying pods	—	—	3	7	13	20	24
Repair of fence	5	5	5	5	5	5	5
<b>Total</b>	<b>109</b>	<b>70</b>	<b>75</b>	<b>75</b>	<b>75</b>	<b>87</b>	<b>100</b>

Table 2-A. Material input requirements in coconut cultivation as monocrop and mixed crop with cocoa

Item	Unit	Establishment period				6-7 per year	Adult stage (per year)
		Age of plantation					
		1	2	3	4-5 per year	as mono-crop with cocoa	
Seedlings	No.	175	18	7	—	—	—
Farmyard manure	Tonnes	4.5	4.5	4.5	4.5	4.5	4.5
<i>Fertilisers*</i>							
Urea	Kg	63.5	127	190	190	190	190
Super phosphate	Kg	117.0	234	350	350	350	350
Muriate of potash	Kg	117.0	234	350	350	350	350
<i>Plant protection chemicals</i>							
BHC 5 per cent	Kg	3.5	7	14	14	28	44
Copper sulphate	Kg	3.5	7	9	9	14	17.5
Lime	Kg	3.5	7	9	9	14	17.5
Contingency	Rs.	200	200	200	200	200	200

Table 2-B. Estimated material input requirements of cocoa under coconuts

Description	Unit	Age of cocoa in year						
		1	2	3	4	5	6	7 onwards
Seedlings	Nos.	400	40	—	—	—	—	—
Fertilisers**								
Urea	Kg	29	58	87	87	87	87	87
Superphosphate	Kg	33	67	100	100	100	100	100
Muriate of potash	Kg	31	62	93	93	93	93	93
Plant protection chemicals	Rs.	75	100	160	200	250	300	325
Contingency	Rs.	500	500	500	500	500	500	500

\* at 500 gN, 320 g P<sub>2</sub>O<sub>5</sub> and 1200 g K<sub>2</sub>O/palm/yr from the third year onwards for coconut.

\*\* at 100 gN, 40 g P<sub>2</sub>O<sub>5</sub> and 140 g K<sub>2</sub>O/tree/yr for cocoa with coconut as mixed crop.

Note: First year one-third of full dose of fertilisers.

Second year two-third of full dose of fertilisers.

**Investment**

In the case of coconut, the first seven years from planting are considered as the establishment period and all the expenditure in this connection including contingencies have been added up to derive the investment which comes to Rs. 35,300/ha (Table 3-A). However, at the stage of introducing cocoa as a mixed crop a further investment to provide assured irrigation was needed and 50 per cent of the investment on this account was charged to the coconut crop and the remaining 50 per cent was charged to cocoa. In this situation, the investment on coconut works out to Rs. 42,300/ha (Rs. 35,300 plus 50 per cent of the cost of irrigation infrastructure: Rs. 7,000). Since the pre-bearing years in the case of cocoa have been observed to be not more than three years, the investment or the cost of bringing cocoa up to the bearing stage was assessed by computing the expenditure on all inputs for the first three years from its planting. According to this study, the investment on cocoa comes to Rs. 15, 200/ha (Table 3-B).

**Maintenance cost**

Like any other perennial crops with a long economic life, the input requirements for coconut and cocoa remain constant over several years during their adult stages. According to this study the apportioned inputs for coconuts and cocoa remained stable from the fourteenth year and the seventh year respectively from their planting, and in monetary terms the annual maintenance cost for coconut as a monocrop comes to Rs. 4,930/ha and as a mixed crop Rs. 4,660/ha, while for cocoa it comes to Rs. 3,250/ha (Tables 3-A and 3-B).

**Average yield**

The average yield of 58 nuts/palm/year was assumed under Kerala conditions for the rainfed coconut monocrop and 80 nuts/palm/year for irrigated coconut with cocoa as mixed crop. In the case of cocoa, the average yield was assumed to be 35 pods/plant/year. With the plant population of 400/ha, the total number of pods/ha/year thus comes to 14,000. On weight basis this yield comes to 4,200 kg of pods or 420 kg of dry beans/ha.

**Production cost**

For estimating the cost of production of coconut and cocoa,

*Table 3-A. Costs of investment and maintenance in coconut cultivation (Rs./ha)*

Item	Rate/unit	Investment cost (initial seven yrs. expd.)	Maintenance cost at adult stage (with perfo Irrig.) Annual Expenditure/year	
			as rainfed mono-crop	as irrigated mixed crop with cocoa
Labour	20.00/manday	16,860	1600	1,380
Materials for fencing, shading and mulching	—	3,800	—	—
Seedlings	6.00/seedling	1,200	—	—
Farm yard manure	100.00/tonne	3,080	450	—
Fertilisers		7,550	1258	1,258
Plant protection chemicals		1,410	372	372
Harvesting	1.00/palm/harvest	—	1050	1,050
Contingencies	200.00/yr.	1,400	200	600
<b>Total</b>		<b>35,300</b>	<b>4930</b>	<b>4,660</b>

the investment, overheads and maintenance costs were taken into account. For coconut the total investment, namely the initial seven years expenditure in the establishment of the crop and the compound interest thereon were reduced to an annuity bearing 10 per cent interest and 60 years of economic life. The annuity value in this case comes to Rs. 6,600/ha. Since the perfo-spray irrigation was introduced at the time of cocoa interplanting, and the life period for the motor is 10 years and of perfo-pipes 20 years, the proportionate annuity value of Rs. 940 was further charged to the coconut crop. Thus the total annuity value in the case of irrigated coconut came to Rs. 7,540/ha in the presence of cocoa as a mixed crop.

Similarly, the initial three years expenditure in establishing cocoa in the coconut garden including the apportioned outlay on

*Table 3-B. Cost of investment and maintenance of cocoa under coconuts (Rs./ha)*

Item	Rate/unit	Investment cost (one to three yrs.)	Annual maintenance cost
Labour	20.00/manday	5,080	2000
Seedlings	1.00/No.	440	—
Fertilisers		845	825
Plant protection chemicals		335	325
Contingencies		1,500	500
Proportionate investment on perfo-spray irrigation		7,000	—
		15,200	3,250

the perfo-spray irrigation system and the compound interest thereon were reduced to an annuity, bearing 10 per cent interest and 30 years of economic life of this crop. The annuity value in this instance was found to be Rs. 2,250/ha (Rs. 1,310 plus Rs. 940 for the irrigation infrastructure).

As the annuity values are the annual shares of total investment to be adjusted over their life span, in order to arrive at the total annual cost, these values have been added to the annual maintenance costs, and in the process the total annual costs per ha for rainfed coconuts come to Rs. 11,530 for irrigated and mixed cropped coconuts Rs. 12,200 and for cocoa Rs. 5500. For the coconut-cocoa cropping system as a whole the figure thus comes to Rs. 17,700/ha.

Considering the production levels of 14,000 nuts and 4,200 kg of pods per ha per annum, in this system the cost of production thus works out to Rs. 0.83/coconut and Rs. 1.31/kg of cocoa pods. However, in the case of coconut monoculture the cost of production per nut comes to Rs. 1.08 (Table 4).

#### Net returns

Even though the ruling prices for coconuts were in the range

of Rs. 2.50 and Rs. 3.50/nut, due to unprecedented drought of the previous year, for this study Rs. 1.80 was considered based on the normal trend. With the given farmgate prices of Rs. 1.80/nut and Rs. 2.00/kg of pods and the corresponding production cost of Rs. 0.83/nut and Rs. 1.31/kg of pods, the net returns per ha per year for rainfed coconut, irrigated coconut and cocoa come to Rs. 7,300, Rs. 13,600 and Rs. 2,900 respectively, and for the cropping system under reference, the net return works out to Rs. 16,500/ha/annum (Table 4).

This study reveals that cocoa with the present price structure is a profitable mixed crop and there is no reason to neglect this crop under any apprehension. As one could see it is a common practice in Kerala to grow several crop species, particularly annuals, such as cassava (tapioca), yams, sweet potato and ginger in the interspaces of coconut palms without proper care and management. Indiscriminate practices of mixed/intercropping systems in coconut gardens without due regard to compatibility and nutritional needs have often resulted in inefficiency in the land use pattern by reducing the productivity of main crop (coconuts) and adding very little as intercrop(s) to the system as a whole (Das, 1983). On the other hand, cocoa with its inherent nature is a compatible crop with coconuts and yields relatively higher income compared to most of the commonly practised intercrops. The investigation has also indicated that there was no adverse effect on coconuts by cocoa under single hedge system. This was also evident in earlier studies elsewhere (Bhat and Bavappa, 1972).

Apart from monetary benefits, the coconut-cocoa system provides long-term benefits to most scarce resource land, as fertility status and conservation of soil improve as compared to other systems in coconut gardens because of the microbial action of the rhizosphere region and the ideal canopy architect of cocoa. In other words, the land use efficiency increases with the coconut-cocoa cropping system.

#### ACKNOWLEDGEMENTS

The author wishes to thank Dr. K.V. Ahamed Bavappa, Director, CPCRI, Kasaragod for providing all facilities for conducting this study; to late Mr. E.V. Nelliath, Division of Agronomy, CPCRI, Kasaragod for providing certain basic information; to

Table 4. Estimated cost and returns in coconut-cocoa cropping system (Rs./ha)

Particulars	Cost of production & returns			Coconut and cocoa system
	Coconut monocrop	Coconut with cocoa	Cocoa as a mixed crop with coconut	
1. Investment during establishment up to bearing	35,300	35,300	8,200	43,500
2. Compound interest on investment (10 per cent)	20,510	20,510	4,160	24,670
3. Total investment (Col. 1 + 2)	55,810	55,810	12,360	68,170
4. Annuity value	6,600	6,600	1,310	7,910
5. Investment on perfo-irrigation system	—	7,000	7,000	14,000
6. Annuity value for investment on perfo system	—	940	940	1,880
7. Annual maintenance cost	4,930	4,660	3,250	7,910
8. Total cost/yr (Sl. No. 4 + 6 + 7)	11,530	12,200	5,500	17,700
9. Income from dry leaves, petioles etc/yr	560	560	—	560
10. Net cost of production/yr. (Sl. No. 8-9)	10,970	11,640	5,500	17,140
11. Average production/yr	10,150 nuts	14,000 nuts	4,200 kg pods	—
12. Cost of production/unit (Sl. No. 10 ÷ 11)	Rs. 1.80/nut	Rs. 0.83/nut	Rs. 1.31/kg. pods	—
13. Farmgate price/unit	Rs. 1.80/nut	Rs. 1.80/nut	Rs. 2.00/kg. pods	—
14. Net return/yr.	7,308 or 7,300	13,580 or 13,600	2,890 or 2,900	16,500

Dr. K. Shama Bhat, Joint Director, CPCRI Regional Station, Vittal for providing information on the introduction of cocoa into India and to Dr. Snoeck, Agronomist, Coffee and Cocoa Research Institute (IRCC), France for his valuable suggestions.

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#### DISCUSSION

- Q : In recent years, there has been a fall in price of cocoa. Do you feel that cultivation of cocoa is still economical?
- Ans: The net returns are worked out adopting a farm gate price of Rs. 2 per kg of pods. Even at that price level, the net return works out to be Rs. 16,500 per hectare per annum for the coconut cocoa system.
- Q : It appears that the estimates regarding the returns are much lower than the actuals.
- Ans: The ruling price of coconut is very high due to unprecedented drought of the previous year. This cannot be taken as a normal price realisable. The price of Rs. 1.80 per nut is based on the normal trend.
- Q : Is it worthwhile to take up a similar study for arecanut cocoa system?
- Ans: A large number of farmers are raising cocoa as a mixed crop in arecanut gardens also. Therefore a similar study is being done on that mixed cropping system.
- Q : In view of the fall in the price of cocoa, why other crops can not be recommended?
- Ans: We have to take into consideration, the compatibility and nutritional needs of the inter/mixed crop. Cocoa has been found to be one of the compatible crops with coconut.