

ECONOMICS OF MIXED CROPPING OF PEPPER, COORG MANDARIN AND CARDAMOM IN ROBUSTA COFFEE

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ABSTRACT

A study carried out for four years (1990-91 to 1993-94) on mixed cropping of cardamom, pepper and Coorg mandarin with robusta coffee net present worth v/s mono (sole) crop of robusta coffee, revealed that the cost of cultivation was Rs. 46322/ha in mixed cropping as against Rs. 27678/ha under monocropping. The net returns of Rs. 105213/ha realised in mixed cropping was 3.69 times more than monocropping. The incremental net gain in mixed cropping was Rs. 76723/ha (269.30%) over the monocrop. The financial criteria such as net present worth and benefit cost ratio were also found to be higher by 3.55 and 1.56 times respectively in mixed cropping. The mixed cropping of cardamom with robusta coffee generated income to the farmers over a period of ten months (July-April) and gainful employment for family members all round the year.

Keywords: Coffee, Cardamom, Mixed cropping, Pepper, Coorg mandarin, Economics

INTRODUCTION

In India, the area under coffee is 2,92,467 ha with a production of 2,23,000 t during the year 1995-96 (Anon. 1997). Kodagu district in Karnataka, which is known for its best flavoured coffee accounts for an area of 77,877 ha with a production of 66,675 t. This district contributes 50.14% area and 41.96% of production in Karnataka and 26.63% area and 33% production in India (Anon. 1996).

Majority of the coffee plantation in India are small holdings below two hectares (83%). Productivity of these units could be increased by intensive cultivation of coffee and resorting to diversification with biologically compatible perennial crops (Gupta and Tewari, 1985; Hanumanth Rao, 1986; Korikanthimath and Peter, 1992). In the present scenario of surplus production and fluctuating price in the international market, diversification of coffee fields

with high value crops like cardamom, pepper and Coorg mandarin assumes greater importance.

MATERIALS AND METHODS

A field experiment was started during 1990 in a 13 year old robusta coffee plantation at M/s. Chettoli estate, Chettalli, North Kodagu, Karnataka. The soil of the experimental site was sandy loam and classified as kandic paleustalf type. The soil is moderately acidic, rich in organic matter, low in available phosphorus and medium in available potash. The average rainfall is 1400 mm with 125 rainy days per annum and nearly 2/3rd of the precipitation is received during south west monsoon with conventional blossom showers for coffee in March/April.

In the plantation where robusta coffee and Coorg mandarin were planted simultaneously during 1978, pepper was planted and trained on *Erythrina lithosperma*

tree standards in 1980. Cardamom was introduced (besides Coorg mandarin and pepper) without removing coffee plants but by trimming the side branches of alternate rows of robusta coffee so as to accommodate cardamom in a single hedge row. The details of the experimental lay out are given in Table 1 and Fig. 1.

Well decomposed coffee pulp compost @ 3 t/ha (during May-June) and the recommended dose of fertilisers were applied to coffee and other component crops in the system in two splits in June and September. Irrigation was provided during January to May at an interval of 15 days. Regular cultural operations and plant protection measures were carried out in the cropping system. Harvesting was done as and when necessary and pooled at the end of each crop season.

Tabular analysis was performed to get the cost of cultivation for mixed cropping and monocrop of coffee (Robusta). Returns were calculated for each crop considering the average realised prices of respective years. In order to work out the feasibility of investment, Net Present Worth (NPW), Benefit Cost Ratio (BCR) and per day return were computed. The cost and returns were

Table 1. Experimental layout

1) Treatments (cropping systems)	
M ₁	: Monocropping of robusta coffee
M ₂	: Mixed cropping of robusta coffee with Coorg mandarin, pepper and cardamom
2) Cropping seasons : 4 years (1990-91 to 1993-94)	
3) Plot size	
Gross	: 500m ²
Net	: 400m ²
4) Crop variety	
Coffee	: Perdinia
Mandarin	: Coorg mandarin
Pepper	: Panniyur-1
Cardamom	: Cl.37 Malabar (prostrate type of panicles)

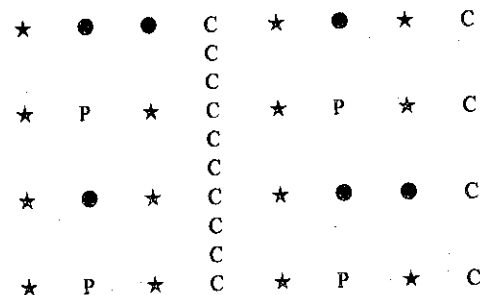


Fig 1. Planting pattern of mixed cropping of robusta coffee with coorg mandarin, pepper and cardamom

Index to crops	Spacing	Density/ha
* Robusta coffee	3m x 3m	1111
● Coorg mandarin	6m x 6m	0278
P Pepper	6m x 6m	0278
C Cardamom	6m x 1.2m	1389
Total		3056

discounted @ 18 per cent to compute NPW and BCR by adopting following formulae.

Net Present Worth: It is the difference between present value of benefits and present value of costs. For an investment to be worthwhile, the NPW must be more than zero.

$$NPW = \text{Discounted gross returns} - \text{Discounted cost.}$$

Benefit Cost Ratio: It is the ratio of farm inflows and outflows in present value terms which measures the returns per rupee of investment. The investment is said to be worthwhile when BCR is greater than one.

$$BCR = \frac{\text{Discounted gross returns}}{\text{Discounted Cost}}$$

$$\text{Per day return} = \frac{\text{Net returns}}{\text{Cropping days (365)}}$$

RESULTS AND DISCUSSION

1. Input requirement/costs

i) Mixed cropping of Robusta Coffee with pepper and cardamom

Among the different inputs, the cost of labour including the other benefits accounted for 66.13% of total cost of

cultivation of Rs. 46323/ha (Table 2). The cost of planting material of cardamom was Rs. 1042 and the amount incurred on fertilizers/ compost and pesticides was Rs. 5546 and Rs. 1253/ha, respectively. One of the advantages of growing mixed crop was the saving of cost by following common cultural operations and single supervision. Common expenditure amounted to Rs. 7844/ha accounting to 16.93% of total cost of cultivation.

ii) Monocropping of Robusta Coffee

The total cost incurred on different inputs under monocropping worked out to Rs. 27678/ha. Among the different inputs

Table 2. Input requirements/costs in mix cropping of Robusta coffee, pepper, Coorg mandarin and cardamom (4 years average)

Sl. No.	Particulars	Cost (Rs/ha)
1.	Planting material (Cardamom)	1042
2.	Fertilizers/compost	5546
3.	Pesticides	1253
4.	Labour	
	(i) Total labour wages	18795
	* (ii) Other benefits (63% of wages)	11843
5.	Common expenditure	
	(i) Total salary of supervisory staff	1585
	* (ii) Benefits/incentives other than salary (63%)	999
	(iii) Fuel charges to run irrigation pump sets.	1500
	(iv) Maintenance of farm machinery	1541
	(v) Miscellaneous expenditure	2219
	Total	46323
Other benefits/incentives:		
1.	Bonus	- 20%
2.	PF and Pension fund	- 10%
3.	Earned Leave	- 5%
4.	Gratuity	- 4%
5.	Sickness & medical	- 6%
6.	Subsidised food grains, housing etc.	- 18%
	Total	- 63%

Table 3. Input requirement/costs in monocropping of Robusta coffee (Rs./ha)

Sl. No.	Particulars	Cost (Rs/ha)
1.	Cost of fertilizers	1918
2.	Labour	
	(i) Total labour wages	11096
	* (ii) Other benefits (63% of wages)	6990
	(iii) Salary of supervisory staff	1585
	(iv) Benefits/incentives (63% of salary)	999
3.	Fuel charges to run irrigation	1500
4.	Maintenance of farm machinery	1305
5.	Miscellaneous expenditure	2285
	Total	27678
* Other benefits/incentives:		
1.	Bonus	- 20%
2.	PF and Pension fund	- 10%
3.	Earned Leave	- 5%
4.	Gratuity	- 4%
5.	Sickness & medical	- 6%
6.	Subsidised food grains, housing etc.	- 18%
	Total	- 63%

the cost towards labour wages including other benefits worked out to be Rs. 18086/ha accounting to 65.35% of total cost of cultivation. The cost of fertilizers worked out to be Rs. 1918 (6.92% of total cost). The remaining 27.73% of the total cost includes the other components like salary of supervisory staff, fuel charges, maintenance of farm machinery etc. (Table 3).

The dominance of labour cost in both the systems indicated the labour intensive nature of operations and potentiality of generating greater employment opportunity in the plantation crops.

2. Cost and returns

i) Cost of cultivation

The cost of cultivation of mixed cropping (Robusta coffee + pepper + Coorg mandarin + cardamom) and monocrop of robusta coffee varied from year to year during the course of investigation (Table 4). During

Table 4. Cost and returns of mixed cropping of robusta coffee+pepper+cardamom v/s monocrop of robusta coffee (Rs/ha)

Sl. No.	Year	Gross Returns		Cost of cultivation		Net Returns		Incremental Net gain/loss over monocrop	Percentage Net gain/loss
		Mixed cropping	Mono cropping	Mixed cropping	Mono cropping	Mixed cropping	Mono cropping		
1.	1990-91	66666	41972	38544	22209	28122	19763	+ 8359	+ 42.30
2.	1991-92	95213	42461	38127	24721	57175	17740	+ 39435	+ 222.29
3.	1992-93	238781	63670	54962	32200	183819	31470	+ 152349	+ 484.11
4.	1993-94	205392	76571	53655	31582	151737	44989	+ 106748	+ 237.27
Mean		151513	56168	46322	27678	105213	28490	+ 76723	269.30

the first year of introducing cardamom, pepper and Coorg mandarin (1990-91) with robusta coffee, the cost of cultivation was higher in the mixed cropping system (Rs. 38544/ha) which was 73.55% more than monocropping. The average cost of cultivation for four years of mixed cropping was Rs. 46,322 which is 67.40% more compared to monocropping. During the third year of the study highest cost of cultivation (Rs. 54,962/ha) was noticed in the mixed cropping. Same trend was noticed in case of monocropping of robusta coffee (Rs. 32,200/ha). The highest yield in cardamom, pepper and robusta coffee was realised during the third year (Table 5) and hence the cost of harvesting was comparatively high resulting in higher total cost of cultivation. In earlier studies harvesting constituted almost 60% of the cost of cultivation in cardamom (Korikanthimath, 1995). A similar trend of labour requirement was also observed in coffee based black pepper cropping system (Korikanthimath and Peter, 1992)

Table 5. Yield pattern in mixed cropping of Robusta coffee with pepper and cardamom (kg/ha)

Sl. No.	Year	Robusta Coffee			Pepper	Price (Rs/kg)	Cardamom	Price (Rs/kg)
		Mixed Crop	Mono crop	Price (Rs/tonne)				
1.	1990-91	1730	2263	18547	910	38	--	285
2.	1991-92	1470	2086	20255	1141	26	135	478
3.	1992-93	1660	2448	26009	1662	34	291	452
4.	1993-94	1430	1850	41390	1172	48	199	405
Mean		1572	2162	26550	1221	36.50	208	

ii) Gross Returns

The highest gross returns of Rs.238781/ha realised in mixed cropping during the third year of the study (1992-93), was 275% more compared to monocropping of robusta coffee (Table 4). The highest gross returns during the third year was due to the higher yields (Table 5). The third year of the study coincided with the realisation of the highest crop of cardamom (291 kg/ha), pepper (1662.00 kg/ha) and robusta coffee (1660 kg/ha) (Table 5). Similarly monocrop of robusta coffee also recorded the highest crop of 2448 kg/ha. The average of four years revealed that a gross return of Rs. 151513/ha was obtained in mixed cropping as compared to Rs. 56168/ha in monocropping of robusta coffee. The mixed cropping system recorded 2.7 times more gross returns compared to monocropping. There was a steady increase in the gross returns under monocropping right from first year of the study. In the case of mixed cropping there was a gradual increase from

first to second year followed by a quantum jump in the third year. During fourth year of the study the gross return was comparatively less as there was relatively less crop in case of robusta coffee (1429 kg/ha), pepper (1176 kg/ha) and cardamom (198.3 kg/ha). Reduction in yield in the succeeding year of a peak crop is common in perennial crops (Korikanthimath, 1995).

In the present study, right from the beginning there was hardly any yield in the Coorg mandarin trees as they were highly infested with greening and other virus complex diseases. Hence, the Coorg mandarin crop was not taken into account for the economic analysis.

iii) Net returns

The highest net return of Rs. 183819/ha realised in the mixed cropping during the third year of the study (Table 4) compared to monocropping of robusta coffee. The highest net return obtained during the third year was due to higher crop yields in the said year. There has been a gradual increase in the net returns of monocropping of coffee from 1991-92 to 1993-94. The net returns of mixed cropping followed a trend similar to the gross returns (Table 4). Sannamarappa (1993) in the arecanut based cropping system

Table 6. Percentage of Robusta coffee, pepper and cardamom towards total gross and net returns of mixed cropping

Sl. No.	Year	Robusta coffee		Pepper		Cardamom		Total	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net
1.	1990-91	48.13 (32086)	59.97 (16864)	51.87 (34580)	98.82 (27791)	-	-58.79 (-16533)	100.00 (66666)	100.00 (28122)
2.	1991-92	31.43 (29922)	24.32 (13907)	31.16 (29666)	36.46 (20844)	37.41 (35625)	39.22 (22424)	100.00 (95213)	100.00 (57175)
	1992-93	18.08 (43175)	12.38 (22757)	23.67 (56508)	24.01 (44135)	58.25 (139098)	63.61 (116927)	100.00 (238781)	100.00 (183819)
	1993-94	28.82 (59188)	25.12 (38121)	27.39 (56256)	29.64 (44973)	43.79 (89948)	45.24 (68644)	100.00 (205392)	100.00 (151737)
Mean		27.12 (41093)	21.78 (22912)	29.21 (44252)	32.73 (34435)	43.67 (66168)	45.49 (47866)	100.00 (151513)	100.00 (105213)

Figures in parenthesis indicate the gross and net returns of respective crops in respective years.

in Maidan parts of Karnataka also reported similar trend in respect of gross returns. The average of four years indicated that, a net return of Rs. 105213/ha realised in the mixed cropping is more by 3.69 times compared to mono cropping.

The incremental net gain of Rs. 152349/ha obtained in mixed cropping during the third year of the study was 484.11% more than the monocropping. The average of four years indicated that the incremental gain of Rs. 76723/ha obtained in mixed cropping was 269.30% more than that of monocropping. This high incremental net gain in mixed cropping indicated the profitability of the combination of pepper and cardamom with robusta coffee. Thus, the mixed cropping helps the farmers to build up their economy compared to monocrops.

iv) Percentage contribution of Robusta coffee, pepper and cardamom towards total gross and net returns

Mixed trend in percentage contribution from each crop towards total gross and net returns could be observed from data in Table 6. This was due to variation in the yield levels in all the crops even though there was increasing trend in the prices of these crops (Table 5). The highest contribution towards

gross and net returns was observed during 1990-91 from robusta coffee (48.13 and 59.97%) and pepper (51.87 and 98.82%). However, no returns were realised in case of cardamom during the first year (1990-91) of the study due to fresh introduction of cardamom. With the commencement of cardamom production, the per cent contribution of other component crops towards gross and net returns declined. This was due to better yield and price of cardamom. The highest contribution of 58.25% and 63.61% towards gross and net returns respectively was recorded from cardamom during the year 1992-93.

The average (four years) contributions of robusta coffee, pepper and cardamom towards gross returns were 27.12, 29.21 and 43.67%, respectively. The corresponding figures for the net returns were 21.78, 32.73 and 45.47% in that order. This indicated the dominance of cardamom's share in the total gross and net returns of mixed cropping system.

v. Returns per day

The highest return per day (Rs. 503.61) was observed in the mixed cropping during the third year of the study as compared to Rs. 86.22 from monocrop of robusta coffee. (Table 7). The per day incremental net gain was Rs. 417.39 in mixed cropping (484.10%) during the third year of the study which

Table 7. Net returns per day in mixed cropping of Robusta coffee, pepper and cardamom v/s monocrop of robusta coffee (Rs./ha)

Year	Mix cropping of robusta coffee pepper and cardamom	Monocrop of robusta coffee	Net gain/loss
1990-91	77.05	54.14	+ 22.91 (+42.32)
1991-92	156.40	48.60	+ 107.80 (+221.81)
1992-93	503.61	86.22	+ 417.39 (+484.10)
1993-94	415.72	123.26	+ 292.46 (+237.27)
Average	288.19	78.06	+ 210.13 (269.19)

Figures in parenthesis indicate percentage net gain/loss

coincided with the highest crop of cardamom and pepper. The average of four years indicated a incremental net gain of Rs. 210.13 and the same was 269.19% more than monocrop.

3. Comparative Economics

The discounted gross returns and the cost of cultivation were more in the case of mixed cropping compared to monocropping of robusta coffee (Table 8). The NPW of Rs. 254972/ha obtained in the mixed cropping (3.55 times more than the monocropping) clearly substantiates the superiority of mixed cropping.

A higher BCR of 3.10 observed in the mixed cropping compared to 1.99 in monocrop of robusta coffee also indicates the profitability of mixed cropping. The high NPW and BCR clearly indicates the advantages of mixed cropping with cardamom and pepper over mono cropping of robusta coffee.

4. Staggered generation of income and employment

The study revealed that there is a staggered generation of returns and employment with the adoption of mixed cropping compared to monocropping of robusta coffee. The harvesting of cardamom commences during the month of July and continues upto end of January at an interval

Table 8. Comparative economics of mixed v/s monocropping of Robusta coffee

Sl. No.	Particulars	Mixed cropping (Robusta coffee+ Cardamom+Pepper+ Coorg mandarin)	Monocropping of robusta coffee
1.	Discounted gross returns (Rs./ha)@ 18%	376145	144310
2.	Discounted cost of cultivation (Rs./ha) @18%	121173	72463
3.	NPW (Rs./ha)	254972	71848
4.	BCR	3.10	1.99

of 15 days. The picking of robusta coffee is then followed during the month of February/March. Subsequently the harvesting of pepper will be taken up during March/April. Thus, the farmer's income is spread over a period of ten months (July-April). This observation is in conformity with the earlier studies of Korikanthimath (1990) in cardamom. This also helps the small and marginal farmers in selling the above produce as and when they need the amount to meet the routine expenses over a period of ten months (July-April) without unduly depending upon the borrowed money of financial institutions.

Mixed cropping of cardamom and pepper with robusta coffee also provides continuous gainful employment to the family members of small and marginal farmers all round the year.

In high ranges of South Indian states namely Karnataka, Kerala and parts of Tamil

Nadu, Coorg mandarin was grown hitherto as an important mixed crop in coffee estates. However, the productivity had decreased due to greening disease and other factors and there is very little hope of reviving citriculture in Coorg and adjoining areas. In view of the above facts cardamom which is a low gestation and high value crop can conveniently replace Coorg mandarin in the coffee estates.

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