

## Economics of mixed cropping of cardamom (*Elettaria cardamomum* Maton) in arecanut (*Areca catechu* L.) gardens

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### Abstract

A study carried out for 8 years (1986-87 to 1993-94) on mixed cropping of arecanut (*Areca catechu*) with cardamom (*Elettaria cardamomum*) in comparison to mono cropping of arecanut indicated that the cost of cultivation was higher (Rs.40,683/ha) in mixed cropping than under mono cropping system (Rs.27,571/ha). The net returns of Rs.1,61,837/ha realised in mixed cropping was 1.56 times higher over mono cropping (Rs.1,03,626/ha). The incremental net gain in mixed cropping was Rs.58,211/ha (56.21 per cent over mono cropping). Net Present Worth and Benefit Cost Ratio were higher by 1.48 and 1.01 times respectively, under mixed cropping compared to mono cropping.

**Key words:** *Areca catechu*, arecanut cardamom, economics, *Elettaria cardamomum*, mixed cropping.

### Introduction

The potential for increasing productivity through high density cropping is considerably higher in perennial crops than in annuals (Bavappa & Jacob 1982). Arecanut (*Areca catechu* L.) as a sole crop does not utilise the natural resources of crop production such as soil, space and sunlight to the fullest extent. The orientation and structure of the arecanut canopy permits only about 40 per cent of photosynthetically active

radiation to penetrate down and become available to the crops grown underneath it (Balasimha 1989). The rooting system of arecanut planted at 2.7 m x 2.7 m spacing could use effectively only 30 per cent of land area (Bhat & Leela 1968). Thus there is a great scope to grow perennial crops of high value as mixed crops with a short gestation period beneath arecanut for efficient utilisation of both land (soil depth) and air space.

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Cardamom (*Elettaria cardamomum* Maton) being a shade loving perennial crop, requires an overhead filtered shade. Arecanut palms growing to a height of 12-15 m provide uniform filtered sunlight which can be advantageously used for raising cardamom as an undergrowth mixed crop. Though it is known that cardamom can be cultivated as a mixed crop with arecanut, no information is available on the economic returns of these crop combinations. Hence, a field experiment was conducted to study the economic returns from a mixed crop of arecanut with cardamom compared to mono crop of arecanut.

### Materials and methods

The field experiment was started in a 36 year old arecanut garden at Sirsi (Uttar Kannada District, Karnataka, India), a predominant arecanut area, by introducing cardamom as a mixed crop. The average rainfall was 2800 mm, spread over from May to December with summer (pre - monsoon) showers in March-May. The soils are classified as ustic palehumurt and were moderately acidic (5.8 pH), rich in organic carbon, low in phosphorus and medium in potash. The treatments consisted of two cropping systems namely, mono cropping of arecanut and mixed cropping of arecanut with cardamom. The study was carried out for 8 years (1986-87 to 1993-94). The gross and net plot size were 5000 m<sup>2</sup> and 4000 m<sup>2</sup>, respectively. The crop varieties used in the study were Sirsi local in case of arecanut and Cl-37 in case of cardamom. In both the cropping systems arecanut was spaced at 2.7m x 2.7m (1372 plants/ha). In the mixed cropping system, cardamom was introduced in between two arecanut plants with a spacing of 2.7 m x 1.2 m (3086 plants/ha) (Fig.1). The crops were irri-

gated during summer. Since *katte* (mosaic) disease was rampant in this area, cardamom which was initially planted in 1986 was replanted during 1991-92. Regular cultural operations were carried out in arecanut and cardamom as per schedule. Fresh soil was applied once in 5 years to provide a thick mulch, micro nutrients and to compensate the loss due to erosion during heavy rainfall months; green leaves collected from the *soppin betta* (reserve forest) were applied @ 5 t/ha once in 2 years. Well decomposed compost @ 2.5 t/ha and recommended dose of fertilizers in two splits (pre and post monsoon) were also applied. Cardamom was harvested from July to January at an interval of 15 days and dried in flue pipe kilns. Arecanut was harvested during December to March and dried in the open sun on a specially erected over head platform.

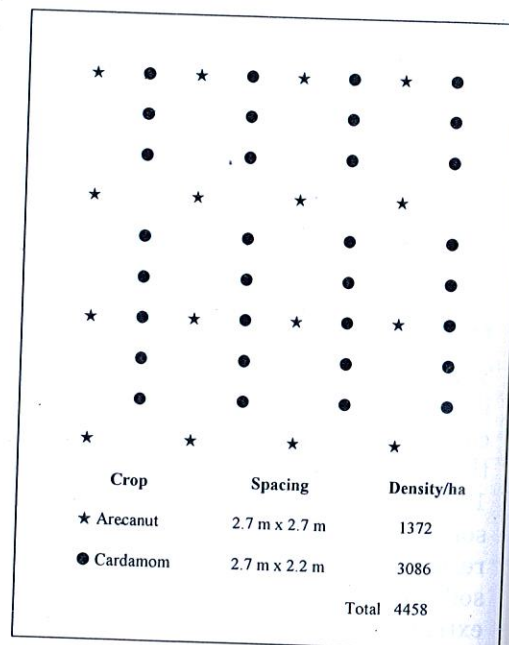


Fig. 1. Planting pattern of mixed cropping of arecanut with cardamom

### Economics of mixed cropping

After dehusking, arecanuts were graded according to size and boldness. Tabular analysis was performed to arrive at the cost of cultivation under mixed and mono cropping systems. In order to study the feasibility of investment, Net Present Worth (NPW) and Benefit Cost Ratio (BCR) were also calculated.

### Results and discussion

#### Input requirement/costs

##### Mixed cropping

The total cost of inputs was Rs.40,683/ha (Table 1). Among the crops, the cost associated with arecanut at higher with Rs.23,434 (57.60 per cent of total cost) and that of cardamom was Rs. 11,873 (29.18 per cent of total cost). The remaining 13.22 per cent of cost was shared by both the crops for common cultural operations like weeding, mulching, shade regulation, fuel charges and miscellaneous items. Among the inputs, the cost of labour accounted for a major share in both the crops. However, cost of fertilizers, pesticides and labour expenses towards fertilizer application, plant protection measures, harvesting etc. was higher in arecanut compared to cardamom.

##### Monocropping

The total cost of cultivation of arecanut as a monocrop was Rs. 27,571/ha (Table 1). Among the inputs, in monocrop also, labour expenses towards fertilizer application, plant protection measures, harvesting etc. was high - Rs.16,102/ha (58.40 per cent of cost of cultivation) followed by fertilizers/manures (36.42 per cent), irrigation fuel charges (2.90 per cent) and pesticides (2.28 per cent).

#### Yield and prices

The mean yield of arecanut was 3221

Table 1. Input requirements/costs in mixed cropping of arecanut with cardamom and mono cropping of arecanut \*

Particulars	Mixed cropping			Mono cropping		
	Arecanut	Cardamom	Common expenses	Total	Percentage of arecanut	
Fertilizers/manures	10,130	4764	-	14,894	36.61	
Pesticides	661	147	-	808	1.99	
Labour	12,643	5234	-	17,877	43.94	
Common expenditure for arecanut and cardamom	-	-	3547	3547	8.72	
Cultural operations, weeding, mulching, shade regulation	-	-	1829	1829	4.49	
Irrigation, fuel/ power charges	-	1728	-	1728	4.25	
Miscellaneous	-	-	5376	5376	13.22	
Total	23,434	11,873	40,683	40,683	100.00	
* Average of 8 years (1986 - 94 ) in Rs/ha					27,571	100.00

**Table 2.** Yield levels and prices realised in mixed cropping of arecanut with cardamom and mono cropping of arecanut

Year	Arecanut		Cardamom		
	Mixed cropping with cardamom (kg/ha)	Mono cropping (kg/ha)	Price (Rs/kg)	Yield (kg/ha)	Price (Rs/kg)
1986-87	2735	2900	240.00	-	-
1987-88	3180	3500	153.50	66	183
1988-89	3860	4035	193.90	408	215
1989-90	2735	2985	210.30	325	217
1990-91	3410	3565	326.90	200	326
1991-92	3400	3585	536.20	-	-
1992-93	3695	4020	566.60	320	335
1993-94	2755	3010	580.60	650	440
Mean	3221	3450	351.00	328	286

and 3450 kg/ha in mixed and mono cropping systems, respectively (Table 2). The price of arecanut showed a fluctuating trend during the study period.

In the case of cardamom, no yield was obtained during 1986-87 and 1991-92 due to fresh introduction and replanting (pre bearing period) during the respective years (Table 2). The average yield was 328 kg/ha with an average price of Rs.286/kg. The price of cardamom also showed a fluctuating trend during the study period.

#### Costs and returns

##### Cost of cultivation

The average cost of cultivation for 8 years was Rs.40,683/ha in the mixed cropping system which was 47.6 per cent higher than mono cropping of arecanut (Rs.27,571/ha). The cost of cultivation showed an increasing trend in both mono and mixed cropping

systems except during the seventh year (1992-93) (Table 3). The highest cost of cultivation (Rs.62,587) in mixed cropping of arecanut during the eighth year of study (1993-94) was due to the bumper yield of cardamom (642.30 kg/ha). Harvesting of cardamom is a labour intensive operation which accounts almost 60 per cent of the cost of cultivation (Korikanthimath 1995). The high cost of cultivation during the sixth year of study (1991-92) was due to the bumper yield of arecanut (4020 kg/ha). Harvesting of arecanut is a risky job and is performed by skilled labourers who demand higher wages which leads to higher cost of cultivation especially during years of good harvest.

##### Gross returns

During the first year of study (1986-87) the gross returns in mixed cropping system (Rs.72,000/ha) was less than that of mono cropping of arecanut (Rs.73,920). This is attributed to the

**Table 3.** Costs and returns of mixed cropping of arecanut with cardamom compared to mono cropping of arecanut

Year	Gross returns			Cost of cultivation			Net returns		Percentage net gain/loss over mono crop
	Mixed cropping	Mono cropping		Mixed cropping	Mono cropping		Mixed cropping	Mono cropping	
1986-87	72,000	73,920		25,138	17,638		46,862	56,282	-9420
1987-88	65,803	59,097		25,848	19,907		39,955	39,190	+765
1988-89	1,70,127	85,898		35,802	22,882		1,34,325	63,016	+71,309
1989-90	1,33,615	68,978		36,948	25,752		96,667	43,226	+53,441
1990-91	1,87,787	1,28,145		37,984	27,516		1,49,803	1,00,629	+49,174
1991-92	1,91,960	2,03,220		51,212	32,586		1,40,748	1,70,634	+29,886
1992-93	3,37,240	2,38,255		49,948	37,839		2,87,292	2,00,416	+86,876
1993-94	4,61,631	1,92,062		62,587	36,452		3,99,044	1,55,610	+2,43,434
Average	2,02,520	1,31,197		40,683	27,571		1,61,837	1,03,626	+58,211

Values denote Rs/ha

pre-bearing stage of cardamom since the crop was introduced as a mixed crop during the said year. The highest gross returns of Rs.4,61,631/ha in mixed cropping during the eighth year (1993-94) of study was due to the bumper yield of cardamom (642 kg/ha-dry). This trend is in conformity with the results obtained by Sannamarappa (1993) who studied the gross returns of arecanut based high density multispecies cropping systems consisting of arecanut, banana, betel vine, coffee, lemon and tapioca. An increasing trend in gross returns of mixed cropping was observed from the fifth year (1990-91) onwards. However, in case of mono cropping also the increasing trend in gross returns started from the fifth year (1990-91) onwards and continued up to the seventh year due to increased price of arecanut. The slight decline in gross returns during the eighth year of study was attributed to a marked drop in yield (3010 kg/ha) of mono crop of arecanut. On an average (8 years average), the gross returns of arecanut was higher by 54.36 per cent compared to mono cropping.

##### Net returns

During the first year of study, the net returns of Rs.46,862 in mixed cropping was less than mono cropping of arecanut by Rs.9420/ha (16.8 per cent). This was due to the pre-bearing stage of cardamom. The highest net returns of Rs.3,99,004/ha in mixed cropping during the eighth year of study was due to the bumper yield of cardamom as stated earlier. On an average (8 years average), the net returns in mixed cropping (Rs.1,61,837/ha) was higher by 1.56 times compared to mono cropping of arecanut. The net loss of Rs.9420/ha during the first year of study in mixed cropping was due to the pre-bearing

stage of cardamom (Table 3). The high incremental net gain of Rs.2,43,434/ha obtained in mixed cropping was higher by 156.4 per cent compared to mono cropping during the eighth year of the study. This was due to the bumper yield of cardamom as mentioned earlier. On an average, a net gain of Rs.58,211/ha in mixed cropping clearly indicates the importance of cultivation of cardamom as a mixed crop with arecanut. Mixed cropping in arecanut plantations besides increasing production and generation of additional income, can also act as a social security against instability of yield in arecanut due to incidence of *mahali* disease (Sannamarappa & Muralidharan 1982).

#### Comparative economics

The discounted costs and returns were higher in mixed cropping system compared to mono cropping system (Table 4). The high NPW of Rs.5,13,989/ha obtained in mixed cropping was 47.7 per cent higher than in the mono cropping system. The highest BCR of 4.46 was also obtained in the mixed cropping system.

**Table 4.** Economics of mixed cropping of arecanut with cardamom compared to mono cropping of arecanut

Particulars	Mixed cropping (Arecanut + Cardamom)	Mono cropping (Arecanut)
Discounted gross returns (Rs/ha) @ 18% p a	6,62,608	4,50,127
Discounted cost (Rs/ha) @ 18% p a	1,48,619	1,02,129
NPW (Rs/ha)	5,13,989	3,47,999
BCR	4.46	4.41

NPW = Net Present Worth  
BCR = Benefit Cost Ratio

Generation of income and employment  
There was a staggered generation of returns in the mixed cropping system compared to mono cropping of arecanut. Harvesting of cardamom commences from July and ends by January, at an interval of 15 days. Harvesting of arecanut was done during December-March. Thus the farmer can sell cardamom from January at regular intervals depending upon the need and urgency to meet the expenses of various cash inputs. Arecanut when dried can be sold in small and convenient lots from January to March. Thus mixed cropping of cardamom with arecanut helps small and marginal farmers in selling the produce as and when they need finances to meet their farm and family expenses over a period of 9 months in a year (July to March). Since both cardamom and arecanut are non-perishable and can be conveniently stocked for a period of at least 15-18 months after harvest, it also gives an option to the farmers to sell the produce depending upon the price in the market.

Mixed cropping of cardamom with arecanut also provides continuous gainful employment to family labourers of small and marginal farmers throughout the year. Harvesting of cardamom is spread over a period of 7 months (July to January) and that of arecanut from December to March, besides various other seasonal operations like application of fertilizers/manures, mulching, weeding, irrigation and plant protection measures almost round the year. After harvesting and drying arecanut in the open sun, the nuts can be stored and dehusked by family labourers/hired labourers any time later depending upon the need for marketing.

#### References

- Balasingha D 1989 Light penetration patterns through arecanut canopy and leaf physiological characteristics of intercrops. *J. Plantn. Crops* 16 (Suppl.) : 16-17.
- Bavappa K V A & Jacob V J 1982 High intensity multispecies cropping - A new approach to small scale farming in the tropics. *World Crops* 34 (2) : 47-50.
- Bhat K S & Leela M 1968 Cultural requirements of arecanut. *Indian Fmg.* 18 (4) : 8-9.
- Korikanthimath V S 1995 Economics of sustained production of cardamom (*Elettaria cardamomum* Maton). *J. Spices Aromatic Crops* 4 : 119-128.
- Sannamarappa M 1993 Arecanut based cropping system in maidan parts of Karnataka. *J. Plantn. Crops* 21 (Suppl.) : 3-6.
- Sannamarappa M & Muralidharan A 1982. Multiple cropping In: Bavappa K V A, Nair M K & Prem Kumar T (Eds.) *The Arecanut Palm* (pp. 133-149). Central Plantation Crops Research Institute, Kasaragod.