

Table 4. Rate of soil moisture use by bittergourd at different growth stages

Levels of irrigation	10-25 DAS	25-40 DAS	40-55 DAS	55-70 DAS	70-95 DAS	Seasonal average
	mm/day					
15 mm CPE	4.33	5.44	4.94	4.54	3.77	4.07
30 mm CPE	3.36	3.88	3.72	3.62	2.71	3.05
45 mm CPE	3.26	3.50	3.37	2.94	2.13	2.67
Farmer's practice	5.07	5.85	5.09	4.89	4.20	4.43

practice of irrigation i.e., irrigation once in alternate days recorded the highest yield of 14.1 t ha<sup>-1</sup> which was statistically on par with irrigation at 15 mm CPE, yielding 13.9 t ha<sup>-1</sup>. The above two treatments were significantly superior to irrigation at 30 and 45 mm CPE. Since irrigation at 15 mm CPE was on par with farmers practice, it is more economical to irrigate bittergourd at 15 mm CPE (approximately 3 days interval) with 40 mm of water which ensures

better water utilization (a saving of 480 mm of water) without affecting the fruit yield.

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## LABOUR REQUIREMENT FOR ARABICA COFFEE AND CARDAMOM AND ITS RELATIONSHIP WITH PRODUCTIVITY LEVELS IN THE MIXED CROPPING SYSTEMS

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## ABSTRACT

The field experiment carried out at Chettalli northern part of Kodagu district, Karnataka revealed that, the mixed cropping of arabica coffee with cardamom able to generate gainful employment 1.90 times higher than the mono crop of arabica coffee. In both the crops the utilisation of women labourers was maximum. A significant correlation between yield levels and labour requirement was observed in arabica coffee. In cardamom, the variation in labour requirement in tune with the yield levels was observed as indicated by their coefficient of variation. Thus, mixed cropping of arabica coffee with cardamom found superior both with respect to generation of gainful employment and income in the high ranges of western ghats.

**KEY WORDS :** Labour requirement, correlation, yield levels, cardamom, arabica coffee.

In India, coffee has a place of pride among plantation crops and is a leading agro-based industry. It is cultivated in 3 lakh hectares in about 1.4 lakh holdings. Majority of these holdings (98%) are under small grower sector ( ha) accounting for 65% of the area contributing around 60% of the country's production. Productivity of these units should be increased by intensive cultivation of coffee, resorting to diversification with suitable perennial crops to improve and sustain high income from available land (Hanumanth Rao, 1986). The

selected component crops should have a short gestation and of a high value which can provide flow of income at different periods of the year (Korikanthimath and Peter, 1992).

Coffee industry is a labour intensive one and it provides direct employment to 3.62 lakh persons and to many others in the processing and marketing field. Almost all the operations in coffee and cardamom have to be carried out by manual labourers in the high ranges of western ghats where

the mechanization is hardly possible. In this direction the present study on requirement of labour in the mixed cropping system of arabica coffee with cardamom and comparison of the same with monocrop of arabica coffee may help the farming community to plan and mobilise the human resources to carry out various operations on time.

## MATERIALS AND METHODS

A field experiment to study the compatibility, productivity and labour requirement of arabica coffee with cardamom, was started during 1992 at Chettalli, northern parts of Kodagu district, Karnataka which is predominantly a coffee growing area. The experiment comprised of 2 treatments viz., monocropping of arabica coffee (M<sub>1</sub>) and mixed cropping of arabica coffee with cardamom (M<sub>2</sub>) studied for a period of 3 cropping seasons (1992-93 to 1994-95). The varieties planted were selection No. 795 in arabica coffee and Cl.37 (Malabar type) in cardamom. The arabica coffee monocropping was spaced at 2.1 m x 2.1 m (2268 plants/ha)

Alternate rows of coffee (planted in 1982) at a spacing of 2.1 m x 2.1 m were removed in 1992 to

Table 1. Per hectare labour requirement in mix cropping of arabica coffee with cardamom (average of 3 years) and monocrop of arabica coffee

Sl.No.	Particulars	Men	Women	Total
I. Mix cropping of arabica coffee				
1.	Arabica coffee	103	191	294
2.	Cardamom	108	285	393
3.	Common cultural operations	79	58	137
	Total	290	534	824
II. Monocropping of arabica coffee				
		261	173	434

introduce cardamom as a mixed crop. After removing alternate rows, coffee could get a spacing of 4.2 cm x 2.1 m (1134 plants/ha) in the mixed cropping system. The inter row spacing of 4.2 m was used for planting cardamom during June, 1992 in a single hedge row at 1.5 m apart (1587 plant/ha).

Regular cultural operations, irrigation and plant protection were carried out in arabica coffee and cardamom as per schedule. Cardamom was harvested from July to January at an interval of 15 days, dried in the flue pipe kiln, processed and graded, coffee was harvested during February and resorted to wet processing. The pulped beans were dried on the RCC drying yard in open sun.

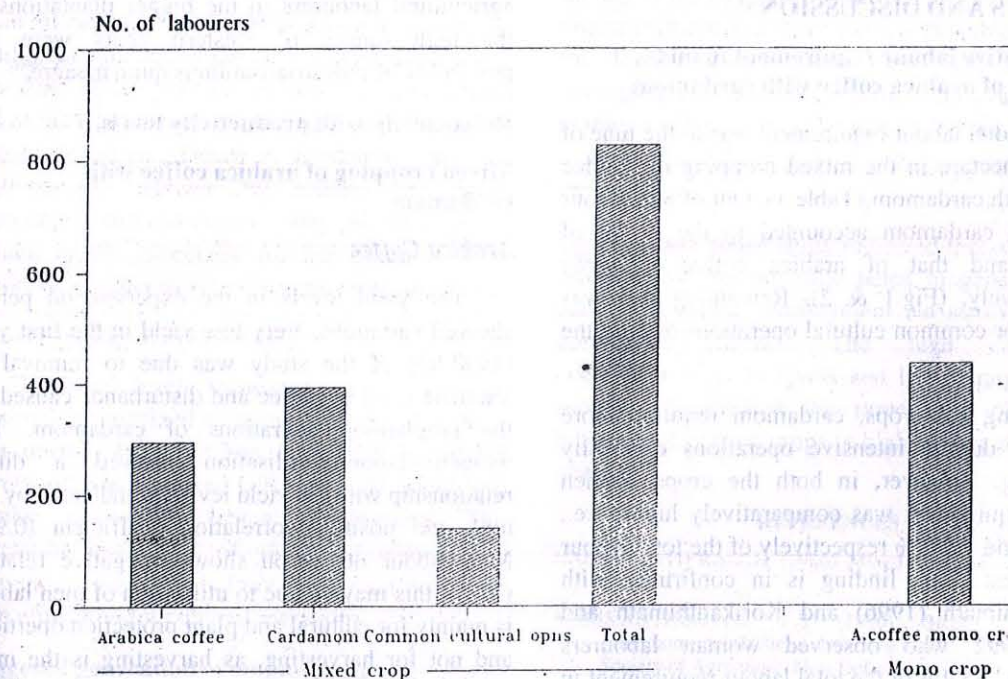


Fig. 1 Labour utilization pattern in mixed cropping of A. coffee with cardamom Vs mono crop of A. coffee per ha

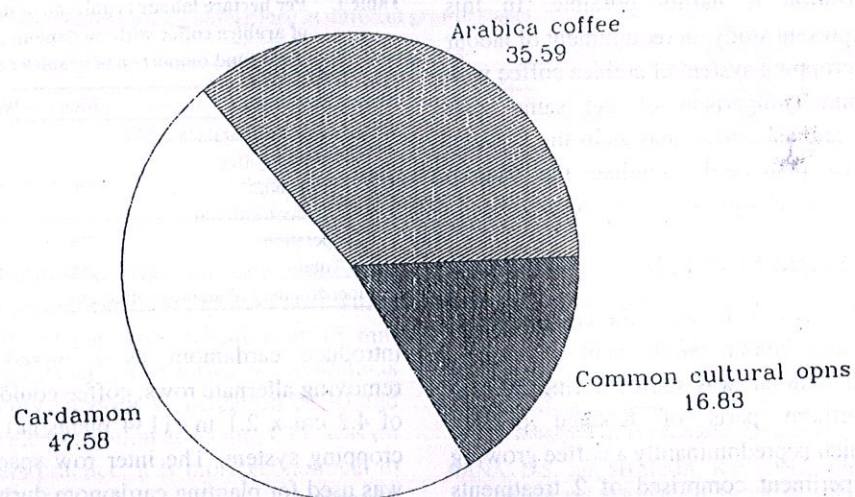


Fig. 2 Percentage of labour utilisation pattern in mixed cropping of A. coffee with cardamom

The labour requirement was worked out for both the systems and correlation analysis was carried out to see the relation between yield levels and labour requirement of arabica coffee in both the systems

## RESULTS AND DISCUSSION

### Comparative labour requirement in mixed cropping of arabica coffee with cardamom

The total labour requirement was to the tune of 824 per hectare in the mixed cropping of arabica coffee with cardamom (Table 1). Out of 824 labour days, the cardamom accounted to the extent of 47.69% and that of arabica coffee (35.68%) prospectively. (Fig.1 & 2). Remaining part was utilised for common cultural operations of both the crops.

Among the crops, cardamom required more labourers due to intensive operations especially harvesting. However, in both the crops women labour requirement was comparatively higher i.e., 64.97% and 72.52% respectively of the total labour requirement. This finding is in confirmity with Korikanthimath (1996) and Korikanthimath and Peter, 1992 who observed woman labourers constituted 85.4% of the total labour requirement in cardamom.

Among the systems, the per hectare labour requirement of mixed cropping (824) was 1.90 times higher than the monocropping of arabica coffee. Thus, mixed cropping system was found to be superior with respect to generation of gainful employment for small and marginal farmers and agricultural labourers in the bigger plantations in the high ranges of western ghats were the possibility of industrialisation is quite meagre.

### Relationship with productivity levels.

#### Mixed cropping of arabica coffee with cardamom

##### Arabica Coffee

The yield levels in the experimental period showed variations. Very low yield in the first year (1992-93) of the study was due to removal of alternate rows of coffee and disturbance caused by the preplanting operations of cardamom. The women labour utilisation showed a direct relationship with the yield levels as indicated by the high and positive correlation coefficient (0.98). Men labour utilisation showed negative relation (-0.73) this may be due to utilisation of men labour is mainly for cultural and plant protection operations and not for harvesting, as harvesting is the most labour intensive operation of almost all plantation

Table 2. Relation between productivity levels and labour requirement

Year	Mixed cropping						Mono cropping					
	Arabica Coffee yield kg/ha	Men	Women	Total	Cardo- mom yield kg/ha	Men	Women	Total	Arabica coffee yield	Men	Women	Total
1992-93	260.2	128	116	234	-	123	170	293	1348.6	250	159	409
1993-94	874.7	97	248	345	49.9	94	180	274	2271.2	275	190	465
1994-95	589.1	85	210	295	626.1	108	504	612	1751.1	250	170	420
r	-	-0.73	0.98**	1.00***	-	-	-	-	-	0.90	0.99*	0.96*
cv (%)	53.51	21.47	35.51	19.08	120.54	9.80	66.99	53.95	25.84	9.08	5.59	6.88

Note : r - indicates the correlation between yield and men, women and total labour requirement

\*\*\* Significant at 1 per cent level

\*\* Significant at 5 per cent level

\* Significant at 10 per cent level

crops. The total labour utilisation showed a perfect correlation (1.00) between yield levels and labour requirement as the negative effect of men labour with yield levels was fully out weighed by the positive significant effect of woman labour utilisation (Table 2).

### Cardamom

Cardamom was introduced in 1992-93 and the first crop of 49.9 kg was obtained during 1993-94. In the second year the bumper yield of 626.1 kg was harvested. It is a natural phenomenon in cardamom, that it records highest yield either during 3rd or 4th year of planting, then comes down and attains an average yield. In tune with the yield levels, the requirement of women labour also varied (cv of 66.99%) as harvesting is a specialised and skilled job which is normally done better by women labourers. Delay in harvesting leads to splitting and damage by rodents and birds (Korikanthimath and Naidu, 1986). Mobilisation of women labour especially for harvesting is most important in order to get maximum crop out turn.

### Monocropping of arabica coffee

The yield levels showed a similar trend as observed in the mixed cropping system with a good crop during 1993-94. The high and significant correlation was observed between yield levels and women and total labour requirement. The correlation coefficient of yield and men labour requirement was high but not significant due to its main utilisation for cultural operations.

### Staggered generation of employment and income

The harvest of cardamom commences from July and continues up to January on an average at an interval of 15 days. Picking of arabica coffee would be taken up and completed during January. Thus harvesting of both cardamom and arabica coffee is spread over a period of 7-8 months besides other seasonal operations viz., weeding, irrigation and plant protection measures resulting in almost round the year. Mixed cropping of arabica coffee and cardamom provides local employment to the agricultural labourers in the bigger plantations in the high ranges of western ghats. This also in turn engages the local labour without unduly migrating to urban areas for seeking unemployment and there by it is possible to avoid the development of urban slums. The spread of harvesting period of 7-8 months (July - January) of arabica coffee and cardamom in mixed cropping system also indicated the staggered generation of income.

Thus the above study indicated that, the mixed cropping system not only helps in generation of additional gainful employment but also in getting continuous income. The high correlation coefficient of yield levels and labour requirement further substantiated the importance of human labour in plantation crops in high ranges of western ghats.

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## DETERMINATION OF INSECTICIDE RESIDUES IN POMEGRANATE FRUITS

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RUNNING HEAD : Insecticide residues in pomegranate

### ABSTRACT

The residues of endosulfan and malathion were estimated in/on fruits of pomegranate 1, 3, 7 and 15 days after insecticide spray at Horticultural Research Station, Yercaud. The initial deposit of endosulfan and malathion in/on fruits were 4.118, 6.149, 4.302 and 6.103 ppm for sprays of endosulfan at 0.07 and 0.14 per cent, malathion 0.1 and 0.2 per cent respectively. The safe waiting periods for the harvest of fruits after the spray of endosulfan and malathion at recommended doses were 2.58 and 0.94 days respectively. More than 99 per cent of residues dissipated within 15 days after the spray of endosulfan and within 7 days after the spray of malathion.

KEY WORDS : Pomegranate, endosulfan, malathion, residue, initial deposit, waiting period.

The pomegranate is mainly attacked by anar butterfly or pomegranate fruitborer, *Deudorix isocrates* (Fabr.) which causes severe damage to pomegranate fruits. The IPM measures such as bagging of fruits, spraying of insecticides, collection and destruction of infested fruits as well as dropped fruits were recommended to minimise the fruitborer damage (Mohan kumar *et al.*, 1991 and Vijaya, 1993). The use of chemical insecticides has led to accumulation of toxic residues in the edible fruits and thus necessitates a safe waiting period between the insecticide spray and harvesting of fruits. Chemical control of larvae using endosulfan 0.07 per cent and malathion 0.1 per cent was highly effective when sprayed three times at 15 days interval commencing from flower opening (Karuppuchamy, 1995). Hence, experiments were conducted to study the dissipation of endosulfan and malathion used for the control of fruitborer in pomegranate.

### MATERIALS AND METHODS

Spraying of insecticides viz., endosulfan 35 EC at 0.07 and 0.14 per cent, malathion 50 EC at 0.1 and 0.2 per cent was given on 16th May 1994, 31st May 1994 and 15th June 1994 in a three tree plots of variety 'Ganesh' replicated three times in a randomized block design at Horticultural Research Station, Yercaud. The fruit samples were collected on 0 (3 hrs after spray), 1, 3, 7 and 15 days after the third spray. Eight fruits were collected from each treatment @ 2 fruits (one at the bottom and the other at the top) in each direction. The fruits were cut into pieces and pooled. From this, a sample of 100 g was collected for fortification and recovery studies of endosulfan and malathion.

Endosulfan residues were extracted by modifying the technique followed by Maitlen *et al.*, (1963) and Dikshit *et al.*, (1980). The samples were analysed by gas-liquid chromatograph (GLC) equipped with Electron Capture Detector (ECD).