ECONOMIC ANALYSIS OF BANANA, TAPIOCA AND GINGER AS INTERCROPS IN RUBBER PLANTATIONS OF TRICHUR TALUK

By

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DISSERTATION

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DECLARATION

I hereby declare that this dissertation entitled "**Economic analysis of banana, tapioca and ginger as intercrops in rubber plantations of Trichur taluk**" is a bonafide record of research work done by me during the course of placement/training and that the dissertation has not previously formed the basis for the award to me on any degree, diploma, associateship or other similar title of any other University or Society.

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30-12-1993.

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CERTIFICATE

Certified that this dissertation entitled "**Economic analysis of banana, tapioca and ginger as intercrops in rubber plantations of Trichur taluk**" is a record of research work done independently by **Sri.P.S.Kingsly** under our guidance and supervision and that it has not previously formed the basis for the award of any degree or diploma to him.

We the undersigned Members of the Advisory Committee of Sri.P.S.Kingsly, a candidate for the Post-Graduate Diploma in Natural Rubber Production, agree that the dissertation may be submitted by him in partial fulfilment of the requirements for the Diploma.

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Introduction

INTRODUCTION

The commercial importance of natural rubber, Hevea brasiliensis is evident from the fact that it is an important ingredient in the manufacturing of more than 35,000 industrial, automobile and household articles. India is the fourth largest producer of natural rubber in the world, enjoying the unique position of having a captive market absorbing the entire internal production and very often depending on imports of natural rubber.

Total area under rubber in India is 4,99,374 ha (1992-93) and the production is 3,93,490 mt. Out of this, 82 per cent of the area is under small holding sector which accounts for 83 per cent of the total production. Inorder to cope up with the demand for domestic consumption, about 16,498 mt of natural rubber is being imported.

As in the case of other perennial crops, the gestation period of natural rubber is also relatively high and its estimated economic life is 30 years which varies depending on the agroclimatic conditions, cultural practices and the planting material selected. Normally, the immaturity phase of natural rubber is confined to the first six years and the production cycle begins from the seventh year onwards. Intercropping in rubber plantations is popular in the immature phase, although, variations are observed mainly on account of intercropping intensity and agroclimatic conditions across the major natural rubber producing countries. In India, intercropping

in the immature phase is becoming popular as a source of maximising net income and intercropping of selected crops is recommended by the Rubber Board during the first three years. The major intercrops like banana, tapioca, ginger, yams etc. are grown in India at varying intensities. In southern districts of Kottayam and Pathanamthitta, tapioca and banana are grown. But in northern districts like Trichur, Palghat and Malappuram, banana and ginger are the main intercrops.

As per the recommendations of the Rubber Board, any seasonal/annual crop can be grown as intercrop in the rubber plantation during the first three years. Even tapioca can be planted in the first year itself if the land is not sloppy. Paddy is also being cultivated during second and third years in areas prone to seasonal flooding.

The investigations reported herein were confined to study the pattern of intercropping in Trichur Taluk, to assess the economics of intercropping and to select the best suited intercrop based on their effect on the growth and development of rubber. The intercrops selected for the study were banana (Nendran and Poovan), tapioca and ginger which are common in Trichur Taluk.

REVIEW OF LITERATURE

The available information on intercropping in rubber plantations in India is basically region specific and confined to selected aspects of intercropping.

In a study of comparative merits of different planting techniques, Shepherd (1967) observed that budded stumps raised in polybags recorded higher girth at 32 months age. Similar results have also been reported by Sivanadyan et al. (1973) who observed that while budded stumps took 69 months to obtain maturity, large polybag plants took 60 months in Malaysia.

A survey of intercropping in India conducted by Potti et al. (1981) revealed that tapioca, paddy, ginger and Nendran variety of banana were the most popular intercrops grown by small rubber holders. The study also indicated that the comparative performance of Nendran banana was better in terms of net income, girthing of rubber, establishment of cover crops and control of weeds.

Chandrasekhara (1984) observed that the growth of rubber intercropped with pineapple was better under Sri Lankan conditions.

Sreenivasan et al. (1987) had studied the benefits of growing banana, ginger and turmeric as intercrops in young rubber and reported benefit cost ratio as 1.61, 0.84 and 1.52, respectively.

The intercropping effect of pineapple in rubber plantations in Kottayam district revealed that the pineapple crop was highly beneficial and recorded a BCR of 2.27 (Rajasekharan, 1989).

A study on rubber-cardamom intercropping showed that both could be successfully adopted in Idukki district (Sivadasan and Nair, 1989). For the large scale cultivation of cardamom as intercrop in rubber plantations, the need for utilising rubber clones suited to higher elevation and to standardise the age group of rubber were emphasised.

Ramachandran (1992) has observed that polybag plants resulted in relatively lower rate of casuality. Considering the main objectives of shortening the immaturity period by bringing more percentage of trees for tapping, he has justified the use of polybag plants.

Studies on intercropping in rubber plantation conducted by Simon (1992) revealed that in general banana was the most economic intercrop in rubber which recorded a BCR of 1.78 followed by gingelly (BCR - 1.46) and ginger (BCR - 0.64) in Talipparamba Taluk. He had also reported that among different varieties of banana Poovan was found to be the best with a BCR of 2.32.

The report of Nair (1992) after field study at Mavelikkara Taluk among small rubber growers, revealed that additional income was obtained by intercropping banana, tapioca, paddy, chilly, colocasia etc. during the initial years of rubber planting.

Materials and Methods

MATERIALS AND METHODS

The study was conducted in Trichur Taluk during the year 1993. A brief note on the special features of Trichur Taluk along with the map showing the distribution of the selected villages for the study and the weather data representative of the sample area are furnished in Appendix I, II and III, respectively. Details regarding the intercropped holdings were collected from the Regional Office, Rubber Board, Trichur and 75 sample holdings intercropped with banana, tapioca and ginger as intercrops were selected. Details were also gathered from 25 selected sample holdings where no intercropping was done. The list of selected growers is furnished in Appendix IV. Personal interview method using a pretested questionnaire (Appendix V) was adopted for the collection of data required for the study.

The mean values of the data collected with respect to various aspects of the study were worked out and presented in different tables. The cost of production and returns were worked out and BCR calculated for individual intercrops and compared.

The cost and returns were worked out using ABC cost concepts similar to the procedure followed in the Farm Management Survey of the Government of India (Kahlon and Singh, 1980).

Cost concepts used:

a. Cost A : 1. Labour charges
2. Material expenses
3. Irrigation
4. Marketing and transporation
5. Interest on working capital
6. Miscellaneous (repairs etc.)

b. Cost B : Cost A + Rental value of land

c. Cost C : Cost B + Imputed value of family labour

Income concepts used:

Farm Business Income : Gross Income - Cost A

Family Labour Income : Gross Income - Cost B

Net Income : Gross Income - Cost C

The effect of intercrop on growth of rubber plants was also studied by recording the growth measurements of rubber such as total height of the plant, height at first branching and girth at 125 cm above ground level from third year onwards and expressed in standard units and presented in various tables. For recording the observations ten plants per unit were selected at random.

Results and Discussion

RESULTS AND DISCUSSION

A detailed survey was conducted among the small growers of Trichur Taluk to find out the best suited and economically viable intercrop in rubber plantations based on the benefit cost ratio and effect of each intercrop on growth of rubber. Table 1 shows the salient features of the sample holdings.

It was observed that 53 per cent of units surveyed were without cover crop. The reason behind it is that majority of samples were under intercropping in the initial years and later establishment of cover crop was not easy due to the closure of canopy.

4.1 Planting material

Out of the total sample holdings, 99 samples were planted with polybag plants of RRII 105 clone and the remaining one unit was planted with budded stump of RRII 105. A polybag plant will have two to three whorls of leaves and a height of three to four feet. Since well established, casualities with polybag plants will be less and they can very well withstand the competition from the intercrops. The beneficial effects of polybag plants were also reported by Shepherd (1967), Sivanadyan *et al.* (1973) and Ramachandran (1992). All the above workers had observed that in the case of polybag plants the immaturity period was reduced considerably and plants were uniform in growth.

Table 1. Salient features of the sample holdings

Particulars	No.
1. Number of samples selected	100
2. Planting material	
a) Units planted with budded stumps	1
b) Units planted with polybag plants	99
3. Spacing	
a) 20' x 10'	72
b) 15' x 15'	28
4. Cover crop	
a) Units with cover crop*	47
b) Units without cover crop	53
5. Intercrop	
a) Nendran	20
b) Poovan	38
c) Ginger	11
d) Tapioca	6
e) Without intercrop	25

* 45 units with Peuraria phaseoloides and two units with Mucuna bracteata

4.2 Planting distance

In sloppy and undulated area a planting distance of 20' x 10' was adopted. However, in slightly undulated areas planting distance of 15' x 15' was adopted. Since majority of the units (72%) selected were located in sloppy area, a wider spacing of 20' x 10' was adopted which also favoured intercropping with Nendran and Poovan varieties of banana, without affecting the growth of rubber plants.

4.3 Cover cropping

The status of cover cropping was found to be 47 per cent. Of these, 45 holdings had Peuraria phaseoloides and two were with Mucuna bracteata. In the remaining 53 units cover crop was not planted, mainly due to the high intensity of intercropping. Establishment of cover crop conserved soil and water to a great extent. Peuraria phaseoloides is edible to cattle and will also get dried partially during summer where as Mucuna bracteata will not get dried and also not palatable by cattle.

4.4 Educational status

The level of education of rubber growers in the surveyed area furnished in Table 2 shows that 37 per cent of the growers can read and write even without formal education. However, only one per cent of the selected population had above secondary school

education. The general observation made from the survey is that the educational status of the grower has not influenced the extent of intercropping or the management of the plantation.

Table 2. Educational status of the sample growers

Can read and write without formal education (%)	Level of education			Total (%)
	Primary (%)	Secondary (%)	Above secondary (%)	
37	33	29		100

4.5 Intercropping

In Table 3, the areawise distribution of the sample holdings is presented. Around 70 per cent of the surveyed area was intercropped and the rest without intercrop. Class wise composition of intercropping is given in Table 4. It can be seen that more than half of the intercropped area was accounted by the class 0.21 - 0.50 ha. Intercropped area claimed by class below 0.10 ha and above 1 ha was insignificant. In the gross intercropped area 57 per cent was accounted by Poovan variety of banana followed by Nendran (23%). Only one fifth of the total area intercropped was planted with ginger and tapioca. It was also observed that while growers with intercropped area below 0.21 ha preferred Nendran variety the rest of the groups preferred Poovan variety (Table 4).

Table 3. Areawise distribution of sample holdings (ha)

Area	Nendran		Poovan		Ginger		Tapioca		Without intercrop	
	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area
Upto 0.10 ha	-	-	-	-	1	0.06	-	-	-	-
0.11 - 0.20 ha	9	1.74	3	0.49	4	0.73	2	0.32	6	1.06
0.21 - 0.50 ha	8	2.38	29	9.45	5	1.68	3	0.99	13	4.58
0.51 - 1.00 ha	3	1.92	5	3.61	1	0.80	1	0.51	4	2.19
Above 1 ha	-	-	1	1.12	-	-	-	-	2	2.68
Total	20	6.04	38	14.67	11	3.27	6	1.82	25	10.51

Table 4. Classwise composition of intercrop (%)

Area (ha)	Share of inter-cropped units	Nendran	Poovan	Ginger	Tapioca	Total
0 - 0.10	1	--	--	100	--	100
0.11 - 0.20	13	53	15	22	10	100
0.21 - 0.50	56	16	65	12	7	100
0.51 - 1.00	26	28	53	12	7	100
Above 1	4	--	100	--	--	100
Total	100	23	57	13	7	100

Note: Composition of each intercrop is their percentage to the total intercropped area

4.6 Cropping intensity

The stand per hectare of Nendran and Poovan varieties of banana were found to be 473 and 415 respectively. In the case of ginger and tapioca the complete interspace was occupied with beds and mounds.

4.7 Manuring of intercrop and main crop

For Nendran and Poovan 17:17:17 NPK complex (Vijay) was used and the dosage was 600 g per plant applied in two to three equal splits. For ginger and tapioca very little quantity of fertilizer was used and the dosage was 200 kg/ha (NPK 17:17:17) in two applications. For ginger alone cowdung and mulch were applied. The use of manure was found much lower than the recommended dosage. In almost all units manuring of rubber was done according to the recommendation of the Rubber Board.

4.8 Effect of intercrops on soil erosion

As mentioned earlier, majority of sample units were sloppy which demanded contour terracing and bunding. Eventhough a certain quantity of soil was removed due to intercropping, a major portion of the same was collected in terraces.

4.9 Yearwise distribution of intercrops

Table 5 shows the distribution of intercropping with banana (Nendran and Poovan), ginger and tapioca during the immaturity

period of rubber. It was noticed that Nendran variety of banana was intercropped along with immature rubber during first year itself. During second and third year Nendran cultivation was not followed except in few units. This may be due to the fact that Nendran is not suited for ratooning.

Table 5. Yearwise intensity of intercropping

Intercrop	Intercropped area as % of total area		
	Ist year	IInd year	IIIrd year
Banana var Nendran	65	28	7
Banana var Poovan	80	20	--
Ginger	60	12	28
Tapioca	100	--	--
Average	75	20	5

The area intercropped with Poovan was more than that of Nendran. During first year itself majority of units were intercropped with Poovan variety. In the case of Nendran, the suckers should be freshly planted every year, irrigation facilities are required and stakes should be provided. Eventhough irrigated variety of Nendran fetches more yield, since many of the plantations were on hilly areas, irrigation could not be provided. In the case of Nendran 25 per cent was irrigated and the rest non-irrigated (Podivazha). Propping had been essential since the cultivation was on hill tops which were wind prone areas. In the

case of Poovan, it was noticed that once planted, fresh plantings need not be done every year since the variety is suited for ratooning. This is an added advantage of Poovan for intercropping. Besides, Poovan variety gives substantial crop even under rainfed condition and it doesn't require propping.

At present the size of the new units planted with rubber is relatively small which causes difficulty in intercropping with ginger on large scale. Non availability of sufficient quantity of mulching material and highly fluctuating price are other important factors limiting ginger cultivation. It was also found that only 3.27 ha area was under ginger in the immature rubber plantation.

As in the case of ginger, tapioca cultivation is also becoming unpopular in rubber plantations. Since tapioca absorbs more nutrients from the soil, usually growers do not prefer to plant tapioca as intercrop because of its potential damage on rubber. Another disadvantage is that, it attracts rats and other pests. Therefore, only in hilly areas tapioca was being cultivated. The popular variety used was "Pathinettu", the one which is highly suited for starch extraction.

When compared with ginger and tapioca intercropping, it was noticed that ginger was cultivated during first, second and third years of planting of rubber whereas tapioca was planted along with rubber only during the first year of planting. Both

the crops disturb the soil and cause soil erosion. Ginger cultivation increases the humus status of the soil because of mulching and use of large quantity of organic manure. But in the case of tapioca cultivation it depletes the soil fertility.

4.10 Cost benefit analysis

The major cost elements with regard to banana intercropping (both Poovan and Nendran) were cost of suckers, labour wages and cost of manures (Table 6). The cost of suckers of Nendran was found to be comparatively lower than that of Poovan. Nendran variety has the additional cost element (13%) for propping and wrapping.

The major cost factors involved in the intercropping of ginger and tapioca are furnished in Table 7. As is expected, the cost share of sets in the case of tapioca was found to be insignificant. But the cost share of seed rhizomes in the case of ginger was far higher. It was observed that in the case of tapioca intercropping more manures were used as compared to ginger since otherwise tapioca compete with rubber for nutrition. In general it was found that the share of family labour in total labour was only 7 per cent.

The cost of cultivation and income estimates are given in Table 8. Using those details the various income were derived and they are presented in Table 9. Maximum net income was obtained

Table 6. Details of cost of cultivation per hectare of banana

	Nendran (Rs.)	Percentage share	Pooven (Rs.)	Percentage share
Cost A				
1. Cost of suckers	1181.70	11	1450.57	20
2. Hired labour charges	2363.41	22	1657.80	23
3. Cost of fertilizers	1890.72	17	1657.80	23
4. Cost of organic manures	472.68	4	414.45	6
5. Cost of plant protection chemicals	118.17	1	103.61	1
6. Irrigation	129.13	1	-	
7. Tools etc.	68.16	1	68.16	1
8. Propping materials, wrapping coir etc.	1349.88	12	-	
9. Miscellaneous (repairs etc.)	49.66	1	40.89	1
10. Cost of marketing and transportation	945.36	9	414.45	6
11. Interest on working capital	471.28	4	319.42	4
Total	9040.15		6127.15	
Cost B				
Rental value	1782.69	16	1063.12	14
Total	10822.84		7190.27	
Cost C				
Imputed family labour	115.89	1	62.09	1
Total	10938.73		7252.36	

Table 7. Details of cost of production per hectare of ginger and tapioca

	Ginger (Rs.)	Percentage share	Tapioca (Rs.)	Percentage share
Cost A				
1. Cost of planting material (sets/rhizome)	4500.00	28	164.83	3
2. Hired labour charge	5244.64	33	1750.00	36
3. Cost of fertilizers	1498.77	9	1285.71	26
4. Cost of organic manures	748.92	5	179.67	4
5. Cost of plant protection chemicals	50.00	1	25.00	1
6. Tools etc.	152.90	1	137.36	3
7. Repairs (Miscellaneous)	91.74	1	82.41	2
8. Transportation/ marketing	366.92	2	329.67	7
9. Interest on working capital	695.96	4	217.50	4
Total	13349.85		4172.15	
Cost B				
Rental values	1966.49	13	565.38	12
Total	15316.34		4737.53	
Cost C				
Imputed family labour	535.15	3	96.15	2
Total	15851.49		4833.68	

Table 8. Details of income from intercropping

	Nendran	Poovan
Stand/ha	473	415
Price/kg	Rs. 4.99	Rs. 4.75
Average weight/bunch	6.54 kg	3.92 kg
Income		
a) From the bunches	Rs.15,436	Rs.7,727
b) From the suckers	Rs. 2,365	Rs.2,905
c) Total income/ha	Rs.17,801	Rs.10,632
d) Income/plant	Rs.37.63	Rs.25.62
	Ginger	**Tapioca**
Production/ha	4,495 kg	4,038 kg
Price/kg	Rs. 4.37	Rs. 1.40
Income/ha	Rs.19,643	Rs.5,653

Table 9. Income from various intercrops at different cost concept (Rs./ha)

Particulars	Crops			
	Nendran	Poovan	Ginger	Tapioca
Farm Business				
Income	8760.85	4504.85	6293.15	1480.85
Family Labour				
Income	6978.16	3441.73	4326.66	915.47
Net income	6862.27	3379.64	3791.51	819.32

in the case of Nendran (Rs.6862.27) followed by ginger (Rs.3791.51). The lowest net income was recorded in tapioca intercropping (Rs.819.32).

The estimated BCR are presented in Table 10. The highest BCR was reported in Nendran intercropping (1.63) followed by Poovan (1.47). Though ginger was the second best earner in terms of the net income, the BCR was lower to that of Poovan due to its higher absolute value of cost. Sreenivasan et al. (1987) have also reported banana as the best intercrop in immature rubber plantation with a BCR of 1.61 followed by turmeric (1.52) and ginger (0.84). According to Simon (1992) the most profitable intercrop in rubber plantation in Talipparamba taluk was banana variety Poovan with a BCR of 2.32. The variation in BCR as compared to that observed in the present study may be due to the variation in price over the years over the localities.

Table 10. Benefit cost ratio of various crops at different cost concepts

Particulars	Crops			
	Nendran	Poovan	Ginger	Tapioca
Cost A	1.97	1.74	1.47	1.35
Cost B	1.65	1.48	1.28	1.19
Cost C	1.63	1.47	1.24	1.17

4.11 Effect of intercrops on growth of rubber

a) Girth

Results of the survey indicated that the girth of rubber plants increased with intercropping compared to non intercropped plots (Table 11). Excepting the first year (i.e., 1992 planting) during the entire immaturity period (i.e., upto fifth year), plots intercropped with Nendran banana registered maximum girth whereas the plots without intercrops recorded the minimum girth. During the first year, ginger intercropped plots performed better with a mean girth of 10.16 cm. The difference in girthing was to the tune of 6.70 cm between Nendran (38.45 cm) intercropped plots and those without intercrop (31.75 cm) during fifth year. Among the intercrops, tapioca intercropped plots showed a poor growth in terms of girthing during all the years. Ginger was found to be the next best to Nendran which was followed by Poovan. In general, it was observed that the intercrops like Nendran, Poovan and ginger had a favourable influence on girthing of rubber during the immaturity period. However, tapioca intercropping adversely affected the girthing. The favourable effect of tapioca intercropping observed during the fifth year may be due to the better maintenance received by the rubber plants during the later years, after the harvest of tapioca. The beneficial effect of ginger can be attributed to the addition of large quantities of organic and inorganic nutrients to the soil by way of mulching and manuring of ginger. Banana (Nendran and Poovan) serve as nurse

Table 11. Girth (cm) of rubber as influenced by different intercrops (as on 1993)

Year of planting rubber	Nendran	Poovan	Ginger	Tapioca	Without intercrop
1988	38.45	36.06	37.46	35.56	31.75
1989	30.90	30.11	30.48	N.A	27.30
1990	N.A	26.41	N.A	N.A	20.32
1991	15.87	15.24	15.24	12.70	13.97
1992	7.62	8.46	10.16	5.08	7.36

N.A. - Data not available

NS: Girth was taken at a height of 125 cm from the bud union from 3rd year onwards and girth at collar region for first and second years of planting

crops by providing shade to the young rubber plants, controlling weed growth, addition of mulch and creating dampness to the soil which all inturn create a microclimate favourable for the better growth of rubber. Potti et al. (1981) had also reported the favourable effect of Nendran intercropping on girth of rubber during the initial years. They have enumerated the beneficial effects of Nendran intercropping in rubber plantation.

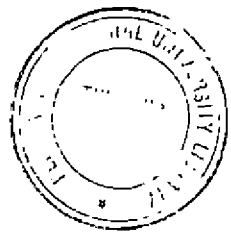
b) Total plant height

The data on the effect of different intercrops on the height of rubber plants are furnished in Table 12. There existed considerable variation among different treatments with respect to total plant height. The rubber plants intercropped with ginger were found to grow taller (6.29 m and 8.38 m) during the later stage of immaturity period (i.e., 4th and 5th year, respectively) followed by Nendran (5.99 m and 7.83 m). However, no uniform results could be observed during all the years. During first year, maximum height was recorded by plants intercropped with Nendran (2.54 m) and minimum by tapioca intercropped plots (1.21 m). In general, plots without intercrops registered a lesser plant height as compared to intercropped plots. The differential performance of rubber in different years of intercropping with different intercrops may be due to the agroclimatic and management effect rather than the direct effect of intercrops. It is quite natural that when there is shade and insufficient nutrition, the plants tend to grow tall and lanky.

Table 12. Total plant height (m) of rubber as influenced by different intercrops (as on 1993)

Year of planting rubber	Nendran	Poovan	Ginger	Tapioca	Without intercrop
1988	7.83	6.70	8.38	7.62	6.09
1989	5.99	5.35	6.29	NA	6.63
1990	NA	5.48	NA	NA	5.08
1991	4.57	3.32	3.75	3.65	4.87
1992	2.54	2.47	2.28	1.21	2.40

NA - Data not available



c) Branching height

The data on the results of the influence of intercrops on the branching height of rubber furnished in Table 13 reveal that first branching occured at a higher level in the case of plots without intercrops (2.61 m) which was followed by tapioca (2.58 m), ginger (2.52 m) and Poovan (2.48 m). Lowest branching height was observed in the case of Nendran intercropped plots (2.38 m). Slight variation in the branching height among different years of planting observed may be due to the environmental effect. The branching height in rubber is negatively related with girthing which is an important measure of growth of rubber. Therefore, intercropping during the immaturity period of rubber in general favours the growth and development of rubber. Among the intercrops studied, Nendran was found to be the best followed by Poovan, ginger and tapioca in terms of their effect on growth of immature rubber plants.

Table 13. Branching height (m) of rubber as influenced by different intercrops (as on 1993)

Year of planting rubber	Nendran	Poovan	Ginger	Tapioca	Without intercrop
1988	2.79	2.43	2.59	2.74	2.60
1989	2.38	2.56	2.33	NA	2.81
1990	NA	2.74	NA	NA	2.43
1991	2.20	2.20	2.64	2.43	2.59
1992	2.13	NA	NA	NA	...
Mean	2.38	2.48	2.52	2.58	

NA - Data not available

Summary and Conclusion

SUMMARY AND CONCLUSION

In India, especially in Kerala State, now-a-days rubber has become a small holder crop. Owing to its long gestation period, rubber plantations are under great pressure for intercropping during the immaturity period. Multitudes of intercrops are being grown by small rubber growers without having the knowledge of how they affect the growth and development of the main crop. Their only concern is to fetch maximum income from immature rubber plantation during which period no income from rubber is possible.

Intercropping of selected intercrops is being recommended by the Rubber Board during the initial three years of planting. However, the selection of intercrops depend on agroclimatic conditions of the locality and regional preference for the intercrop. In northern parts of Kerala, usually, banana, ginger and tapioca are preferred.

The present study was intended to elucidate the pattern and economics of intercropping in immature rubber plantations in Trichur taluk. The investigations also envisaged the assessment of the effect of different intercrops on the growth of rubber based on which the best economically viable intercrop could be selected.

For the study, 75 sample holdings intercropped either with banana (Nendran and Poovan), tapioca or ginger and 25 sample

holdings without any intercrop were selected and the relevant data collected by personal interview using a pre-tested questionnaire during January-June 1993. The salient results emanated from the study are summarised here under:

All the units surveyed were planted with the clone RRII 105 and except in one case the planting material used was polybag plants.

Cover cropping was adopted to the tune of 47 per cent mainly with Peuraria phaseoloides.

More than 50 per cent of the intercropped area was confined to the class 0.21 to 0.50 hectare.

- Out of the gross intercropped area, 57 per cent was accounted by banana var. Poovan followed by Nendran (23%), ginger (13%) and tapioca (7%).

- With regard to yearwise intensity of intercropping, 75 per cent of the farmers have done intercropping during first year, which was reduced to 20 per cent during second year and 5 per cent during third year.

- Tapioca intercropping was found to be limited to first year of planting rubber.

- Nendran banana was found to be the most profitable intercrop with a BCR of 1.63 followed by Poovan (1.47) and ginger (1.24). The lowest BCR (1.17) was recorded in the case of tapioca intercropping.

- The growth of immature rubber in terms of girth was found to be favourably influenced by intercropping banana and ginger.
- Tapioca intercropping in general adversely affected the girthing of rubber.
- Intercropping resulted in increased height of rubber.
- First branching of rubber plants occured at higher level (2.61 m) in the case of plots with no intercrops.
- Lowest branching height (2.38 m) was observed in the case of Nendran intercropped plots.

Considering the higher benefit cost ratio and the favourable effect on the growth of rubber, banana variety Nendran can be recommended as the best suited intercrop in the young rubber plantations in Trichur taluk. Next to Nendran, Poovan and ginger can also be recommended. However, the present practice of tapioca intercropping may be discouraged because of its adverse effect on growth of young rubber.

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Appendices

APPENDIX - I

BRIEF NOTE ON TRICHUR TALUK

Trichur Taluk situates in Trichur District of Kerala. The Taluk has an area of 623.08 Sq. Km. with a population of 7,51,124. Trichur is the cultural city of Kerala.

Majority of the land is under paddy and coconut. Approximately 3000 ha of land is under rubber cultivation.

The Taluk comprises four blocks viz. Anthicad, Cherpu, Ollukkara and Puzhakkal, consisting of more than 70 villages. Medical College, College of Horticulture, Veterinary College, Engineering College and Law College are the main professional colleges in the taluk. Kerala Agricultural University, Kerala Engineering Research Institute and Kerala Forest Research Institute are the other assets of the taluk.

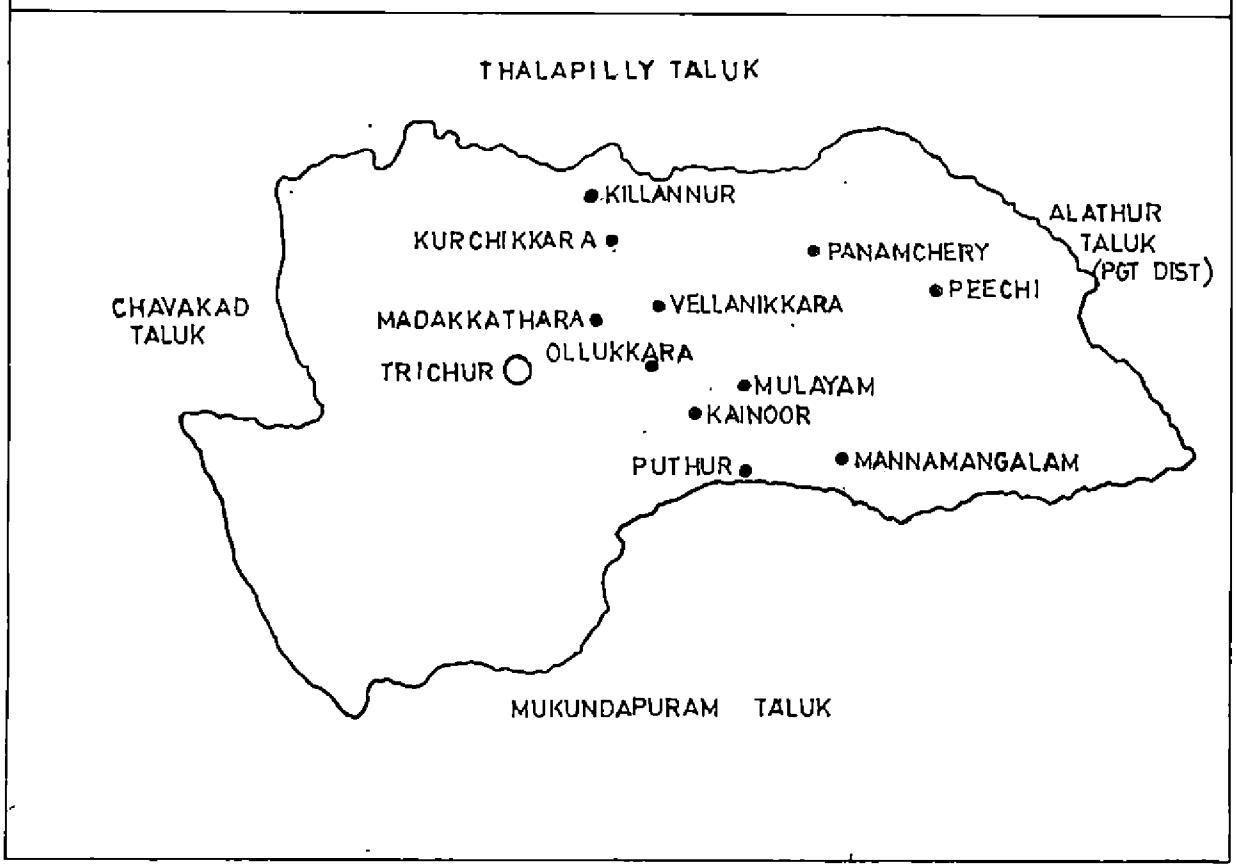
There are two irrigation projects (Peechi and Poomala) which provide water for irrigating 1700 ha of land.

There is an area of 25452 ha baren land suitable for rubber cultivation. A part of this land if planted with rubber will provide employment for 30 years by way of planting operations, tapping, processing and manufacturing. Besides, aforestation also helps In ecological balancing.

APPENDIX III

TRICHUR TALUK

(MAP SHOWING THE DISTRIBUTION OF VILLAGES SELECTED FOR THE STUDY)



APPENDIX - III

Data on rainfall and temperature of Trichur Taluk

RAINFALL (in mm) Year		January	February	March	April	May	June	July	August	September	October	November	December
1990		3.5	0.0	4.4	38.8	583.9	467.3	759.3	356.4	87.5	313.3	69.8	1.8
1991		3.9	0.0	1.8	83.8	56.1	993.1	975.6	553.3	61.5	281.7	191.3	0.2
1992		0.0	0.0	0.0	48.6	90.6	979.8	874.5	562.9	302.9	386.7	376.7	2.0
1993		0.0	6.6	0.0	32.1	131.1							
TEMPERATURE (in centigrade)													
1990	Max.	33.5	34.9	36.0	35.8	31.5	29.7	28.4	29.0	30.7	31.9	31.2	32.3
	Min.	20.8	21.9	23.8	25.4	24.1	23.3	22.5	23.0	23.4	23.2	22.6	23.1
1991	Max.	33.6	35.9	36.4	35.6	35.1	29.7	29.1	29.0	31.5	30.9	31.5	31.9
	Min.	22.2	21.7	27.9	24.5	25.5	23.8	22.8	22.7	23.6	23.2	23.0	21.7
1992	Max.	32.6	34.5	36.9	36.3	33.8	30.1	28.8	28.9	30.1	30.7	31.0	31.1
	Min.	20.9	21.8	22.8	24.6	24.8	23.7	22.7	23.3	23.1	22.9	23.1	22.3
1993	Max.	32.6	34.1	35.4	34.5	34.4							
	Min.	20.7	22.0	23.7	25.0	24.8							

Source: Department of Agricultural Meteorology, College of Horticulture, Vellanikkara, Trichur

APPENDIX – IV

List of growers selected for the study

Sl.No.	Ref. No.	Village	Name and address	Area (ha)
1	2	3	4	5
Units intercropped with banana var. Nendran				
1	PD/TR/A/91/519	Killannur	T.G.Ammini Amma, Vijayabhavanam, Poomala	0.20
2	PDA/TR/92/41	Killannur	M.J.Mathew, Mannoor, Mattampuram	0.61
3	RD/TR/91/470/A	Pananchery	Paily Varghese, Kottarathil, Thalikode, Mudicode	0.80
4	PD/TR/88/53/A	Puthur	K.K.Varghese, Kappany, Ponnukkara	0.46
5	PD/TR/88/54/A	Puthur	K.K.Vaarghese and Thressiamma, Kappany, Ponnukkara	0.25
6	PDA/TR/92/46	Mannamangalam	Mariam, Peruvelil, Mannamangalam	0.22
7	PD/TR/89/121/A	Pananchery	M.Y.Paily, Mattathil, Kannara	0.30
8	PD/TR/89/117/A	Peechi	A.K.Thankamma, Kainattu, Peechi	0.21
9	PD/TR/89/25/A	Pananchery	Sebastian Chacko, Kalluvetil, Mudicode	0.28
10	PDA/TR/91/1532	Killannur	N.V.Varkey, Nettikattil, Chottupara	0.30
11	PD/TR/88/52/A	Peechi	C.M.Mathew, Chamakandathil, Vilangannoor	0.20
12	PDA/TR/92/174	Peechi	V.K.Mathew, Varikalayil, Kannara	0.20
13	PD/TR/89/243/A	Pananchery	Kuruvilla Varghese, Veliyath, Kannara	0.16
14	PD/TR/89/58/A	Pananchery	Ammini Ulahannan, Parapalil, Pattikad	0.20
15	PD/TR/88/111/A	Pananchery	Jose Chacko, Kallivelil, Mudicode	0.18
16	PD/TR/89/116/A	Puthur	M.A.Thomas, Mangattukattil, Vettukad	0.36
17	PD/TR/88/202/A	Pananchery	Sebastian Chacko, Kalluvelil, Mudicode	0.20
18	PD/TR/91/66/A	Pananchery	Manoj Abraham, C/o.V.P.Samuel, Valamkottu, Mannuthy	0.20

1	2	3	4	5
19	PD/TR/88/55/A	Puthur	Thressiamma Varghese, Kappany, Ponnukkara	0.20
20	RD/TR/88/58/A	Peechi	T.K.Mathaikutty, Thoppil, Peechi	0.51
			Total	6.04
Units intercropped with banana var. Poovan				
21	PD/TR/88/101/A	Mannamangalam	A.M.Joy, Ainumakkal, Marottichal	0.20
22	PD/TR/90/731/A	Killannoor	Ouseph Ulahannan, Vaiseril, Poomala	0.15
23	PD/TR/92/57/A	Killannoor	K.J.Varkey, Kochumanikunnel, Chottupara	0.18
24	PD/TR/92/55/A	Peechi	Biji Abraham, Kavanathottathil, Kannara	0.16
25	PD/TR/A/92/537/A	Peechi	C.P.Xavier, Chandazhathu, Kannara (P.O)	0.22
26	PD/TR/A91/200/A	Mannamangalam	Aleyamma Paulose, Parakkal, Mannamangalam	0.20
27	PD/TR/91/330/A	Mannamangalam	P.U.Paulose, Parakkal, Mannamangalam	0.28
28	PD/TR/91/844/A	Mannamangalam	K.A.Paily, Kozhakkekara, Mannamangalam	0.23
29	PD/TR/91/11/A	Killannur	K.K.Antony, Kulangara, Tirur	0.84
30	PD/TR/91/1068/A	Madakkathara	T.V.Babu, Thenganamoochi, Thanikudam	0.25
31	PD/TR/91/38/A	Puthoor	M.A.Thomas, Mangattukattil, Vettukadu (P.O)	0.30
32	PD/TR/89/37/A	Kurichikkara	P.D.Johny, Pullickan, Pongannamkadu	0.27
33	PD/TR/89/46/A	Killannoor	K.K.Rajappan, Kottankulangara, Poomala	0.39
34	Applied for	Mannamangalam	P.J.Joseph, Puthenpurakkal, Marottichal	0.24
35	PD/TR/89/107/A	Mulayam	M.S.Vincent, Myladoor, Valakavu	0.39
36	PD/TR/89/124/A	Peechi	Sosamma Varghese, Thadathil, Kannara	0.31
37	PD/TR/A89/597/A	Panancheri	George Achankunju, Manakalathu, Thalikode, Mudikode	0.24

1	2	3	4	5
38	PD/TR/90/60/A	Killannoor	P.C.Mathew, Perumparayil Chottupara	0.33
39	PD/TR/90/61/A	Killannoor	P.C.Antony, Perumparayil, Chottupara	0.28
40	PD/TR/90/132/A	Kurichikkara	P.D.Jose, Pulickan, Mattampuram	0.50
41	PDA/TR/92/21	Peechi	N.V.Pappy, Niravath, Kannara	0.40
42	PDA/TR/92/178	Ollookkara	Annamma George, Chalyelil Chuvannamannu	1.12
43	PD/TR/A/92/261	,,	Sani George, Chalayelil Chuvannamannu	0.64
44	PDA/TR/92/177	,,	C.K.George, Chalayelil ,,	0.72
45	PD/TR/A/91/6	Killannur	P.L.Thomas, Pallikunnel, Poomala	0.60
46	PD/TR/89/737/A	Kurichikkara	P.T.Thomas, Padikal, Kurichikara	0.61
47	PD/TR/88/98/A	Kurichikkara	Annamma Joy, Mannakath, Kurichikkara	0.80
48	Applied for	Killannoor	K.J.Baby, Koothodiyil, Chottupara	0.40
49	Applied for	Peechi	K.P.Joseph, Kakkanadu, Vilangannur, Peechi	0.40
50	PDA/TR/91/1197	Mannamangalam	N.P.Jacob, Nammanariyaal, Marottichalil	0.36
51	PDA/TR/91/1532	Killannoor	N.V.Varkey, Nettikattil, Chottupara	0.40
52	PD/TR/91/16/A	Ollukkara	N.K.Velayudhan, Nayarangadi, Mannuthy, Mullakkara	0.26
53	PD/TR/91/15/A	,,	Sathi Velayudhan, Nayarangadi, Mannuthy, Mullakkara	0.28
54	PDA/TR/92/171	Killannoor	M.S.Kumaran, Mangaparambil, Poomala	0.45
55	PD/TR/88/142/A	Kurichikkara	K.A.Gopalan, Kurumburam, Mattampuram	0.27
56	PD/TR/88/95/A	,,	Sosamma Thomas, Paadikel, Kurichikkara	0.45
57	PD/TR/88/1/A	,,	Sosamma John, Kalapurakal, Kurichikkara	0.30
58	PD/TR/92/240/A	Killannoor	P.J.Kuriakose, Poovathinkal, Chottupara	0.25
			Total	14.67

...4.

1	2	3	4	5
Units intercropped with ginger				
59	PD/TR/A/92/261	Ollukkara	Sani George, Chalayelil, Chuvannamannu	0.80
60	Applied for	Mannamangalam	M.M.Michle, Mulamkavil, Marottichal	0.40
61	PD/TR/A/88/53	Puthur	K.K.Varghese, Kappany, Ponnukkara	0.46
62	PD/TR/A/88/54	,,	K.K.Varghese and Thressiamma, Kappany, Ponnukkara	0.25
63	PD/TR/A/89/117	Peechi	A.K.Thankamma, Kainattu, Peechi	0.21
64	PD/TR/A/89/116	Puthur	M.A.Thomas, Mangattukattil, Vettukad	0.36
65	PD/TR/A/88/101	Mannamangalam	A.M.Joy, Ainumakkal, Marottichal	0.13
66	PD/TR/A/88/55	Puthur	Thressiamma Varghese, Kappany, Ponnukkara	0.20
67	PD/TR/A/91/136	Pananchery	P.V.Abraham, Puttumpurath, Chuvannamannu	0.20
68	PD/TR/A/89/58	,,	Ammini Ulahanna, Parappalil, Pattikad	0.20
69	PD/TR/A/91/470	,,	Paily Varghese, Kottarathil, Thalikode, Mudikode	0.06
			Total	3.27
Units intercropped with tapioca				
70	PD/TR/91/136/A	Panamchery	P.V.Abraham, Puttum purath, Chuvannamannu	0.12
71	Applied for	Mannamangalam	M.M.Michle, Mulamkavil, Marottichal	0.20
72	Applied for	Peechi	C.O.Ouseph, Cheriyakanayil, Chuvannamannu	0.25
73	PD/TR/92/62/A	,,	T.C.George, Thengukalayil, Vilangannur	0.38
74	PD/TR/88/89/A	Kainoor	P.V.Raghavan, Ponganamoola, Kainoor	0.36
75	PD/TR/88/58/A	Peechi	T.K.Mathaikutty, Thoppil, Peechi	0.51
			Total	1.82

...5.

1	2	3	4	5
Units without intercrop				
76	PD/TR/A/88/41	Peechi	K.E.Baby, Kozhikunnath, Peechi	0.51
77	PD/TR/A/88/29	Killannur	T.K.Narayanan, Thadathilkunnel, Poomala	0.23
78	PD/TR/A/88/13	Kurichikkara	Valsa, Autokkaran, Mattampuram	1.08
79	PD/TR/A/88/1	,,	Sosamma John, Kalapurakal, Kurichikkara	0.49
80	PD/TR/A/89/10	Mannamangalam	P.A.Mathew, Punchakarayil, Marottichal	1.60
81	PD/TR/A/89/34	Kurichikkara	P.D.Paul, Pulickan, Ponganamkad	0.49
82	PD/TR/A/89/73	,,	P.D.Sunny, Pulickan, Ponganamkad	0.38
83	PD/TR/A/89/535	Killannur	Aleyama Thomas, Kolothura, Poomala	0.40
84	PD/TR/A/90/29	,	Pauly, W/o.Sebastian, Alapadan, Chottupara	0.60
85	PD/TR/A/90/30	,,	A.D.Enasu, Alapadan, Chottupara	0.55
86	PD/TR/A/90/255	,,	Aleyama Thomas, Kolothura, Poomala	0.26
87	PD/TR/A/91/24	,,	Ouseph Ulahannan, Vaiseril, Poomala	0.14
88	PD/TR/A/91/1011	,,	K.V.George, Kochumanikunnel, Chottupara	0.37
89	PD/TR/A/91/65	Pananchery	M.I.Mathew, Valomkottu, Mullakkara	0.20
90	PD/TR/A/91/62	,,	V.S.Peter, Valomkottu, Mullakkara	0.40
91	PDA/TR/92/317	Mannamangalam	Jiju P. Varghese, Parackal, Mannamangalam	0.30
92	PD/TR/A/92/696	,,	V.A.Kuriakose, Vannilathil, Mannamangalam	0.53
93	PDA/TR/92/215	,,	P.A.Geevarghese, Parackal, Mannamangalam	0.29
94	PDA/TR/92/45	,,	N.I.Kurian, Nanmanaryil, Mannamangalam	0.18

1	2	3	4	5
95	PD/TR/A/92/189	Killannur	Aleyama Kurian, Aruvalikal, Poomala	0.16
96	PDA/TR/92/235	,,	M.P.Madhavan, Madhuravelil, Poomala	0.20
97	PDA/TR/92/271	Peechi	Mary Scaria, Kuzhimattathil, Kannara	0.35
98	PD/TR/92/488/A	Killannur	K.V.George, Kochumanikunnel, Chottupara	0.18
99	PD/TR/A/92/543	,,	Elia Varkey, Kochumanikunnel, Chottupara	0.22
100	PD/TR/A/92/670	Peechi	V.T.Sebastian, Velikkakath, Peechi	0.40
			Total	10.51

APPENDIX - V

QUESTIONNAIRE FOR COLLECTING DATA ON INTERCROPS FROM SMALL RUBBER GROWERS

1.a. Name and address of the estate owner :

b. Location :

c. Slope of the land :

d. Level of education of the growers :

Can read & write Primary Secondary Above secondary

2. Regd. No./Ref. No. of the estate :

3. Type of planting material with clone :

4. Planting distance :

5. Area under immature rubber :

Extent and year of intercropping Ist 2nd 3rd

6.a. Cover cropped or not :

b. Establishment of cover crop and extent of area :

7. Name of intercrop and number of plants : Ist 2nd 3rd

8. Area under each intercrop :

9.a. Cropping intensity :

b. Manuring of intercrop :

c. Manuring of rubber :

10. Cost of cultivation :

	Banana		Ginger	Tapioca
	Nendran (Rs.)	Poovan (Rs.)	(Rs.)	(Rs.)
a. Cost of seeds/suckers :				
b. Labour charges :				
c. Cost of fertilizers :				
d. Cost of organic manures :				
e. Expenditure for irrigation :				
f. Cost of plant protection chemicals :				
g. Interest on capital :				
h. Repairing of tools :				
i. Land rent paid :				
j. Imputed family labour :				
k. Others, if any :				
Total :				

11. Other cultural operations taken up :

12. Effect of intercrop on soil erosion :

13. Average price during the last three years	90-91	91-92	92-93
14. Selling price in the locality :			
15. Total yield (kg) and returns (Rs.) :			

16. Mode of disposal :

17. Growth parameters of rubber plants :

    a. Height at first branching (m) :

    b. Total height of the plant (m) :

    c. Average girth (cm) :

    d. Overall performance :

18. Remarks :

Place :

Date :

Signature