ECONOMIC FEASIBILITY OF BETELVINE AS AN INTERCROP IN RUBBER HOLDINGS OF MAVELIKKARA TALUK

By

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DISSERTATION

Submitted in partial fulfilment of the requirements for the

Post Graduate Diploma in Natural Rubber Production

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DECLARATION

I hereby declare that this dissertation entitled '**Incidence** cidence **of Tapping Panel Dryness in Rubber in the small holdings of Meenachil Taluk**' submitted in partial fulfilment of the course '**Post Graduate Diploma in Natural Rubber Production**' of Kerala Agricultural University, is a bonafide record of research work done by me and that the dissertation has not previously formed the basis of the award to me for any degree, diploma, associateship, fellowship or other similar title of any University or Society.

Vellanikkar,
1-12-1994.

SEBASTIAN MICHAEL

Dedicated to
Those who inspire me

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Vellanikkara,
22.6.1993.

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DECLARATION

I hereby declare that this dissertation entitled ***"Economic*** *omic* ***feasibility of betelvine as an intercrop in rubber holdings of Mavelikkara taluk"*** *is submitted in partial fulfilment of the course Post graduate Diploma in Natural Rubber Production of Kerala Agricultural University is a bonafide record of research work done by me and that the dissertation has not previously formed the basis of the award to me of any degree, diploma, associateship, fellowship or other similar title of any University or Society.*

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CERTIFICATE

Certified that this dissertation ***"Economic feasibility of betelvine as an intercrop in rubber holdings of Mavelikkara taluk"*** *is a record of research work done by* ***Smt. P.R. Vijayakumari*** *under our guidance and supervision and that it has not previously formed the basis for the award of any degree or diploma to her.*

We, the undersigned members of the committee of ***Smt. P.R. Vijayakumari,*** *a candidate for the Post Graduate Diploma in Natural Rubber Production, agree that the dissertation entitled* ***"Economic feasibility of betelvine as an intercrop in rubber holdings of Mavelikkara taluk"*** *may be submitted by Smt. P.R. Vijayakumari, in partial fulfilment of the requirement of the Diploma.*

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Introduction

1. INTRODUCTION

Though a newcomer among the plantation crops in the country, Rubber occupies enviable place in the national economy. Natural rubber plantation industry which took its tiny first step into India at the dawn of the present century now cover more than 4.50 lakh hectares. Rubber, Hevea brasiliensis is a perennial crop and occupies about 15 per cent of the net cultivated area in Kerala. Majority of the rubber growers are small holders occupying an area of less than one hectare. Since the crop has got a long gestation period, the farmer has to invest a huge amount for raising the crop and has to wait for at least six years to get some earnings from the crop. At present there is only a nominal subsidy of Rs.5,000/- per hectare during gestation period and the balance amount is to be met by the farmer. The spacing recommended for rubber is 4.6 m x 4.6 m. The crop will take three years to spread the canopy. An interspace of at least 2 m is available between two rubber plants which could be efficiently utilised by the intercrop. In Kerala land is very limited. Hence we can utilize this interspace for cultivating other annual crops.

Rubber Board has allowed the farmers to cultivate some annual crops along with the main crop for the first three

years so that income could be generated during the gestation period without badly influencing the main crop. Since the scope for increasing the cultivable area in the country is limited, we have to increase production by intensive cultivation. Intercropping is a technique of intensive cultivation i.e., cultivating other crops in the interspaces of the main crop. Any annual crop including tapioca can be grown in the first year of planting. In the second and third year all annuals except tapioca and paddy can be intercropped.

Piper betle commonly known as "Vettilakodi" is now widely cultivated in Mavelikkara taluk. To meet the increasing demand for the plant leaves for chewing purpose, the commercial cultivation of the crop is now undertaken in Kerala and is becoming more and more popular in the taluk of Mavelikkara.

Though betelvine is not listed among the intercrops recommended for rubber, few farmers at Mavelikkara recently tried this crop in rubber holdings. Recent study (Nair, 1992) has highlighted the practice of growing betelvine as intercrop in rubber plantations of Mavelikkara taluk. Since it is a highly remunerative crop the present study was initiated to assess the economic feasibility of the crop as an intercrop in the rubber holdings.

This writeup embodies the observations and results of the investigations.

Review of Literature

2. REVIEW OF LITERATURE

All the perennial crops have got a long gestation period and it takes four to five years for the canopy and root system to fully occupy the space allotted to each plant. Much work has been carried out to identify ideal crops that can be grown in the interspace of these perennial crops without adversely affecting the growth of main crop.

Colocasia, turmeric and ginger have been reported as suitable intercrops in coconut plantations of Kerala (Lalithabai, 1981). Vijayan (1989) has reported the feasibility of cultivating cucumber and amaranthus profitably in the interspaces of plantain without affecting the bunch yield. Nair *et al.* (1991) reported the possibility of growing 13 medicinal/aromatic plants as intercrops in eight to 20 years old coconut plantations.

Hartely (1977) has reported the poor performance of oil palm while planted with rubber in Indonesia.

Joseph *et al.* (1978) has reported that rubber interplanted with paddy and banana in rotation showed better rate of growth than the others; where rubber was planted with green gram and nendran in rotation, paddy and tapioca in rotation and exclusive leguminous cover.

A survey of agro-economic condition of small rubber growers in Anakkara village of Idukki district by Joseph *et al.* (1978) revealed that the rubber growers preferred one intercrop in their plantation and pepper was found to be the most common one.

Rubber Board has permitted intercropping in the first three years of planting. It should be planted at least one metre away from the rubber plants to avoid direct competition between the main crop and intercrop (Rubber Board, 1980).

Sreenivasan *et al.*(1987) have reported the benefit cost ratio for intercrops in Rubber Plantation as 0.83 for ginger, 1.52 for turmeric and 1.50 for banana, indicating the banana cultivation as more profitable. The total return from ginger did not cover the total cost due to the very low market price. The analysis showed that the relative profitability depends primarily on the market price during the harvesting season.

Vijayakumar *et al.* (1989) reported that Adhatoda beddomei, Rauvolfia serpentina, Holostemma annulare, Kaempferia galanga, Alpinia galanga, Sida rhombifolia, Pueraria sp, Desmodium sp, Strobilanthus haenianus etc. could be successfully cultivated as intercrops in rubber plantations.

Shade tolerant medicinal plants has been reported as

feasible intercrops in the rubber plantation during the unproductive period (Rubber Board, 1987-88).

Blencowe (1989) has reported bananas as the most popular intercrop of rubber in Malaysia. According to him the choice of intercrop is limited by a number of factors.

a. The crop must be easy to grow and have no detrimental effect on the rubber.

b. Labour requirement, which are often seasonal, must be within the capabilities of the family unit or if additional labour is to be hired, it must be freely available at a cost appropriate to the value of the crop.

c. The crop, if to be produced in surplus to family consumption, must be marketable.

Raghavan (1992) has listed the natural flora of medicinal plants that survives in the thick shade of mature rubber plantations.

Rubber Board is giving much stress to the practice of establishing cover crops in the rubber plantations, since it suppresses weeds, check soil erosion, and increases the fertility of the soil.

Composite farming in rubber plantation is reported by

Venkataramani (1992). It is found that rearing rabbits and cultivation of paddy and mushrooms are ideal avenues for small growers. The rabbits can be reared on the cover crops, residues obtained from intercrops - banana, pineapple and mucuna during the immature phase of rubber. It is reported that intercropping experiments started in the research centre Tura and has revealed that rubber plants found in between banana grew better.

Simon (1992) has reported that among the intercrops studied for rubber, plantain was the best one followed by gingelly and ginger in Taliparambu taluk.

Nair (1992) has reported the practice of growing betelvine as intercrop in rubber holdings. The growth of rubber plants in such areas was found excellent but no literature is available about the economic feasibility of betelvine as an intercrop in the rubber holdings.

To assess the feasibility of betelvine as an intercrop in rubber plantations it has to be compared with that of another common intercrop. The present study reveals the economic feasibility of betelvine as an intercrop in the rubber holdings of Mavelikkara Taluk.

Materials and Methods

3. MATERIALS AND METHODS

3.1 Location of study

Mavelikkara taluk is situated in the western part of Alappuzha district and has fifteen villages namely Bharanikavu, Chennithala, Chunakkara, Kattanam, Kannamangalam, Mavelikkara, Nooranad, Palamel, Peringala, Thamarakulam, Thazhakkara, Thekkekara, Thriperinthura, Vallikunnam and Vettiyar (Annexure 1 and 2).

The present study was programmed to assess the economic feasibility of betelvine as an intercrop in the rubber holdings of Mavelikkara taluk. For this purpose a comparative study was made in rubber holdings with plantain, betelvine and covercrop as intercrop and were compared with those without any intercrop.

Details regarding the intercropping pattern in the rubber holdings in the various villages of Mavelikkara taluk were collected from the Rubber Board Regional Office at Adoor, Field Offices at Bharanikavu, Kochalummood and Pandalam. The presidents of the Rubber Producer's Societies of the concerned locality were contacted for the purpose. Though Mavelikkara taluk has 15 villages, rubber was cultivated mainly in eight villages namely Palamel, Nooranad,

Vettiyar, Thazhakkara, Thekkekara, Chunnakkara, Thamarakulam and Vallikunnam (Annexure - 3). In the other villages the main cultivation was coconut and paddy.

3.2 Selection of holdings

Betelvine cultivation was found very popular in Mavelikkara taluk. But very few rubber holdings were found to occupy betelvine as an intercrop. Such holdings were located mainly at Thekkekara and Palamel villages. All the five holdings having betelvine as intercrop were selected for the study. Besides, 20 rubber holdings each under the following category were randomly selected for collecting the data:

a. Rubber holdings with no intercrop
b. Rubber holdings with plantain as intercrop
c. Rubber holdings with covercrop in the interspace
d. Holdings with betelvine as pure crop
e. Holdings with plantain as pure crop

The above units were scattered and located in different villages of Mavelikkara taluk. In all the units the planting material was polybag plants of RRII-105.

3.3 Observations recorded

In order to work out the economic feasibility of betelvine as an intercrop in rubber, details regarding the

cultural practices, cost of cultivation, mode of disposal of the produce, net return obtained etc. were collected from the farmers by contacting them personally with the help of a pre-tested interview schedule (Attached as Annexure-4).

The growth of rubber trees as influenced by various intercrops was evaluated based on the details collected through the interview schedule and was confirmed by visiting individual holdings. Observations were recorded for the rate of establishment, general growth and vigour, pest and disease incidence etc. Twenty trees from each unit were selected for recording girth at 125 cm and height at branching.

Soil samples were collected from three representative holdings under each category and were analysed at the soil testing laboratory at RRII for NPK, and Mg following the methods suggested by Rubber Res. Institute of India (1989). The data collected were tabulated and interpreted for arriving at conclusive results.

3.4 Computation of benefit/cost ratio

The prevailing cost for inputs like planting material, manures, fertilisers, plant protection chemicals and other items essential for each crop were considered for computing the total cost. Interest on capital investment was calculated at the rate of 7.5 per cent and land rent was calculated at

the rate of Rs.150 per 100 sq metre for betelvine and Rs.5 to 7 per plant for plantain (varied with locality). In the case of materials like bamboo, pole, coir, steel wire etc. half the cost was considered. The benefit cost ratio was worked out based on the data collected during the survey.

3.5 Meteorological observations for the location

In this taluk the south-west monsoon extends from the beginning of June to the end of September and north-east monsoon from October to November. Details regarding the rainfall and temperature were collected from the District Agricultural Farm, Mavelikkara.

Results and Discussion

4. RESULTS AND DISCUSSION

The data collected and the facts revealed during the study are presented and discussed below in appropriate heads.

4.1 Details of the location

In Mavelikkara taluk, south -west monsoon extended from the beginning of June to the end of September and north-east monsoon from October to November. The average rainfall in 1991-'92 was 2357.9 mm. During the above period the temperature was found to have varied from 32.8°C to 19.8°C. The average number of rainy days was 145.5 in 1991-'92 (Annexure - 5a and b).

A good number of farmers of Mavelikkara taluk have started rubber cultivation recently. The number of registered units under rubber was only 896 covering an area of 631.91 hectares).

4.2 Cultivation practices adopted for the maincrop and intercrops

4.2.1 Rubber

Details regarding the cultural practices adopted for the maincrop are shown in Table 1. Area-wise distribution of rubber in the surveyed units is presented in Table 2.

Table 1. Cultural practices adopted for Rubber in Mavelikkara Taluk

Number of units surveyed = 65

Sl. No.	Number of units surveyed-65		
	Practices recommended (Rubber Board - 1985)	No. of units adopted	Percentage of total
1.	Planting material-polybag	65	100
2.	Terracing	30	46
3.	Pruning	50	77
4.	Weeding	65	100
5.	Mulching	20	31
6.	Manuring	65	100
7.	Plant protection	65	100
8.	Branch induction	33	51
9.	White washing	52	80
10.	Covercrop establishment	20	31
11.	Drainage	Nil	

Table 2. Area-wise distribution of rubber in the units surveyed

Number of units surveyed = 65

Sl. No.	Holding size (ha)	No. of units	Area (ha)
1.	0.04-0.10	18	1.53
2.	0.11-0.20	14	2.60
3.	0.21-0.50	24	8.74
4.	0.51-1.00	4	3.12
5.	1.01-1.50	3	3.87
6.	1.51-2.00	1	1.64
7.	2.01-3.00	Nil	--
8.	3.01-4.00	Nil	--
9.	4.01-5.00	1	4.33
Total		65	25.83

In all the holdings surveyed, polybag plants of RRII-105 were used as the planting material. Since the terrain was of gentle slope or level, soil conservation practices were found not necessary in most of the holdings. Even then, terracing was found to be a common practice. In a few holdings, edakayyalas (stone bunds) were constructed to control soil erosion.

Polybag plants were planted in pits of 75 cm^3 during June-July months. Majority of the farmers were having the practice of applying fertilisers or organic manures at the time of planting (12 kg compost per pit). Availability of the manure appeared to be the factor governing the type of manure used. During the early stages of establishment, the plants were found protected with plaited leaves of coconut. Gapfilling, proper staking against wind damage, manuring as per the recommendations of the Rubber Board (Rubber Board, 1985), ring weeding around the base of the plant, plant protection measures mainly against shoot rot disease were the other cultivation practices found adopted for the crop. Fifty one per cent of the farmers adopted the practice of branch induction. Only thirty one per cent of the farmers adopted the practice of mulching. In the holdings where it was practiced, dried leaves or green material were used. Eighty per cent of the farmers adopted the practice of white-washing. George (1990) and the Rubber Board (1992) have stressed the

importance of mulching and white washing for better growth of rubber. In general, the small holders of Mavelikkara taluk were found adopting scientific management practices for rubber. However, the practice of covercrop establishment in the early stages were found not satisfactory.

4.2.2 Betelvine

Betelvine cultivation was found very popular in Mavelikkara taluk. It was found cultivated mostly in paddy fields and rarely in the uplands. The crop was unique in its holding size and was found to be less than 25 cents in all the cases studied (Table 3).

Even in holdings where betelvine was accommodated as an intercrop the available area was found not fully utilized for its cultivation. Only small pockets were found occupied with betelvine. The extra care needed and the exorbitant cost of cultivation (discussed later) might be the reason for this restriction.

4.2.2.1 Land preparation

Unlike the maincrop, the intercrop betelvine required more care and attention during land preparation.

The land was dug well to a depth of 0.5 m and furrows of 10 to 15 m length, 0.75 to 1 m width and 30 cm depth were

Table 3. Area-wise distribution of betelvine in the units surveyed

Sl. No.	Area in hectares (slab)	Pure crop		Intercrop	
		No. of units	Area (ha)	No. of units	Area (ha)
1.	0.01-0.02	6	0.12	2	0.04
2.	0.03-0.04	9	0.32	3	0.10
3.	0.05-0.06	3	0.17		
4.	0.07-0.08	2	0.16		
	Total	20	0.77	5	0.14

made 1 m apart. High dose of organic manure was incorporated in the furrows at the time of land preparation (1 kg/sq m). The organic manure applied included farmyard manure and dried leaves of cashew. The leaves of jack tree when incorporated was found to favour fungal infection to the plants.

4.2.2.2 Planting material

Top shoots of two to three year old vines were used as planting material. Three noded cuttings were prepared and planted in small pits of 20 cm^3 taken 30 cm apart in the furrows. While planting, single node was burried in the soil and the rest were left above the soil level. The soil around the planted cutting was pressed firmly to encourage quick sprouting. There were two planting seasons. The Edavakodi was planted in May-June and the Thulakodi in August-September.

4.2.2.3 After care

Shade was provided to the cuttings with coconut leaves and were irrigated daily till establishment. Cuttings established in three weeks time.

Moisture conservation was found to be the most important aspect of betelvine cultivation. Care was taken to keep the soil always moist without water stagnation. Frequent light irrigation (twice a day) and mulching with cashew leaves

could conserve the moisture to the required level. Pot watering was the common practice in the surveyed area.

The cuttings were found to sprout within a month by which time they were to be trailed on standards. Bamboo standards were found to be commonly used. The vines were trailed initially on coir and were later tied to the bamboo standards. The clinging roots provided support for the vine. Steel wires were also found used to reinforce the bamboo poles. The longevity of the bamboo poles were found to be only two years. Since the bamboo poles were in ample supply and were relatively cheaper in the surveyed area, the farmers were found to use the same for trailing betelvine.

Mulching was found to restrict the weed growth to a great extent. Hand weeding was done whenever found necessary.

The farmers were found reluctant to apply chemical fertilizers to the betelvine crop. The common practice was to apply dried and powdered cowdung mixed with wood ash (35 kg/100 sq m) at fortnightly intervals. In alternate weeks, cowdung slurry (35 kg/100 sq m) was sprinkled. Bone meal was also applied at fortnightly intervals (9kg/100 sq m) and the plant base was mulched with dried leaves at frequent intervals.

Scale insects and mealy bugs were the main pests that

attacked the crop. No insecticides were found applied due to fear of toxic action. Only physical methods were adopted to check the insect damage.

Abraham (1986) reported that bacterial leaf spot is a severe disease during the rainy season at Vellayani in Thiruvananthapuram district. No severe disease infestation was observed in the locality surveyed. Prophylactic spray with chemical fungicides were also not practiced.

4.2.2.4 Lowering the vines

Under normal conditions the vines grew to a height of 10 feet in one year's time. In order to obtain vigorous growth there was a practice of lowering the vines (whole growth after defoliation) to the ground level and then mulching with top soil in August-September. The crop was then thoroughly irrigated and manured. This practice was found to induce vigorous shoots and rejuvenate the crop. This was found usually practiced at 6 to 12 months interval.

4.2.2.5 Harvesting and yield

The vine grew to a height of five to six feet in three to six months time. At this stage branching was noticed in the vines. Leaves were removed along with the petiole with the right thumb and index finger. Once the harvesting was

commenced it was continued in every week. The period of harvesting lasted till the next lowering of vines. After each harvest manuring was done with organic manures. Only the leaves from the laterals were collected for marketing (Kannivettila). Then new laterals were formed from the leaf axils. After harvest the leaves were sorted and arranged in bundles of 80 numbers. From a healthy vine garden of 100 suckers (100 sq m area) 20 bundles each consisting of 80 leaves were obtained every week.

4.2.2.6 Economic life span

It was reported that the vines could be coiled around the base of the standard and the process could be repeated for 15 to 20 years under open conditions. No reduction in the yield due to age had been reported. This might be due to the rejuvenation effect while the vines were lowered and mounded every year.

4.2.3 Plantain

Plantain was also cultivated in plenty in Mavelikkara taluk. As a pure crop it was found cultivated in paddy fields and as an intercrop in rubber holdings. The holding size was small when planted as pure crop (Table 4).

As an intercrop the available area was utilized fully

Table 4. Area-wise distribution of plantain in the units surveyed

Sl. No.	Area in hectares (slab)	Pure crop		Intercrop	
		No. of units	Area (ha)	No. of units	Area (ha)
1.	0.01-0.20	20	1.02	15	3.22
2.	0.21-0.50	Nil	--	4	1.09
3.	0.51-0.60	Nil	--	1	0.57
	Total	20	1.02	20	4.88

and the average size of holding was 0.24 hectares. In the surveyed area all the 20 holders started intercropping in the first year of planting itself.

4.2.3.1 Land preparation and planting

The land was ploughed well and pits of size 50 cm^3 were taken. Spacing adopted was different for pure crop and intercrop (Table 5). Propagation was by suckers or offshoots which spring at the base of the banana tree from underground rhizomes. Vigorous sword suckers with stout base were used for planting. Planting was done using disease free suckers keeping five centimetre of pseudostem above the soil and the pits were refilled with top soil.

4.2.3.2 After care

Mulching was practiced by all farmers. The study revealed that all the farmers except one adopted the practice of irrigating the plantain. Details are presented in Table 6.

The farmers were using inorganic as well as organic manure for the plantain (12 kg/plant). The common practice was to apply manure every month.

The propping of plants were not seen practiced in any of the holdings surveyed. The removal of dry leaves, suckers and pseudostems were seen practiced in all the holdings.

Table 5. Planting distance adopted for plantain in the units surveyed

Number of units surveyed = 40

Sl. No.	Inter crop		Pure crop	
	Planting distance (in feet)	No. of units	Planting distance (in feet)	No. of units
1.	16 x 10	1	8 x 7	6
2.	15 x 10	2	8 x 8	4
3.	14 x 14	2	7 x 7	5
4.	16 x 16	1	6 x 6	5
5.	14 x 16	2		
6.	15 x 15	1		
7.	14 x 9	2		
8.	16 x 12	1		
9.	20 x 10	5		
10.	10 x 10	1		
11.	12 x 10	1		
12.	Scattered	1		
	Total	20		20

Table 6. Cultural practices adopted for plantain in the units surveyed

Number of units surveyed = 40

Sl. No.	Particulars	No. of units that adopted the practice	% of the total
1.	Mulching	40	100
2.	Fertilizer application	40	100
3.	Organic manure application	40	100
4.	Irrigation	39	97.5
5.	Propping	Nil	--
6.	Pesticide application	12	30
7.	Removal of dry leaves, pseudostems and suckers	40	100

Bunchytop was the common disease noticed. Out of the 40 units surveyed only 12 had adopted the practice of applying pesticides (Carbofuran around 30 g/plant).

4.2.4 Covercrop

4.2.4.1 Land preparation

The land was tilled well and small beds were taken. Manures were not found applied before sowing the seeds.

4.2.4.2 Planting material

All the farmers in the surveyed area used seeds as the planting material. Pueraria phaseoloides was the common intercrop. Out of the 20 farmers, only 50 per cent of the farmers had done hot water pretreatment before sowing the covercrop seeds (Table 7).

4.2.4.3 After care

Only two farmers had irrigated the covercrop in initial stages. Only one farmer had applied manure.

The establishment of leguminous cover will result in saving of nitrogenous fertilisers and has several other advantages (George, 1990, Rubber Board, 1992). The study revealed that the farmers were aware of the effect of cover cropping but the adoption of scientific cultural practices was very poor.

Table 7. Cultural practices adopted for the covercrop in the units surveyed

Number of units surveyed = 20

Sl. No.	Particulars	No. of units	Percentage
1.	Seeds as planting material	20	100
2.	Hot water pre-treatment	10	50
3.	Irrigation	2	10
4.	Manure application	1	5

4.3 Cost of cultivation for the intercrops

4.3.1 Betelvine

The cost of cultivation of betelvine calculated, based on the data collected from the holders is presented in Table 8. Computation on per hectare basis showed that the cost of cultivation for betelvine as a pure crop was as high as 2.65 lakhs and was 2.19 lakhs when it was grown as an intercrop. The cost of cultivation was found to be very high compared to many other cash crops. This might be the reason for taking up betelvine cultivation in small pockets and the holding size in the surveyed area confirmed the above assumption (Table 3).

The major share of the cost incurred was for the procurement of manures and manuring (33.22 per cent) followed by expenses towards planting materials and irrigation (Table 8). These three accounted for 52 to 57 per cent of the total expenditure. Since the planting material need be procured only during the first year of establishment, a higher net return could be expected in the subsequent years. The higher investment for manures and manuring might be due to the practice of applying organic manures alone for the crop. The prevailing climatic conditions at Mavelikkara taluk (Annexure 5) warrants intensive irrigation for the crop during the summer months.

Table 8. Operation-wise cost of cultivation of betelvine (per hectare)

Particulars	Pure crop		Intercrop	
	Cost	% of total	Cost	% of total
1. Land preparation, planting, trailing, lowering				
a. Material	52292	19.7	31583	14.45
b. Labour	18758	7.07	8000	3.66
Sub total	71050	26.77	39583	18.21
2. Manures and manuring				
a. Cost	53809	20.26	46167	21.13
b. Labour	26416	9.94	26417	12.09
Sub total	80225	30.20	72584	33.22
3. Irrigation expenses	44938	16.92	51167	23.42
4. Harvesting and transporting expenses	15777	5.94	12333	5.64
5. Other expenses like bamboo, pole, steel wire, coir, tools etc.	22098	8.32	21348	9.77
6. Interest on capital	11068	4.17	7823	3.58
7. Land rent	15490	5.94	13667	6.26
Grant total	265426	100	218505	100

4.3.2 Plantain

Cost of cultivation for plantain was found to be Rs.49,456/- when planted as pure crop and was Rs.24,698/- when planted as intercrop (Table 9). This difference might be due to the reduced planting density when planted as intercrop (Table 10). The expenses towards manures and manuring was the highest both in the case of pure crop (44.96 per cent) and intercrop (37.39 per cent) and the trend was the same for the other intercrop - betelvine.

4.3.3 Covercrop

Cost of cultivation for the covercrop in the interspace is presented in Table 11. Expenses towards procurement of seed, land preparation and sowing accounted for 90.7 per cent of total expenditure. The percentage spent for manuring was only 0.7. Only very few farmers were found applying manures for the covercrop. Among the three intercrops studied, the cost of cultivation was the highest for the betelvine followed by plantain and covercrop. Cost of cultivation computed on per plant basis for betelvine and plantain is presented in Table 12. It was around Rs.13/- for betelvine and Rs.43/- for plantain. When grown as an intercrop and was relatively lower than the corresponding values for the pure crop.

Table 9. Operation-wise cost of cultivation of plantain (per hectare)

Particulars	Pure crop		Intercrop	
	Cost	% of total	Cost	% of total
1. Land preparation and planting				
a. Material	3325	6.72	1880	7.61
b. Labour	4909	9.93	2820	11.42
Sub total	8234	16.65	4700	19.03
2. Manures and manuring				
a. Cost	14125	28.56	6206	25.13
b. Labour	8110	16.40	3028	12.26
Sub total	22235	44.96	9234	37.39
3. Irrigation expenses	8143	16.47	4445	17.99
4. Harvesting and transporting expenses	1169	2.36	933	3.78
5. Other expenses like tools repairing charges etc.	1440	2.90	1011	4.09
6. Interest on capital	1968	3.98	1095	4.43
7. Land rent	6243	12.62	3090	12.50
8. Pesticide	24	0.05	200	0.80
Grand total	49456	100	24698	100

Table 10. Planting density for betelvine and plantain in the area surveyed

Cropping pattern	Area surveyed (ha)	No. of plants	Stant/ ha	Average size of holding (ha)	No. of plants/ holding
1. Betelvine					
a. Pure crop	0.77	13520	17558	0.04	676
b. Intercrop	0.14	2400	17143	0.03	480
2. Plantain					
a. Pure crop	1.02	969	950	0.05	48
b. Intercrop	4.88	2830	580	0.24	141

Table 11. Operation-wise cost of cultivation of cover crop (per hectare)

	Particulars	Cost (Rs.)	% of the total
1.	a. Seed	68	13.9
	b. Land preparation and sowing	377	76.8
	Sub total	445	90.7
2.	a. Manures	2.5	0.5
	b. Labour	1.0	0.2
	Sub total	3.5	o.7
3.	Irrigation expenses	14.8	3.0
4.	Interest on capital	27.7	5.6
	Grant total	491	100

Table 12. Cost of cultivation of different intercrops (Per plant)

Particulars	Betelvine		Plantain	
	Pure crop (Rs.)	Inter crop (Rs.)	Pure crop (Rs.)	Inter crop (Rs.)
1. Suckers				
a. Cost	3.05	1.79	3.61	3.51
b. Labour wages	1.03	0.46	4.95	4.81
Sub total	4.08	2.25	8.56	8.32
2. Manure				
a. Cost	2.84	2.61	15.60	10.66
b. Its labour wage	1.47	1.54	8.70	4.93
Sub total	4.31	4.15	24.30	15.59
3. Pesticide/insecticide	--	--	0.02	0.47
4. Irrigation expenses	2.57	3.08	7.80	7.67
5. Interest on capital	0.62	0.45	2.12	1.98
6. Land rent	0.88	0.79	6.91	5.59
7. Other items (Bamboo, pole, steel wire, coir etc.)	1.47	1.22	1.49	1.76
8. Harvesting and marketing	0.87	0.72	1.15	1.45
Grant total	14.80	12.66	52.35	42.83

4.3.4 Partitioning of the total cost for various intercrops

The total cost partitioned for inputs and labour wages for growing betelvine and plantain as pure crop as well as intercrop is presented in Table 13 and 14. Out of the total material cost 70 to 80 per cent was towards procuring planting materials and manures in the case of betelvine whereas in the case of plantain the major investment on inputs was for procuring the manures (68 to 75 per cent). Much difference in the proportioning of the total costs was not observed between pure crop and intercrop. In the case of covercrops major investment was for the procurement of quality seed material (Table 13).

With respect to the labourers engaged and the cost incurred in own family labour, it was observed that 42 to 52 per cent of the total investment for labour was for irrigation in case of betelvine whereas it was 36 to 40 per cent in the case of plantain. Harvesting and transporting charges were found to be comparatively less (Table 14). The extra investment on labour wages in the pure cropped area of betelvine might be due to the additional number of vines standing per unit area.

4.4 Benefit cost analysis

The results of benefit cost analysis are presented in

Table 13. Material-wise cost of cultivation of different intercrops (per hectare)

Particulars	Betelvine				Plantain				Cover crop	
	Pure crop		Inter crop		Pure crop		Inter crop			
	Cost	% of total	Cost	% of total	Cost	% of total	Cost	% of total	Cost	% of total
1. Seeds/ suckers	52292	40.79	31583	31.87	3325	17.60	1880	20.67	68	96
2. Manure	53809	41.97	46167	46.59	14125	74.78	6206	68.22	3	4
3. Other items like bamboo, pole, coir, steel wire etc.	22098	17.24	21348	21.54	1440	7.62	1011	11.11		
Total	128199	100	99098	100	18890	100	9097	100	71	100

Table 14. Partitioning of labour wages towards cost of cultivation of different intercrops (per hectare)

Particulars	Betelvine				Plantain				Cover crop	
	Pure crop		Inter crop		Pure crop		Inter crop			
	Amount	% of total	Amount	% of total	Amount	% of total	Amount	% of total	Amount	% of total
1. Suckers and planting	18758	17.71	8000	8.17	4909	21.98	2820	25.12	377	96
2. Manuring	26416	24.95	26417	26.98	8110	36.32	3028	26.97	1	0.2
3. Irrigation	44938	42.44	51167	52.26	8143	36.46	4445	39.60	15	3.8
4. Harvesting and transportation	15777	14.90	12333	12.60	1169	5.23	933	8.31	--	--
Total	105889	100	97917	100	22331	100	11226	100	393	100

Table 15. The cost of cultivation on per hectare basis was relatively high for betelvine than plantain. The cost of cultivation for betelvine did not vary much in both the cropping systems adopted. On a per plant basis, the cost incurred was around Rs.15/- for pure crop and Rs.13/- for intercrop. Accordingly, the benefit cost ratio was worked out to be 2.03 for pure crop and 2.51 for the intercrop. It was interesting to note a relatively higher benefit cost ratio (2.51) for betelvine as intercrop. This is the reflection of higher total yield in the intercropped area.

The planting density and management practices for betelvine was the same when it was grown as a pure crop or as an intercrop. The significant difference in the benefit cost ratio might be due to favourable effect of the maincrop. Betelvine growers of Mavelikkara taluk were not having the practice of applying chemical fertilisers for the crop. Since the vegetative part is the harvestable produce, chemical fertilisers especially nitrogenous fertilisers can favourably influence the crop. The fertiliser mixture (10:10:4:1.5) incorporated to the soil to favour the growth of rubber might have directly influenced the vegetative growth of betelvine. This indicated that chemical fertiliser could improve the vegetative growth of betelvine. But the keeping quality of the harvested leaves and the disease tolerance of the plants are yet to be studied.

Table 15. Benefit cost analysis or different intercrops on per hectare basis

Particulars	Betelvine		plantain	
	Pure crop	Intercrop	Pure crop	Intercrop
Cost of cultivation	265426 (15)	218505 (13)	49456 (52)	24698 (43)
Total yield	105675 (6)	107933 (6.5)	10925 (11.5)	5800 (10)
Return from harvested produce	528375 (30)	540398 (31.5)	11400 (12)	6380 (11)
Return from suckers	6625 (0.38)	6935 (0.41)	60088 (63)	29000 (50)
Total return	535000 (30.5)	547333 (31.9)	71488 (75)	35380 (61)
Net return	269574 (15)	328828 (19)	22032 (1.45)	10682 (18)
Benefit cost ratio	2.03	2.51	1.45	1.42

The values in parenthesis indicate the computation on per plant basis

Yield of betelvine is in bundles and that of plantain in kilogram

The benefit cost ratio was worked out to be 1.45 for plantain as a pure crop and was 1.42 when it was treated as a intercrop. The cost of cultivation for plantain as pure crop was almost double than that for the intercrop (Table 15).

Thus the results indicate the feasibility of intercropping rubber with betelvine in its early stages of growth.

4.5 Effect of intercrop on growth of rubber

The rate of establishment and growth parameters of rubber as influenced by different intercrops is presented in Table 16. The rate of establishment was found to be relatively good in all the four cases studied with relatively more success in holdings intercropped with betelvine. The higher percentage of establishment (95 to 100 per cent) might be due to the practice of using polybag plants as planting material. The height measured at second year was found to be relatively high in the areas intercropped with betelvine. Girth at 125 cm measured at third year also showed the same trend with more than 30 per cent increase for the plants intercropped with betelvine as compared to those without any intercrop (Plate I). The favourable effect of betelvine on growth of rubber might be due to the beneficial effect of irrigation and heavy dose of organic manures given to the intercrop. Excellent growth for the rubber in the betelvine intercropped area has been reported earlier by Nair (1992).

Table 16. Effect of intercrops on growth of rubber

Growth parameters	Cropping pattern			
	No inter-crop	Cover crop	Plantain	Betelvine
Rate of establishment (%)	95	96	97	100
Height at 2nd year (feet)	10'	12'	12'	15'
Girth at 3rd year (at a height of 125 cm)	15	16	16	20

Plate 1. Three year old rubber holding intercropped with betelvine

(Note the increase in girth and branching height in the intercropped area)

The comparatively increased branching height of the rubber plants in the areas intercropped with betelvine might be due to the fact that the betelvine plants and its bamboo structure occupy more than 10 feet height like a pandal and branches were formed only after reaching at a height above the pandal. Areas intercropped with plantain and covercrop also showed better establishment, plant height and girth as compared to those without any intercrop.

4.6 Soil analysis data

The soil analysis data is presented in Table 17. The nutrient status of the soil was found to be relatively good in the holdings where covercrop was established. Organic carbon and the available P was the highest in the covercropped area, indicating the efficiency of the covercrop in improving the nutrient status of the soil. Both the intercrops studied were found to deplete the organic carbon content. The available P was relatively low in holdings intercropped with plantain. The nutrient status of the soil was found not much affected by betelvine intercropping. The available P, K and Mg were comparable with those holdings having covercrop in the interspace, whereas the organic carbon content of the soil was found to be greately reduced. This indicates the need for applying more nitrogenous fertilisers in the holdings intercropped with betelvine.

Table 17. Nutrient status of the soils in the area surveyed

Details of the area	Organic carbon (%)	Available nutrient status of soil (mg/100 gm soil)			(pH)
		Phosphorus (P)	Potassium (K)	Magnesium (Mg)	
Without any intercrop	0.941	3.2	13.13	3.99	5.5
Cover crop in the interspace	1.3	12.5	5.38	2.99	5.4
Plantain as intercrop	0.56	2.9	3.88	2.49	5.2
Betelvine as intercrop	0.59	10.5	9.13	2.60	4.5

Though betelvine was found to be an economically viable intercrop in rubber plantations of Mavelikkara taluk, this particular crop need utmost care and attention as compared to any other economic crop . Hence betelvine as an intercrop could be recommended for rubber holdings where there is provision for ample supply of irrigation water and organic manure. Though betelvine cultivation was found feasible in small rubber holdings of Mavelikkara taluk, its performance in larger holdings/plantations are to be worked out before popularising the same.

Since betelvine could occupy the field for 10 to 15 years with economic returns, people would be relunctant to give their land on 'lease' to the poor farmers for betelvine cultivation. In rubber plantations, it will take three to four years for the canopy to spread and occupy the space allotted for the crop. Once the canopy spreads, intercrops rarely establish inside and would fail to give economic returns. Hence, most of the existing intercrops will subside after the fourth year. Given proper care and attention betelvine as an intercrop would perform well in the early three to four years and later, the returns from betelvine will have to be sacrificed. This indicates the reason for the farmer's preference for raising betelvine as pure crop rather than an intercrop in rubber plantations. In the surveyed area

only five units could be identified with betelvine as intercrop and farmers were forced to adopt this practice due to non availability of land for long term culture.

Eventhough betelvine was found to act as a feasible intercrop in rubber holdings, we will have to sacrifice the whole betelvine crop by the fourth year which would have otherwise gain economic yields upto 15th year as a pure crop. Hence, we can suggest betelvine as an intercrop in rubber holdings only if land is too scarce for its monoculture.

Summary and Conclusion

5. SUMMARY AND CONCLUSION

A study was carried out to assess the economic feasibility of betelvine as an intercrop in the rubber holdings of Mavelikkara taluk. After collecting the details of the intercropping pattern in the area from the Rubber Board Regional Office at Adoor and field offices at Bharanikavu, Pandalam and Kochalummood, the growers were interviewed for collecting the primary data through personal visits with the help of a questionnaire.

Only five units could be identified having betelvine as intercrop. In addition to this 20 units each consisting of plantain as pure crop, plantain as intercrop, betelvine as pure crop and another 20 units having covercrop in the interspace were also selected for the study. The climate as well as soil conditions of the area were found suited for the cultivation of betelvine. The study revealed that the farmers have started intercropping the rubber holdings with betelvine recently. Only a limited number of farmers have started the practice of planting covercrops in their holdings. Majority of the farmers were using polybag plants for planting and were adopting scientific cultivation practices for rubber.

The maximum holding size intercropped with betelvine was only 0.04 hectare and the minimum was 0.02 hectare. The

actual holding size of rubber where betelvine was intercropped ranged between 0.2 hectare to 1.00 hectare. The study revealed that the minimum number of rubber plants present in the areas intercropped with betelvine was eight and the maximum number was 36. So it is very clear that in a vast area of rubber holding only a negligible portion in a corner of the land had the betelvine as intercrop.

Cost of cultivation computed on per hectare basis was Rs.2,18,505/- for the betelvine as intercrop which was relatively higher than the plantain. So it is practically impossible for a small holder to invest a huge amount for betelvine cultivation in his entire holding. It was also revealed from the study that the farmers and their family devoted practically all the time for the upkeep of the betelvine garden since it provided their bread and butter. For a large grower who employs hired labour it gives additional income , over and above all the expenses incurred.

The benefit cost ratio for betelvine as intercrop was worked out to be 2.51 whereas it was 1.45 for the plantain. This results indicate the feasibility of intercropping rubber with betelvine in the initial stages of growth.

It was also noticed that the growth of the rubber plants when intercropped with betelvine was excellent compared

to the rest of the plants in the same holding. The branching height of the rubber plants was found to be 15 feet when intercropped with betelvine whereas it was only 12 feet when the interspaces were occupied by covercrop and plantain and only 10 feet in the areas without any intercrop. Rubber plants in the area without any intercrop had lesser girth than that coming under covercrop, plantain and betelvine. The rubber plants in the area intercropped with plantain and covercrop had the same girth in the third year. But it is clear that the covercropped area will incur only a lesser amount for maintaining the rubber plants in the proper way compared to the other intercrops since there is no weed growth in the area where covercrop is well established and the manuring expenses are also less. The soil analysis data showed that nutrient status of the soil was found not much affected by betelvine intercropping.

Betelvine could be cultivated as an intercrop in areas where there is enough water and organic manure for its upkeep. Further it would be a great loss for a farmer to remove the betelvine within three years of planting in the intercropped area whereas it could be retained for atleast 15 years continuously in the same area if planted as a pure crop.

If more and more farmers resort to betelvine cultivation the production will increase thereby causing a

reduction in demand followed by an inevitable price crash. For a marginal farmer who is not having much money to spent for the hired labour, betelvine could be recommended as an intercrop provided his family is industrious.

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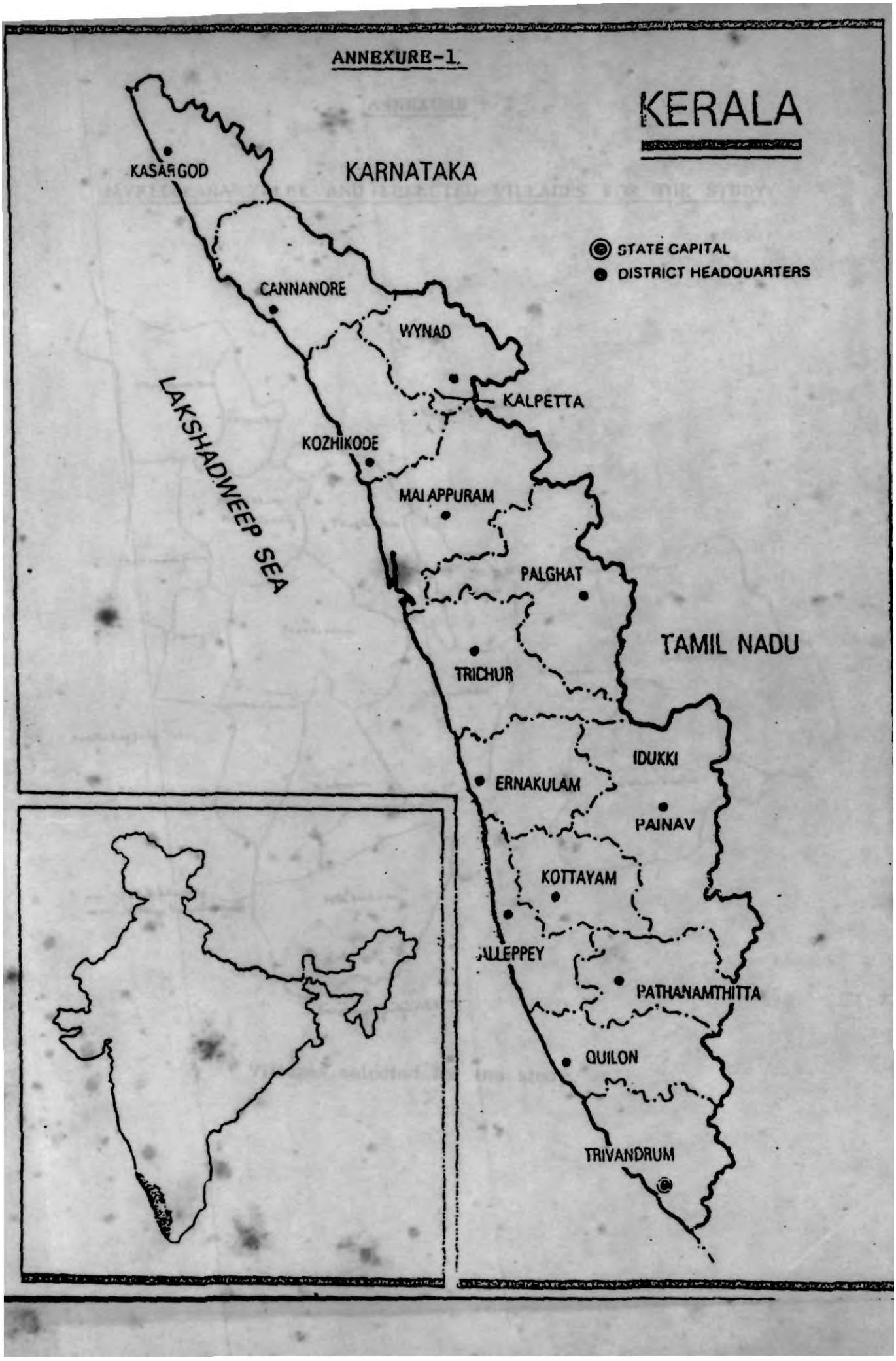
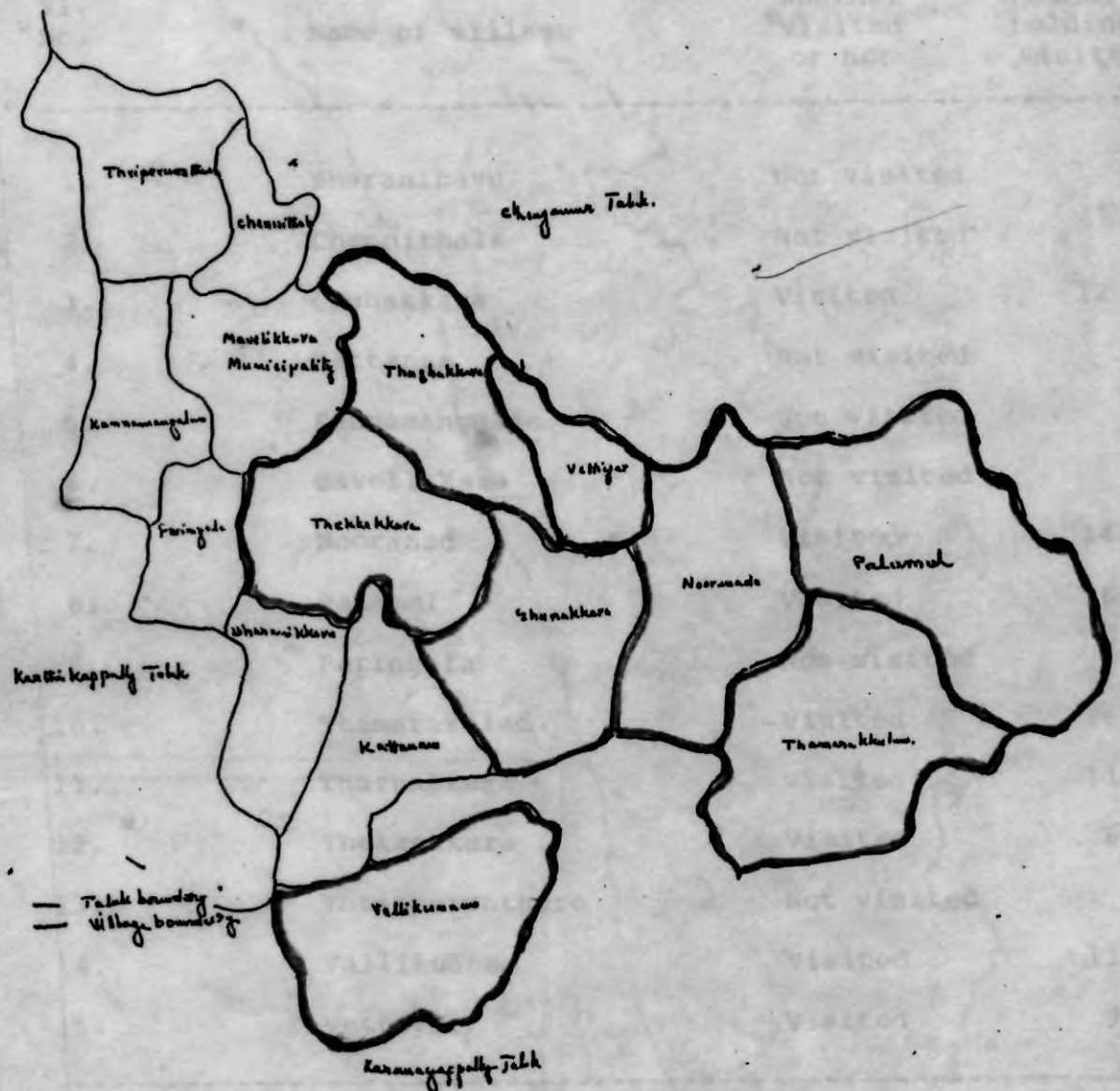
Annexures

ANNEXURE-1.


KERALA
KARNATAKA
KASARGOD
CANNANORE
WYNAD
KALPETTA
KOZHIKODE
MALAPPURAM
PALGHAT
TRICHUR
TAMIL NADU
IDUKKI
ERNAKULAM
PAINAV
KOTTAYAM
ALLEPPEY
PATHANAMTHITTA
QUILON
TRIVANDRUM
LAKSHADWEEP SEA
STATE CAPITAL
DISTRICT HEADQUARTERS

ANNEXURE - 2

MAVELIKKARA TALUK AND SELECTED VILLAGES FOR THE STUDY



● Villages selected for the study.

ANNEXURE - 3

Sl. No.	Name of village	Whether visited or not	Number of holdings visited
1.	Bharanicavu	Not visited	
2.	Chennithala	Not visited	
3.	Chunakkara	Visited	12
4.	Kattanam	Not visited	
5.	Kannamangalam	Not visited	
6.	Mavelikkara	Not visited	
7.	Nooranad	Visited	14
8.	Palamel	Visited	16
9.	Peringala	Not visited	
10.	Thamarakulam	Visited	26
11.	Thazhakkara	Visited	11
12.	Thekkekkara	Visited	6
13.	Thripperunthura	Not visited	
14.	Vallikunnam	Visited	11
15.	Vettiyar	Visited	9
	Total		105

ANNEXURE - 4

Questionnaire of collecting data on intercrops from small rubber growers

1. a. Name and address of the estate owner

   b. Location

   c. Size of the family (No. of adults)

   d. Level of education

   can read & write Primary Secondary Above Secondary

2. Reg. No./Ref. No. of the estate

3. Type of planting material with clone

4. a. Area under immature rubber (ha)

   b. Spacing

	Year	
1st	2nd	3rd
4th	5th	6th
7th		

   c. Area under mature rubber (ha)

5. a. Covercropped or not — Yes/No

   b. Establishment of covercrop — Not established/established/well established at patches/others specify

   c. Area under covercrop

Contd....2.

6. Name of intercrop

	Year	
a. Spacing	1	2
	3	4

7. Area under each intercrop

8. Cropping intensity (actual area intercropped in the rubber plantation)

9. Cost of cultivation	Betelvine	Plantain	Covercrop
a. Cost of seeds/suckers			
b. Labour wages			
c. Fertilisers cost			
d. Cost of cowdung etc.			
e. Cost of pesticide/ insecticide			
f. Expenditure for irrigation			
g. Interest on capital			
h. Land rent paid			
i. Inputed family labour			
j. Others, if any			
Total			

10. Other cultural operations taken up — Mulched/white washed

11. Average price during the last 3 years 1989-90, 90-91, 91-92

12. Selling price in the locality

13. Total return (Rs.)

Contd....3.

14. No. of vacancies supplied

15. Height of branching

16. Girth after 2nd year

17. Overall performance

18. Weed count

19. Irrigated or not
(if planted with betelvine)

    a. Weed count

20. If intercropped with betelvine whether the planter proposes to retain it after 3rd year

21. Yield obtained First year

22. Mode of disposal

Place:

Date :

ANNEXURE 5(a)

Monthwise rainfall data of Mavelikkara taluk (1991-92)

Month	1991		1992	
	Rainfall in mm	No. of rainy days	Rainfall in mm	No. of rainy days
January	--	Nil	--	Nil
February	--	Nil	--	Nil
March	56.0	7	--	Nil
April	146.0	13	2.0	4
May	96.0	11	416.0	15
June	119.0	28	633.0	25
July	388.0	24	810.0	26
August	498.0	24	494.8	25
September	72	6	303.0	19
October	281.0	25	486.0	15
November	196.0	6	387.0	17
December	32.0	1	--	Nil
Total	1884.0	145	3531.8	146
Average of '91 & 92	2357.9			

ANNEXURE 5(b)

Monthwise temperature data of Mavelikkara taluk

Month	Temperature (°C)			
	Maximum	Minimum	Maximum	Minimum
January	31.6	24.0	33.3	16.3
February	34.1	17.2	32.8	19.8
March	36.1	17.3	34.0	19.9
April	36.0	18.0	34.4	21.5
May	35.0	1607	32.5	21.3
June	30.1	22.2	30.8	21.0
July	31.2	23.0	29.5	19.4
August	33.5	20.4	29.8	19.8
September	33.4	22.0	30.2	19.6
October	33.8	20.2	33.3	19.5
November	33.3	20.2	31.4	18.9
December	33.5	20.3	32.8	16.2
Total	401.6	241.3	385.2	233.2
Mean	33.5	20.1	32.1	19.4

ECONOMIC FEASIBILITY OF BETELVINE AS AN INTERCROP IN RUBBER HOLDINGS OF MAVELIKKARA TALUK

By

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ABSTRACT OF A DISSERTATION

Submitted in partial fulfilment of the
requirements for the

Post Graduate Diploma in Natural Rubber Production

Faculty of Agriculture
Kerala Agricultural University

Department of Plantation Crops & Spices
KERALA AGRICULTURAL UNIVERSITY
Vellanikkara - Trichur

1993

ABSTRACT

A study has been conducted to analyse the economic feasibility of betelvine as an intercrop in the rubber holdings of Mavelikkara taluk.

Only five units having betelvine as intercrop could be identified in this area. One hundred other holdings 20 each of betelvine as pure crop, plantain as intercrop, plantain as pure crop having covercrop and without any intercrop were also selected for the study.

The study revealed that only a small portion of the holding was occupied by the betelvine, when it was treated as an intercrop. The cost of cultivation was found to be very high when compared with other cash crops. This might be the reason for limiting the cultivation to a small portion. This was confirmed by the fact that betelvine as pure crop was also limited in extent.

The benefit cost analysis of the above crops revealed that betelvine cultivation was highly profitable with a benefit cost ratio of 2.51 in the intercropped area and was significantly higher than that for plantain which is the other common intercrop. The soil analysis data showed that betelvine absorbed lesser nutrients than plantain.

The rubber plants of betelvine intercropped area showed vigorous growth than other intercrops which was due to the regular irrigation and fortnightly application of organic manure to the betelvine.

Though the cost of cultivation was very high for betelvine, it could be recommended as an intercrop in the rubber holdings where there is availability of water throughout the year since it ensures substantial weekly income for the grower and his family.

Though betelvine could be treated as a perennial crop, the farmers choosing it as an intercrop in rubber holdings will have to sacrifice the same by the fourth year when the rubber canopy closes to the full extent. Hence, we can suggest betelvine as an intercrop in rubber holdings only if land is too scarce for its monoculture.