THE PERFORMANCE OF CLONE R R II 105 IN KUTTANAD TALUK OF ALLEPPEY DISTRICT

By

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DISSERTATION

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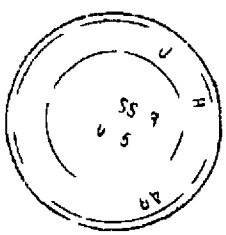
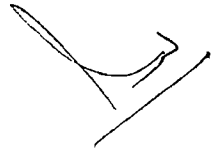


DECLARATION

I hereby declare that this dissertation entitled **The performance of clone RRII 105 in Kuttanad taluk of Alleppey district** 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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CERTIFICATE

Certified that the dissertation entitled **The performance of clone RRII 105 in Kuttanad taluk of Alleppey district** is a record of research work done independently by **Sri Mathew John** 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 Mathew John** a candidate for the Post Graduate Diploma in Natural Rubber Production agree that the dissertation entitled **The performance of clone RRII 105 in Kuttanad taluk of Alleppey district** may be submitted by him in partial fulfilment of the requirement for the Diploma

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Introduction

INTRODUCTION

Hevea brasiliensis (Wild ex Abr de Juss) Muell Arg is perhaps the youngest of the major domesticated crops in the world It accounts for 98 per cent of world s natural rubber production Natural rubber has various uses and there is hardly any segment of life which does not make use of rubber based materials Though the tree and its products have been known for long in the Amazonian Valley its introduction as a plantation crop to the East during the last quarter of the 19th century paved the way for systemat c studies on improvement its exploitation and processing of the crop

The first commercial planting of rubber in India was done in 1902 at Thattakad near Alwaye on the banks of river Periyar Rubber now covers an area of about five lakh hectares of which 85 per cent is in Kerala State

India enjoys a unique position in the field of natural rubber The country has been consuming the entire production of natural rubber which in fact runs short of demand The shortage is overcome by imports depending upon demand The production of natural rubber during 1992 in the country was 3 83 lakh tonnes (Rubber Board 1994) It is estimated that the national requirement by 2000 would be 6 80 lakhs and in 2010 it is likely to be 12 8 lakh tonnes (Menon 1993) This goal of production can be achieved both through long term and short term measures Bringing more area under rubber as well as replanting of old plantings with high yielding clones are the long

term strategies taken up by the Rubber Board Rubber Board envisages extending the area under rubber to the extent of 30 000 ha consisting of 23 000 ha in Kerala and Tamil Nadu 5 000 ha in Tripura and 2 000 ha in other States/Union Territories (Rubber Board 1994)

Kuttanad taluk in Alapuzha district is considered as an area with specific problems due to its peculiar land scape and soil condi tions (Jacob 1967) The total area of the taluk is 1 20 000 ha of which 52 000 ha is occupied by wet land Garden land available is 32 000 ha and the rest is occupied by water waste (Gopalakrishnan *et al* 1983)

Paddy is the main crop of the wet land The garden land in the taluk is generally utilized for the cultivation of coconut cocoa and vegetables By the introduction of Rubber Plantation Development Scheme since 1980 growers started rubber cultivation in Kuttanad in garden lands So far rubber cultivation has been taken up by 25 small holders with a total area of 12 31 ha A feasibility study was conducted in the area on the use of wet land for rubber cultivation (Gopalakrishnan *et al* 1983) The study did not take into account the garden land which can be utilized for growing rubber Though Rubber Board recommends cultivation of rubber in garden lands of the taluk no systematic study has since been conducted to find out the performance of rubber in this problem zone

The short term approaches to increase production and produc tivity include adoption of scientific methods of cultivation and

exploitation of the tree In order to formulate policies for increas ing productivity region wise studies are to be conducted on the conditions of the holding and adoption of management practices Since Kuttanad is described as a lake bed region situated 1 M above MSL a study on the above aspect would be helpful in formulating recommenda tions for this area

The present study was therefore undertaken in Kuttanad taluk with the objectives evaluating the performance of rubber with re spect to yield and secondary characters and studying the different management practices for rubber adopted by the growers

Review of Literature

REVIEW OF LITERATURE

Rubber cultivation in India is confined to the west coast region of the country extending from Kanyakumari in Tamil Nadu to Coorg district in Karnataka The climatic conditions and physio chemical properties of the soil differ from region to region Based on the variation in climatic and soil conditions the rubber growing tract is classified into eight regions (Jacob 1967) Kuttanad is classified as an area with specific problems due to its peculiarity in climate and soil

The studies conducted so far on the performance of rubber in problem areas are much less However the available literature on this aspect are reviewed

2 1 Weather parameters

2 1 1 Rainfall

Rubber is traditionally a rainfed crop According to Mon tieth (1977) the potential evapotranspiration rate was around 4 mm day ^{1} In his study it was found that a rainfall of 125 mm month ^{1} with equal distribution was essential to maintain optimum gaseous exchange for rubber

Cretin (1978) recorded positive correlation between rainfall deficit and cumulat ve product on loss

Pushpadas and Karthikakutty Amma (1980) found that for

optimum growth and yield rubber required an evenly distributed rainfall of 2000 3000 mm in a year In area where rainfall was much less it was found that the tree became stunted with crooked stem and lower number of branches The growth of tree was retarded in regions with pronounced drought season

In Malaysia the daily E T rate of the clone RRIM 600 grown under glass varied from 2 1 to 6 9 mm day ^{1} and under field conditions it was found to be 4 4 mm day ^{1} (Haridas 1980)

The average annual rainfall in Kuttanad was reported as 3250 mm (Gopalakrishnan *et al* 1983)

2 1 2 Temperature

Temperature is one of the key environmental factors influencing plant growth Mean monthly temperature of 21 C to 35 C without wide variations is found suitable for the growth of rubber (Pushpadas and Karthikakutty Amma 1980) According to Gopalakrishnan *et al* (1983) the temperature in Kuttanad region varied from 21 C to 36 C and their report indicated that temperature was ideal for cultivation of rubber in this area

In tropical low elevation areas a mean monthly temperature of 26 C to 28 C with adequate soil moisture and sun shine were associated with high production (Rao and Vijaya Kumar 1992)

2 1 3 Relative humidity

Transpiration rate is influenced by temperature and relative

humidity of the surrounding atmosphere A humid atmosphere throughout the year without much variations is found to be ideal for successful cultivation of rubber According to Pushpadas and Karthikakutty Amma (1980) the relative humidity varies from about 70 per cent during January to 95 per cent during August in many rubber growing regions of India When relative humidity is higher evapotranspiration is lower High rate of evapotranspiration results n lower soil moisture regimes and lower turgor pressure of cells Since the turgor pres sure of the laticiferous system influences the yield of latex rela tive humidity indirectly influenced the yield The decrease in yield during the course of the day is related to increased loss of water due to transpiration and the resultant drop in pressure potential n the latex vessels (Deva Kumar *et al* 1988) Kuttanad enjoys a very humid climate which is suitable for rubber cultivation (Gopalakrish nan *et al* 1983)

2 1 4 Wind

Wind is another important climatic factor having tremendous influence on the performance of rubber plantations Morphological and anatomical deformations are reported to be usually associated with high wind velocities One of the notable features of trees in windy areas is the deformation of their canopies to produce an asymmetric structure in which the branches appear to be swept to the leeward side (Grace 1977)

Young plantations with heavy canopy may show stem bending and require corrective pruning and roping Susceptibility to wind

damage is the greatest at the time of maximum girthing and canopy development Trees with narrow crotches are more prone to wind damage Tracts with strong wind should be avoided for cultivation of rubber (Rao and Vijaya Kumar 1992)

2 1 5 Flood

Clones may differ in their susceptibility to flood damage One of the nine year old plantings of Tjir 1 clonal seedling on coastal alluvium in Malaysia suffered severe tree damage following inundation under 0 7 to 1 m of flood water for 25 days Stem bleeding and some defoliation were observed but after wound dressing and resting recovery seemed possible (Rubber Research Institute of Malaya 1964) In 1967 following rainfall of 2800 mm over a few months certain plantings were under 4 6 m of water for 6 to 7 days Clones RRIM 601 and RRIM 615 were defoliated while RRIM 600 and RRIM 605 retained their leaves (Newale 1967)

2 2 Effect of agro techniques on growth and yield of rubber

Adoption of appropriate agro techniques has long been recognised as the surest means of sustaining high levels of productivity in rubber

2 2 1 Advantage of clonal material

Joseph *et al* (1980) reported the superiority of using clones as plant ng materials The clones were uniform in respect of growth vigour bark thickness yield properties of latex winter ing refoliatior nutritional requirements and tolerance to diseases

2 2 2 Use of polybag plants

Ramachandran (1992) reported that polybag plants produced better growth when compared to other methods

Joseph and Nair (1984) found that by adopting polybag plants of advanced growth the trees could be brought into tapping one year earlier

2 2 3 Use of optimum population density

Increased density of planting resulted in lower tree girth biomass and crown higher crotch height and lighter branching (Ng *et al* 1979 Satheesan *et al* 1982 Webster and Baulkwill 1989 Napitupula 1977) Virgin bark and renewed bark also became thinner with high stand per hectare The reduction in thickness was more pronounced in the renewed bark (Ng *et al* 1979) Because of these effects yield per tree tended to be lower with increased number of trees per unit area In addition to this percentage tappability in a field during the initial year of tapping also decreased with increas ing density thus affecting yield per unit area

Ng *et al* (1979) studying the economic aspects of high density planting concluded that under Malaysian conditions the cumulative yield increased as the planting density was increased from 211 to 741 trees ha ^{1} but declined with further increase in density However as the density increased from 211 to 741 trees ha ^{1} the production cost was more than the revenue The highest cumulative profit was released with a planting density of 399 trees ha ^{1} The

highest yie d per tapper was also obtained with a density of 399 trees ha ^{1}

In India Rubber Board (1994) recommends an optimum popula tion density of 420 445 plants per hectare

2 2 4 Establishment of cover crops

The beneficial effects of establishing cover crops in imma ture rubber plantations were reduction in weeding cost maintenance of moisture control of soil erosion fixation of nitrogen by legu minous cover crops addition of organic manure and reduction in soil temperature (Potty *et al* 1980)

2 2 5 Manuring

Judicious nutrient management is the surest way of ncreas ing yield in rubber Manurial trials on rubber in different rubber growing countries confirmed good response of the tree to the applica tion of fertilizers The effect of various nutrient elements on growth of Hevea was also established from the studies conducted in Malayasia (Bollejones 1954) The mineral composition of *Hevea* was reported to be influenced by soil fertility status (Dijkman 1951)

The nutrient requirement of *Hevea* varies with stages of growth In India Nair (1956) suggested a blanket recommendation based on soil fertility status and the observations from fertilizer trials on rubber conducted elsewhere The experiments indicated that the response of rubber is directly related to soil available nutri ents and leaf nutrient status (Ananth *et al* 1966 Potty *et al*

1976) A discriminatory approach was therefore proposed as the most efficient and economic method for optimum fertilizer use (Pushpadas and Ahamed 1980)

2 2 6 Drought management measures

The effectiveness of mulch ng and lime washing in young rubber to protect the plants from drought during summer were reported by Potty *et al* (1980)

2 2 7 Plant protection measures

Rubber tree is susceptible to several diseases but their economic importance and severity vary with climatic conditions clones and cultural practices adopted

Abnormal leaf fall caused by *Phytophthora* is an annually recurring disease of rubber in India causing severe yield losses ranging from 38 56 per cent Pillai (1977) George *et al* (1980) and Abraham (1991) found that RRII 105 was tolerant to these diseases

Powdery mildew caused by the fungus *Oidium hevea* attacks the immature leaflets when trees refoliate after the annual wintering causing secondary leaf fall Saraswathy Amma *et al* (1987) reported that RRII 105 and RRIM 600 were showing low disease intensity while PB 235 was highly susceptible

Pink disease caused by *Corticium salmonicolor* is the only important stem disease of rubber The fungus attacks the bark of the main stem and branches of 3 7 years old immature trees Pink disease

also occurs in mature trees The severity of attack varies from one locality to another according to rainfall pattern A few clones are known to be of above average susceptibility but most cultivars are prone to the disease (Liyanage and Jacob 1992)

2 2 8 Tapping systems and tapping panel dryness

Abraham and Hashim (1983) recommended the tapping systems for different cultivars The schedule covered conventional tapping from opening to felling recommended separately for clones and seedlings over a period of 25 to 28 years

High intensity of exploitation is known to promote incidence of tapping panel dryness in rubber The proportion of dry trees increased with tapping intensity and particularly with tapping fre quency (Bealing and Chua 1972 Paranjothy *et al* 1976) Clonal sensitivity to tapping panel dryness was observed Dijkman (1951)

2 3 Performance of clones

As a result of extensive breeding studies conducted by Rubber Research Institute of India since 1954 the improved clone RRII 105 was released for cultivation in the State This clone is recommended under category I of planting materials by the Rubber Board

George *et al* (1980) described the general characteristics of RRII 105 The growth rate of RRII 105 stood next to GT I and superior to RRIM 600 Average thickness of virgin bark of mature clone was about 9 89 mm and that of renewed bark over a period of six

years was 8 2 mm It showed satisfactory tolerance to abnormal leaf fall but succeptible to pink disease It was also reported that in the first year of tapping an average yield of 1990 kg/ha/year was obtained Average yield over six year in panel A was estimated as over 2700 kg/ha/year Yield depression during drought was only 23 per cent compared to Tjir 1 (Control) which recorded 31 per cent

Krishnankutty *et al* (1982) reported that the performance of planting materials varied according to different agroclimatic zones It is also reported that the yield performance of clones in Malaysia and India differed In India rubber yields were generally less than that under Malaysian conditions in respect of all clones generally

Saraswathy Amma *et al* (1988) studied the performance of a few RRII clones The results showed that planting materials had region wise response relating to yield and other secondary charac ters It was also suggested that planting materials should be select ed based on regional performance

Materials and Methods

MATERIALS AND METHODS

Paddy s the major crop in the wet land of Kuttanad Garden land occupies 26 6 per cent of the total area Due to the urgent need for increasing production of rubber Rubber Board recommends cultiva tion of rubber in the garden land of Kuttanad The cultivation of rubber has been started recently in some areas So far no study has been conducted on the performance of rubber in this area The present study was therefore conducted in Kuttanad to find out the performance of rubber in the taluk It was also intended to study the management practises adopted by the growers

So far 25 small holdings with a total area of 12 31 ha are planted with rubber which are localised at Kidanagara Pulinkunnu Ramankary and Muttar of Kuttanad taluk (Appendix I) All the 25 units were included for the study The details of the holdings surveyed are outlined in Appendix II

The total number of units were broadly classified into two groups

1 Holding with immature area comprising 14 units

2 Holding with mature area comprising 11 units

Each group was further sub divided into three viz good average and poor based on the management practices adopted by plant ers (Append x III and IV)

Details of height and girth increments recorded earlier were

collected from the available records kept in the Rubber Board Regional Office Changanacherry The weather parameters for the area were collected from the Rice Research Station Moncompu

Details regarding planting materials planting distance weeding manuring intercropping interplanting lime washing establishment of leguminous cover etc were collected during the field visit Attempts were also made to study the secondary characters like panel dryness wind damage flood condition pink disease etc Information on the girth of the plants year of opening for tapping system of tapping yield per day etc were collected The field data pertaining to the above parameters were colllected personally using pre tested interview schedule (Appendix V) The data regarding planting distance girth etc were actually measured and expressed in centimetres

The units selected for survey were broadly classfied into immature and mature plantations Each group was further grouped as good average and poor based on management practices Thus the different categories included

R Immature plantations under good management

R1 Immature plantations under average management

R2 Immature plantations under poor management

RM Mature plantations under good management

RM1 Mature plantations under average management

RM2 Mature plantations under poor management

The data thus collected were appropriately tabulated sum merised presented and discussed

Results and Discussion

RESULTS AND DISCUSSION

Kuttanad taluk has a garden land of 32 000 ha Twenty five growers planted rubber in the garden land The units are located in Kidangara (24%) Pulinkunnu (28%) Ramankary (32%) and in Muttar (16%) as shown in Table 1 The results obtained are discussed in the following pages

4 1 Weather parameters

4 1 1 Temperature

The data collected on the mean monthly temperature recorded during the period from 1990 to 1993 are given in Table 2 It could be seen that Kuttanad enjoyed a maximum temperature of about 34 5 C and a minimum of 19 3 C The annual variation in temperature was only negligible The data also indicated that the monthly variation in temperature was insignificant From the study it was observed that the temperature in the region was ideal for rubber cultivation The observation made by Pushpadas and Karthikakuttyamma (1980) Gopalak rishnan *et al* (1983) and Rao and Vijayakumar (1992) are in agreement with that of the present study

4 1 2 Rainfall

The data on monthly rainfall and number of rainy days in Kuttanad for four years from 1990 to 1993 is furnished in Table 3

Table 1 Village wise details of rubber holdings in Kuttanad taluk

Sl No	Name of village	No of immature rubber units		No of mature rubber units		Percentage
		No	Area (ha)	No	Area (ha)	
1	Muttar	1	0 63	3	0 80	16
2	Kidangara	3	0 70	3	1 62	24
3	Pulinkunnu	6	3 47	1	0 43	28
4	Ramankary	4	1 79	4	2 87	32
	Total	14	6 59	11	5 72	100

Table 2 Mean maximum and minimum temperature (C) for the period from 1990 to 1993 in Kuttanad taluk

	1990		1991		1992		1993		Mean	
Month	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Jan	30 50	20 60	32 60	21 60	32 60	19 30	31 20	19 54	31 73	20 26
Feb	33 00	22 00	33 50	21 80	32 50	22 60	32 45	21 42	32 86	21 96
March	33 90	24 10	34 40	24 50	34 00	23 90	33 44	24 42	33 92	24 23
April	34 00	25 40	34 50	24 90	34 50	25 70	33 80	25 38	34 20	25 34
May	31 50	24 10	34 00	25 93	33 00	25 00	33 25	25 53	32 94	25 14
June	30 50	23 40	30 10	23 70	30 70	23 80	29 40	23 80	30 18	23 67
July	29 80	22 50	30 60	23 00	30 00	22 60	29 40	23 40	29 95	22 88
Aug	30 20	23 70	29 80	23 01	30 00	23 00	30 40	24 50	30 10	23 57
Sept	31 20	23 80	31 85	24 41	30 64	24 71	31 30	24 40	31 25	24 33
Oct	32 00	23 60	31 30	24 20	30 68	24 03	31 00	24 00	31 25	23 95
Nov	31 60	23 30	32 50	22 80	32 24	24 97	32 20	24 10	32 14	23 79
Dec	34 00	22 00	32 80	21 20	32 84	22 39	32 40	23 60	33 02	22 29

Table 3 Mean monthly rainfall and number of rainy days during the period from 1990 to 1993 in Kuttanad taluk

Month	1990		1991		1992		1993		Mean	
	Rain fall (mm)	No of days	Rain fall (mm)	No of days	Rain fall (mm)	No of days	Rain fall (mm)	No of days	Rain fall (mm)	No of days
Jan	22 40	2	0 60						5 75	0 50
Feb	25 00	1			4 50	1	2 00		7 88	0 50
March	83 70	4	23 60	4			7 00	1	28 58	2 25
April	37 50	3	150 80	9	12 80	2	69 19	8	67 57	5 50
May	624 30	22	144 50	14	276 40	13	202 20	19	311 85	17 00
June	516 60	23	993 70	26	654 80	24	911 50	27	769 15	25 00
July	568 80	24	485 70	23	586 80	26	780 80	26	605 53	24 75
Aug	177 70	16	457 40	18	461 00	22	177 00	14	318 28	17 50
Sept	154 10	9	51 50	6	324 20	12	161 20	10	172 75	9 25
Oct	336 20	17	205 60	19	383 00	17	604 10	18	382 22	17 75
Nov	254 40	7	82 60	5	322 60	12	203 30	12	215 77	9 00
Dec	47 80	1	22 00	1	6 20	1	35 60	2	27 90	1 25
Total	2845 50	129	2623 00	125	3032 30	130	3154 09	137		

The results indicated that the rainfall received during the four years ranged from 2623 mm during 1991 to 3159 09 mm during 1993 The number of rainy days ranged between 125 during 1991 and 137 during 1993 The data also revealed that the South West monsoon extended from June to August and North East monsoon from October to November January and February were the driest months with practical ly no rain Occassional summer showers were obtained during March and April

According to Pushpadas and Karthikakuttyamma (1980) rubber growing regions in Kottayam Idukki Alleppey Ernakulam and Trichur receive an annual rainfall of 2000 4500 mm Thus the results ndicat ed that Kuttanad taluk received sufficient rainfall for rubber cult vation

4 1 3 Flood

The data on the level of water table in Kuttanad taluk is furnished in Table 4 The results indicated that the fields were under submerged condition for a period from 7 15 days during 1993 94 The water level rose above 60 cm for 2 3 months The results reported by Rubber Research Institute of Malaysia (1964) showed that Tjir 1 clonal seedlings recovered from a severe flood Newall (1967) re ported that clones differed significantly in respect of susceptibili ty to flood He found that RRIM 600 and RRIM 605 were least affected by flood According to Pushpadas and Karthikakuttyamma (1980) the water table should be well below 100 cm for successful rubber culti vation In the present study the growth of rubber was least affected

Table 4 Water table in rubber growing areas in Kuttanad taluk during 1993 94

Sl No	Ref No	Location	No of days submerged	*Months during which Water level rises above 60 cm	Water level rises below 60 cm
1	R1	Kidangara	12	3	9
2	R2	Do	8	3	9
3	R3	Do	10	3	9
4	RM2	Do	12	3	9
5	RM1 3	Do	14	3	9
6	RM1 4	Do	14	3	9
7	R1 5	Ramankary	11	2	10
8	R2 3	Do	10	2	10
9	R2 4	Do	10	2	10
10	R2 5	Do	10	3	9
11	RM3	Do	7	2	10
12	RM1 1	Do	12	2	10
13	RM1 2	Do	12	3	9
14	RM2 2	Do	10	2	10
15	R1 2	Muttar	10	2	10
16	RM2 3	Do	12	2	10
17	RM 4	Do	7	2	10
18	RM2 1	Do	10	2	10
19	R4	Pulinkunnu	15	3	9
20	R1 1	Do	12	3	9
21	R1 3	Do	14	3	9
22	R1 4	Do	14	3	9
23	R2 1	Do	13	3	9
24	R2 2	Do	15	3	9
25	RM1	Do	14	3	9

by high water table This might be due to the flood resistant/toler ant nature of RRIM 105 Eventhough there are no reports on the flood resistance/tolerance of RRIM 105 GI 1 which is one of the parents of RRIM 105 is tolerant to high water table (Joseph *et al* 1980)

4 1 4 Relative humidity

The data on relative humidity during the four years from 1990 to 1993 in Kuttanadu taluk is furnished in Table 5 The results revealed that the mean relative humidity during the four years ranged between 75 20 per cent and 95 03 per cent Among the different months December 1992 had the minimum relative humidity of 75 20 per cent while the maximum of 95 03 per cent was recorded during July 1990

The data indicated that the relative humidity is high in Kuttanad taluk which ensures better growth and productivity of rubber (Gopalakrishnan *et al* 1983)

4 2 Management practices adopted by the rubber growers in Kuttanad taluk

Studies were conducted on the adoption of different practic es viz type of planting material used spacing weeding manuring intercropping cover cropping and plant protection in mature and immature plantations

4 2 1 Immature plantations

The data gathered on different management practices are furnished in Table 6

Table 5 Relative humidity for the period from 1990 to 1993 in Kuttanad taluk

Month	Relative humidity (%)				
	1990	1991	1992	1993	Mean
January	89 26	89 20	92 20	77 25	86 98
February	91 64	89 50	91 00	77 32	87 37
March	90 58	91 00	93 00	79 64	88 55
April	84 48	86 00	87 00	80 43	84 48
May	92 90	87 00	87 00	81 35	87 06
June	92 10	95 00	92 00	85 23	91 08
July	95 03	92 00	91 00	92 20	92 56
August	90 60	90 50	93 20	90 90	91 30
September	91 10	90 93	85 20	81 10	87 08
October	92 29	94 00	86 20	86 70	89 79
November	91 63	92 00	85 00	87 20	88 95
December	89 00	90 80	75 20	82 60	84 40
Mean	90 88	90 66	88 16	83 49	

Table 6 Management practices adopted by the rubber growe s for immature rubber ın Kuttanad taluk

Sl No	Category/ Ref No	Year of plant ng	Area (ha)	Plantıng materıal	Populat ıon den s ty/ha	No of plants now ın the un t	Weed ng	Manur ng detaıls — Type of fertılı	Quantity applıed/ plant (g)	Tıme of appla cat on	Method of appl cat ıon	Type of ntercrop	Type of cover crop	Plant protectıon measures adopted	Protect on agaınst drought
1	Good R1	1990	0 33	Poly bagged	530	175	Once	20 20 20	500	Once	Pocket	Plantaın 1st & 2nd year	Pe rarıa	Bor paste	Ime wash
2	R2	1990	0 30		533	160	Tw ce	10 10 4	500	Twıce		Tap oca 1st year	N l		
3	R3	1990	0 02 0 05		1400 1000	28 50)	Once	20 20 20	250	Once		Nıl	N l		
4	R4	989	0 91	Poly bagged	483	440	Tw ce	15 0 6	450	Tw ce		Plantaın 1st year	N l		
5	Average R1 1	989 1992	0 4 0 40		1097 625	450 250	Once Once	10 0 4	500	Tw ce		Cocoa Plantat n 1st & 2nd year	Nıl	— Bor Paste	— —
6	R 2	1989	0 63		555	350	N l	20 20 20	1000	Once	Round				
7	R1 3	1987 1988	0 20 0 52		475 490	95 255	N l	10 10 4	500	Once		Cocoa	N l		
8	R1 4	987	0 46		478	220	N l	10 10 4	500	Once		Cocoa	N l		
9	R1 5	1986	0 30	Budded stumps	833	250	N l	15 10 6	500	Once	Pocket	N l	Nıl		—
0	Poor R2 1	1988	0 16	Poly bagged	150	24	N l	Nıl				N l	N l		—
11	R2 2	1992	0 41		730	300	Thrıce	10 10 4	500	Once	Round	Nı	Nıl		—
12	R2 3	1993	0 91		560	504	Once	P_2O_4 175	Basal			Plantaın	N l		
13	R2 4	993	0 37		543	201	Once	P_2O_4 175				N l	N l		
4	R2 5	1993	0 21		523	110	Once	P_2O_4 175				Banana	Nıl		

The results showed that 13 growers used polybag plants as planting material and one used the brown budded stumps for planting The advantages of using polybag plants are stressed by Joseph and Na r (1984)

The population density in the 14 holdings ranged from 150 to 1400 The stand per hectare was found to be high In one unit (Serial number 10) the population density is only 150 which is mainly due to cattle grazing Rubber Board (1994) recommends an optimum plant population desity of 420 445 plants ha^{-1} As a whole the planting density observed in the surveyed area showed a higher trend ard this s mainly because of the small holding size and some sort of hedge planting adopted on sides of canals and on bunds amidst the paddy fields

Weeding was not a problem in this area as the weeds were damaged during short periods of flooding during July Out of 14 growers six growers practiced weeding once in an year Two growers weeded the field twice and one grower thrice Five growers did not attend weeding

The data on manuring (Table 6) showed that the growers were not strictly adopting the recommendations of Rubber Board Many scientists reported the advantages of judicious fertilizer applica tion in rubber (Bellejones 1954 Dijkman 1951 Nair 1956 Ananth *et al* 1966 Potty *et al* 1976)

The data furnished in Table 6 also indicated that intercropping was followed in 9 holdings out of 14 In five holdings banana was used as intercrop during the first and second year In three holdings cocoa was interplanted along with rubber Tapioca was planted during the first year in one holding The beneficial effect of intercropping using banana is reported by Rubber Research Institute of Malaysia (1972) Dijkman (1951) reported that the practice of interplanting with cocoa would give early crops from the third year from cocoa Thereafter the rubber trees suppress the growth of cocoa Tapioca was thought to compete strongly with rubber and it might promote the spread of root disease But later studies by Pushparajah and Tan (1970) indicated that if cassava is planted 1 5 2 0 m away from the rubber the adverse effect could be reduced

The data furnished in Table 6 also showed that the plantations under the category good alone adopted lime washing against drought The effectiveness of mulching and lime washing in young plants to protect from drought during summer were reported by Potty *et al* (1980)

The data also indicated that a total of 26 plants were affected by pink which were properly treated with Boardeaux mixture It is reported that the fungus attacks the bark of the main stem and branches of 3 to 7 year old immature trees The severity of attack varies from one locality to another according to rainfall pattern and cultivars (Liyanage and Jacob 1992)

4 2 2 Mature plantations

The different management practices adopted by the growers in mature rubber plantations are furnished in Table 7

The result showed that 7 growers out of 11 used poly bagged plants for planting and three growers used brown budded stumps/clonal seedlings for planting and another grower (Serial number 9) attempted field budding Use of advanced planting material was popularised by Rubber Board during 19/9 and the growers in Kuttanad adopted that techniques from 1982 onwards Joseph and Nair (1984) and Ramachandran (1992) reported the advantages of using poly bagged plants

The stand per hectare in the 11 units ranged from 365 to 800 and the population density was within the Board's recommendation in 3 units Watson (1989) reported that wind damage will be less in high density planting

Paardekooper and Newall (1977) reported that gross profit per hectare was almost constant when the population density ranged from 200 to 600 tappable trees per hectare

Weeding was not a problem in Kuttanad as the weeds were dam aged during the short period of flooding

Table 7 also indicated that 72 per cent of the growers

Table 7 Management practices adopted by rubber growers for mature rubber in Kuttanad taluk

Sl No	Category/ Ref No	Year of planting	Area (ha)	Planting material	Population density/ha	No of plants now in the unit	Weeding	Manuring			Type of intercrop	Type of cover crop	Plant protection measures adopted
								Type of manure	Quantity applied/ plant (g)	No of application	Method of application			
1	Good RM1	1984	0 43	Poly bagged	523	225	N 1	20 20 20	250	2	Pocket	Plantain 1st year	Peuraria	Rubber Board
2	RM2	1982 1984	0 71) 0 34)		576	605	Once	Bone meal MOP Urea	500 + 500	2				Do
3	RM3	1986	0 61	Budded stumps	614	375	N 1	10 10 10	1000	1				Do
4	RM4	1988	0 20	Poly bagged	435	89	N 1	10 10 10	500+ 500	2		Banana 1st & 2nd year	Peuraria	Do
5	Average RM 1	1986	1 03		624	643	N 1	15 0 6	500	1				Do
6	RM1 2	1979 1986	0 46 0 26	Budded stumps	365 438	168 4)	Once	20 20 20	1000	1				Do
7	RM1 3	1984	0 30	Poly bagged	733	220		20 20 20	250	1				Do
8	RM1 4	1984	0 27		666	180		Urea+Rock phosphate	500 500	1				—
9	Poor RM2 1	1980 F/B 1982	0 30	Field budding	966	290						Banana 1st & 2nd year		—
10	RM2 2	1984 1986	0 41 0 0	Poly bagged	488 500	200 20)								—
11	RM2 3	1974 1982	0 10 0 20	Budded stumps	800 550	80 110								

8 The results showed that irrespective of population density the plants attained the required girth by the seventh year (Sl No 5 to 8) The population density of these estates were high and it ranged from 523 to 614 The results obtained in the present study didnot agree with findings reported by Buttery and Westgarth (1965) In their long term trial of 28 years in Malaysia it was observed that 90 per cent of the trees planted at 119 ha ^{1} were tappable in the third year but at 1074 ha ^{1} 31 per cent remained too small when the trees were 19 years old This might be due to the fact that in most of the cases in the surveyed area rubber was planted in isolated patches of two rows and also along the banks of small canals so that sufficient land and air space was available The population density in such areas was worked out without considering the actual area occupied by the canals in between the rows of rubber

The data also indicated that the plants under Serial number 8 attained tappable girth by the end of sixth year In this case the population density was 435 Higher growth rates of rubber under optimum spacing using advanced planting materials additional quanti ties and frequencies of application of fertilizer mulch ng and corrective pruning was reported by Sivanadyan *et al* (1973) All the above factors along with the optimum soil moisture conditions during the entire growth period might have led to the shortening of immatur ity period to six years in unit No 8

The data on immature rubber furnished in Table 8 as Ser al number 1 to 4 also indicated better growth rate The plants under Serial number 3 recorded a girth of 43 cm after three years which

Table 8 Girth of RRII 105 under category good during immaturity period and during May 1994

Sl No	Ref No	Year of planting	Extent (ha)	Stand per ha	Girth of plants in cm					
					Year					May 1994
					3rd	4th	5th	6th	7th	
1	R1	1990	0 33	530	15	20				26
2	R2	1990	0 30	533	20	28				33
3	R3	1990	0 02	1400	23	33				43
			0 05	1000	20	28				33
4	R4	1989	0 91	440	Data not available					40
5	RM 1	1984	0 43	523	23	30	40	48	55	60
6	RM 2	1982	0 71	576	20	28	40	48	55	60
		1984	0 34	576	20	28	35	43	50	55
7	RM 3	1986	0 61	614	Data not available					53
8	RM 4	1988	0 20	435	do					55

were planted at the highest density of 1400 ha ^{1} Favourable growing conditions along with cultivation in two rows along the bank of canal might have contributed towards the better growth in this case also

The observation on girth of plants categorised under Average are furnished in Table 9 Among the nine units under this category four units were under mature rubber and the rest under immature rubber Observation on girth of plants in four units were not available in the Regional Office as they did not avail the subsidy

The result showed that plants did not attain the tappable girth by the end of seventh year Poor management conditions and the high population density might be the reason for the poor performance of rubber as reported by Buttery and Westgarth (1965) and Sivanadyan *et al* (1973)

The data on girth of plants in units categorised under Poor are furnished in Table 10 It was found that the performance of plants were very poor The plants under Serial number 3&4 took almost 13 years to attain tappable girth Even in the units with 100 plants per hectare the rate of growth was very poor The studies conclusively proved that management practices play a major role in enhancing rate of growth of rubber

4 4 Productivity

The data on system of tapping number of tapping days obtained per year yield per day total yield from the unit and yield

Table 9 Girth of RRII 105 under category average during immaturity period and during May 1994

Sl No	Ref No	Year of planting	Extent (ha)	Stard per ha	Girth in cm					
					Year					May 1994
					3rd	4th	5th	6th	7th	
1	RI 1	1989	0 41	1097						38
		1992	0 40	625	13					13
2	RI 2	1989	0 63	555	15	20	28			33
3	RI 3	1987	0 20	475						43
		1988	0 52	490						35
4	RI 4	1987	0 46	478						43
5	RI 5	1986	0 30	833						50
6	RM1 1	1986	0 45	643	15	20	28	36	43	53
7	RM1 2	1979	0 46	365						88
		1986	0 26	438	15	20	28	35	43	55
8	RM1 3	1984	0 30	733	15	20	28	35	43	60
9	RM1 4	1984	0 27	666	15	20	28	35	43	58

Table 10 Girth of RRII 105 under category poor during May 1994

Sl No	Ref No	Year of planting	Extent (ha)	Stand per ha	Girth during May 1994 (cm)
1	R2 1	1988	0 16	100	30
2	R2 2	1992	0 41	731	6
3	RM2 1	1982	0 11	966	50
4	RM2 2	1986	0 10	490	45
5	RM2 3	1982	0 20	613	50

per hectare are furnished in Table 11 It was observed that all the growers under the category Good adopted S/2 d/2 system of tapping while the growers under the category Average adopted S/2 d/1 The average yield per ha ranged from 1677 kg to 3190 697 kg under Good It ranged between 1952 kg and 2475 kg under the category Average

The study also showed that tapping rest was not usually given except during flood period for 7 to 15 days during July August More than 140 tapping days were obtained in all cases except Serial number 3 and 4 units Because of labour problem Serial number 3 was tapped for 93 days and Serial number 4 for 30 days

The average yield of rubber in India during 1992 93 was 1154 kg ha ^{1} (Rubber Board 1994) The data furnished in Table 11 showed that even in area under average management conditions the yield was above the national average The reason for this might be due to the favourable climatic conditions and better management practices adopted in the case of units under category Good In units under the category Average daily tapping was followed and this might have led to the higher yield These findings agree with the reports of George *et al* (1980) Joseph and Haridasan (1991) and Abraham (1991)

4 5 Bark thickness (virgin and renewed)

The data collected on bark thickness (virgin and renewed) in the three categories are furnished in Table 12 From the study it was found that the rate of growth of renewed bark was good in all the units under the category Good except in Serial number 4 where the

Table 11 Tapping system and yield in units categorised under good and average

Sl No	Ref No	Area	No of plants under tapping	Year of opening	System of tapping	Days tapped per year	Yield per day		Total yield (kg)	Yield per ha (kg)	Category
							Sheet (kg)	Scrap (kg)			
1	RH1 1	0 43	225	1991	S/2 d/2	140	9 0	0 8	1372	3190 697	Good
2	RH2	1 05	605	1988 1991		148	8 5	2 5	3256	3100 925	
3	RH3	0 61	300	1992		93	10 0	1 0	1023	1677 000	
4	RH4	0 20	87	1994		30	2 5	0 1	78	Shallow tapping	
5	RH1 3	0 30	220	1990	S/2 d/1	165	4 5	0 5	742 5	2475 000	Average
6	RH1 4	0 29	180	1990		155	3 0	0 4	527	1952 000	

NOTE Unit Nos RH1 1 and RH1 2 under category average and units under RH2 1 RH2 2 and RH2 3 under category poor are planted with other cultivars like RRII 118 PB 217 PB 311 Ettumanoor clone and unselected seedlings along with RRII 105 No separate yield data was available and hence not included in the survey

Table 12 Bark thickness (virgin and renewed) of plants in the three categories during May 1994

Sl No	Ref No	Year of planting	Year of opening	Thickness of virgin bark (mm)	Thickness of renewed bark (mm)	Category
1	RM 1	1984	1991	7 0	7 0	Good
2	RM2	1982 1984	1988 1991	9 2 7 0	9 2 7 0	
3	RM3	1986	1992	6 2	6 2	
4	RM4	1988	1994	6 2	5 5	
5	RM1 1	1986	1992	6 5	6 0	Average
6	RM1 2	1979 1986	1985 1992	11 0 9 1	9 7 7 1	
7	RM1 3	1984	1990	8 0	6 5	
8	RM1 4	1984	1990	8 0	6 5	
9	RM2 1	1980	1987	11 0	8 0	Poor
10	RM2 2	1986	1992	6 5	6 0	
11	RM2 3	1982	1989	8 0	8 0	

growth was excellent It attained 5 5 mm thickness within 5 months In this unit tapping was started in January and was tapped only for 30 days Further the tapping was shallow This might be the reason for the higher rate of growth of renewed bark In the other two categories the rate was less This proved that the management practices influence the rate of growth of renewed bark The results obtained tally with the findings of George *et al* (1980)

4 6 Secondary characters

4 6 1 Tapping panel dryness

This is a physiological disorder in most of the high yielding clones Tapping panel dryness in each category of plantation is furnished in Table 13 Under category Good 4 64 per cent trees were affected under S/2 d/2 system and in Average 7 82 per cent trees were affected under S/2 d/1 and in Poor category 19 33 per cent trees were affected by panel dryness In Serial number 10 the plants were tapped from 1993 onwards and hence tapp ng panel dryness was not noticed eventhough the system adopted was S/2 d/1 From the study it is evident that high tapping panel dryness was associated with high intensity of tapping as reported by Sethuraj (1976) and Paardekooper (1989)

4 7 Abnormal leaf fall

The data furn shed in Table 14 showed that abnormal leaf fall was not recorded in any of the holdings This might be due to the fact that conditions prevailing in this area were not favourable

Table 13 Relation between tapping system and tapping panel dryness

Sl No	Category	Ref No	Year of opening	System of tapping	No of trees tapped	No of days tapped	No of plants affected by panel dryness	Percent
1	Good	RM1	1991	S/2 d/2	225	140	10	4 44
2		RM2	1988 1991		605	148	45	7 43
3		RM3	1992		300	93		
4		RM4	1994		87	30		
	Total				1207		55	4 64
5	Average	RM1 1	1992 1985	S/2 d/2	643	63		
6		RM1 2	1992	S/2 d/1	274	142	45	16 42
7		RM1 3	1990		220	165	30	13 60
8		RM1 4	1990		180	155	28	15 50
	Total				1317		103	7 82
9	Poor	RM2 1	1987	Slaughter	90	130	80	27 58
10		RM2 2	1993	S/2 d/1	50	120		
11		RM2 3	1989	Upward	104	116	60	32 60
	Total				724		140	19 33

Table 14 Disease incidence (percentage) in the three categories of holding

Category	Ref No	Year of planting	Extent (ha)	Total No of plants	No affected by abnormal leaf fall	Disease incidence				
						Shoot rot		Pink		Powdery mildew
						No affected	(%)	No affected	(%)	
Good	RM1	1984	0 43	256		16	6 25	10	3 9	Mild
	RM2	1982 1984	1 05	620				10	1 6	
	RM3	1986	0 61	400		25	6 25			
	RM4	1988	0 20	100		13	13 00			
Average	RM1 1	1986	0 45	300		56	16 60	20	6 6	Mild
	RM1 2	1986	0 26	113		14	12 30	6	5 3	
	RM1 3	1984	0 30	250				28	11 0	
	RM1 4	1984	0 27	202		18	8 90	4	1 9	Partial
Poor	RM2 1	1982	0 10	90						Mild
	RM2 2	1986	0 10	50						
	RM2 3	1982	0 20	104						
		Total		2485		136	5 47	78	3 13	

for the disease outbreak It was also found that most of the plant ers used RRII 105 as planting material which is reported to have fair tolerance to the disease (George *et al* 1980)

4 8 Shoot rot

The data on incidence of shoot rot in the three categories are furnished in Table 14 A total of 136 plants were lost in the first year of planting in six units due to shoot rot and the loss was worked out to be 5 47 per cent

4 9 Pink disease

The data showed that pink disease was also negligible and its percentage was only 3 93

4 10 Powdery mildew

The incidence of *Oidium* was very mild The growers were not adopting any control measures against the *Oidium*

4 11 Wind damage

The data on extent of wind damage are furnished in Table 15 Wind damage was noted only in the mature area Out of 2696 mature trees 74 plants were damaged by wind and th s worked out to 2 74 per cent So the wind damage was very negligible and no remedial measures were required

Table 15 Extent of wind damage in three categories of holdings

Category	Ref No	Year of planting	Extent (ha)	Total No of plants	Extent of wind damage	
					No of plants affected	(%)
Good	RM1	1984	0 43	256	14	5 46
	RM2	1982 1984	1 05	620	14	2 25
	RM3	1986	0 61	400	1	0 25
	RM4	1988	0 20	100		
Average	RM1 1	1986	0 45	300	14	4 66
	RM1 2	1986	0 26	113	8	7 00
	RM1 3	1984	0 30	250	2	0 80
	RM4	1984	0 27	202	4	1 90
Poor	RM2 1	1982	0 10	90	4	4 40
	RM2 2	1986	0 10	50		
	RM2 3	1982	0 20	104	13	12 50

Summary and Conclusion

SUMMARY AND CONCLUSION

An attempt was made to assess the performance of clone RRII 105 in Kuttanad taluk Data were collected through personal contacts and interview with the help of a pretested interview schedule

For the study all the units in Kuttanad were selected The results revealed that garden lands were suitable for rubber cultiva tion because of the high fertility of the soil and conducive climatic features The growers adopted a high population density per unit area All the growers used clone RRII 105 for planting and majority used polybagged plants The study also revealed that growth of plants were satisfactory even if the stand per hectare was high

Another interesting factor noted was that the fungal diseas es were very negligible Weed growth was found to be little due to prolonged floods (7 to 15 days) during July August The average yield obtained was high when compared to the national average As the growers preferred high intensity tapping tapping panel dryness showed an increas ng trend The study showed that the growers in this area are not strictly following the management practices recommended by the Rubber Board

The studies thus indicated that rubber cultivation is economic and viable in garden lands of Kuttanad taluk Field studies are to be initiated to find out the optimum population density per hectare and manurial practices for enhancing productivity in the taluk

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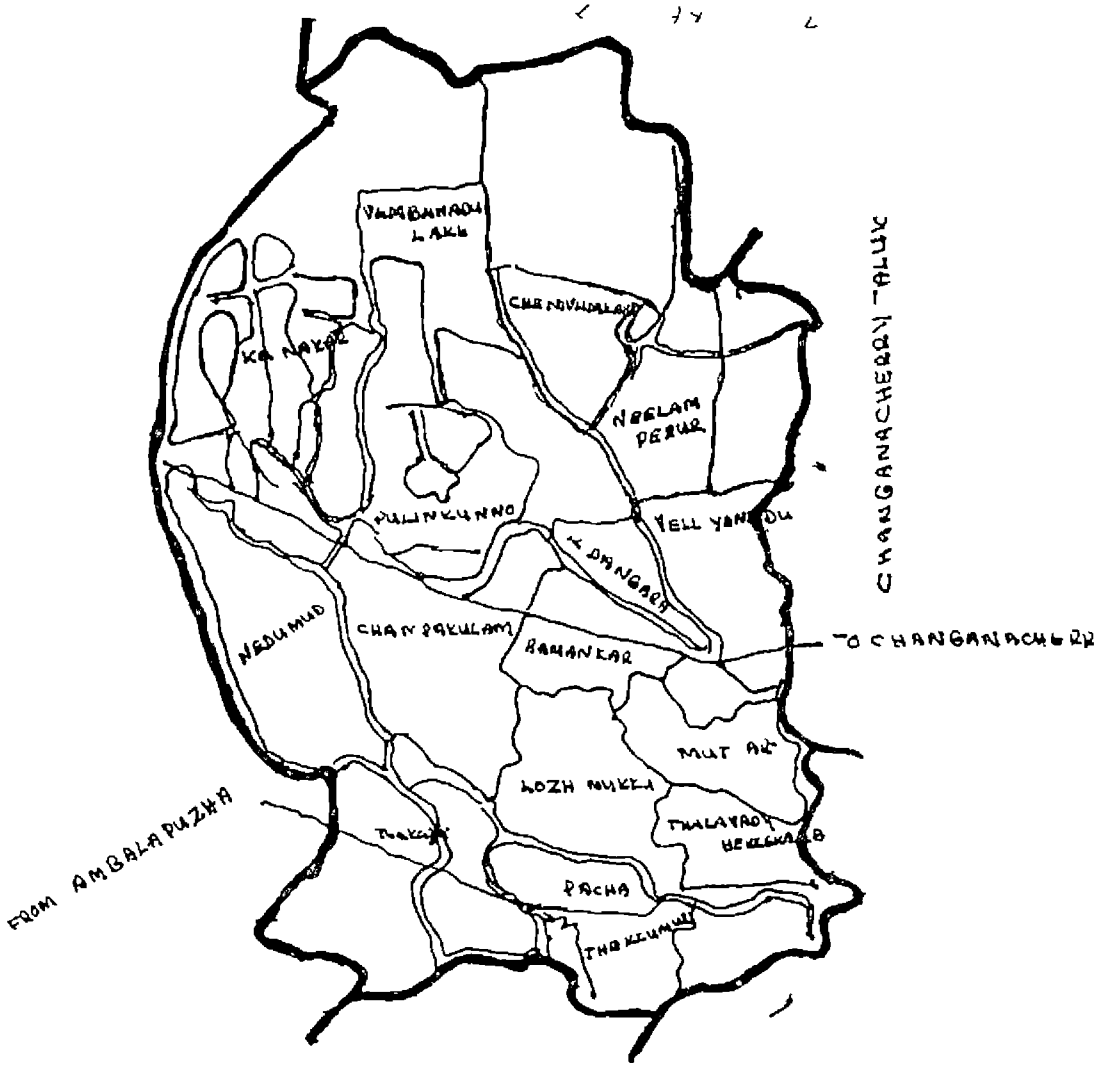
Appendices

APPENDIX I

Map showing the Villages in Kuttanad taluk



APPENDIX II
List of units selected for study

Sl No	Regn/Appln No	Name and address of owner	Area (ha)
1	2	3	4
1	PD3/CH/A/90/362	Sri Ouseph Chacko Thundiyil Kidangara	0 33
2	PD3/CH/A/90/321	Sri Eapen Joseph Vadakara Kidangara	0 30
3	PDA/CH/A/721/92	Sri Varky Varky Kochupurackal Kuttissery Kidangara	0 07
4	Unregistered	Sri K Josekutty Kulanthara Near S H School Changanacherry	0 91
5	PD3/CH/A/92/308	Sri K Sasikumar Kunnumpurath Vallamkulam	0 81
6	PD2/CH/A/89/585	Sri Eapen Aprem Mapprathusseril Mithrakkary P O	0 63
7	Kutanadu 7	Thomas Joseph Edayadil Kannady P O Pulinkunnu	0 72
8	Kuttanadu 13	Sri Alex Joseph Edayadiyil Kannady P O Pulinkunnu	0 46
9	Unregistered	Sri K A Joseph Karuvelithara Nalukalathil Mithrakkary P O	0 30

Contd

Appendix II Continued

1	2	3	4
10	Kuttanadu 14	Sri Jimmy Joseph Edayadiyil Kannady P O Pulinkunnu	0 16
11	Unregistered	The Trustee St Reetha s Church Kannady	0 41
12	Kuttanadu 8 PDA/CH/461/93	Sri Peter Thomas Athikayam Veliyanadu	0 91
13	PDA/CH/459/93	Sri Ninan Thomas Athikayam Veliyanadu	0 37
14	PDA/CH/460/93	Sri N K George Ettuparayil Pullamplayil Kannady P O	0 43
15	Kuttanadu 11	Sri Thomas Thomas Athikayam Veliyanadu	0 21
16	Kuttanadu 10	Sri Thomas Kuncheriya Thuruthimalyil Kidangara	1 07
17	Unregistered	Sri Thomas Abraham Karuvelithara Keerickal Mampuzhakkary	0 61
18	Unregistered	Sri Abraham Abraham Geemangalath Mampuzhakkary	0 20
19	PD2/CH/A/86/350	Sri K C Joseph Karuvelithara Mithrakkary	1 03

Contd

Appendix II Continued

1	2	3	4
20	PD2/CH/86/714	Sri Thomas Joseph Thoppil Veliyanadu West P O	0 72
21	PD/CH/A/84/813	Sri Jacob Eapen Vadakara Kidangara	0 30
22	PD/CH/A/84/806	Sri Eapen Kuncheria Vadakara Thattasserry Kidangara	0 27
23	Unregistered	Sri Joseph Kurian Vachaparambil Mithrakkary	0 30
24	Unregistered	Sri Alexander Antony Karuvelithara Mithrakkary	0 51
25	Kuttanadu 9	Sri Joseph Antony Geemangalath Mithrakkary	0 30

APPENDIX III

Classification of immature units based on management practices

Sl No	Ref No	Name of owner	Year of planting	Area (ha)	Category
1	R1	Sri Ouseph Chacko	1990	0 33	Good
2	R2	Sri Eapen Joseph	1990	0 30	
3	R3	Sri Varky Varky	1990	0 07	
4	R4	Sri K Josekutty	1989	0 91	
5	R1 1	Sri K Sasikumar	1989 1992	0 41 0 40	Average
6	R1 2	Sri Eapen Aprem	1989	0 63	
7	R1 3	Sri Thomas Joseph	1987 1988	0 20 0 52	
8	R1 4	Sri Alex Joseph	1987	0 40	
9	R1 5	Sri K A Joseph	1986	0 30	
10	R2 1	Sri Jimmy Joseph	1988	0 16	Poor
11	R2 2	The Trustee	1992	0 41	
12	R2 3	Sri Peter Thomas	1993	0 91	
13	R2 4	Sri Ninan Thomas	1993	0 37	
14	R2 5	Sri Thomas Thomas	1993	0 21	

APPENDIX IV

Classification of mature units based on management practices

Sl No	Ref No	Name of owner	Year of planting	Area (ha)	Category
1	RM 1	Sri N K George	1984	0 43	Good
2	RM 2	Sri Thommi Kuncheria	1982 1984	0 71 0 34	
3	RM 3	Sri Thomas Abraham	1986	0 61	
4	RM 4	Sri Abraham Abraham	1988	0 20	
5	RM1 1	Sri K C Joseph	1986	1 03	Average
6	RM1 2	Sri Thomas Joseph	1979 1986	0 46 0 26	
7	RM1 3	Sri Jacob Eapen	1984	0 30	
8	RM1 4	Sri Eapen Kuncheria	1984	0 27	
9	RM2 1	Sri Joseph Kurian	1980/ FB 1982	0 30	Poor
10	RM2 3	Sri Alexander Antony	1984 1986	0 41 0 10	
11	RM2 3	Sri Joseph Antony	1979 1982	0 10 0 20	

APPENDIX V

Performance of the clone RRII 105 in Kuttanad taluk of Alleppey District

Interview schedule

01	Name and address of the owner		
02	Name and Reg No of the estate		
03	Location of the estate		
04	Date of visit		
05	Area owned by the grower	(a) Mature (b) Immature	ha ha
06	Year/years of planting with extent	19 / ha 19 / ha 19 / ha	
07	Variety of clone used for planting	RRII 105/RRIM 600/GT1/ Ettumanoor clone	
08	Type of planting material used	Budded stumps/Polybagged plants	
09	Planting distarce adopted		
10	No of pits taken/No of plants planted		
11	No of vacancies supplied with year		
12	No of plants now existed		
13	Whether the area is exclusively planted/inter planted		
14	Details of other trees present in the area	1 2 3	
15	Whether intercropping done If yes state (a) Name of the intercrop (b) Frequency of intercrop	Yes/No	
16	Whether leg cover estab lised If yes (a) Year of establishment	Yes/No	

(b) Variety of Leg. cover established :
(c) Still present :

17. Weeding : Yes/no

18. No. of times done :

19. Whether manuring done regularly. If yes, : Yes/No
Immature Mature
(a) Type of fertilizer applied :
(b) Quantity applied per plant :
(c) Method :
(d) Time of application :
(e) If not, reason for not manuring :

20. Details of plant protection measures adopted

(a) Spraying : Yes/No
(b) Dusting : Yes/No
(c) Lime wash : Yes/No
(d) Pannel protection measures : Yes/No

21. Intensity of damage due to : Partial Medium Serious Lost

(a) Phytophthora :
(b) Oidium :
(c) Pink disease :
(d) Brown bast :
(e) Wind damage :
(f) Flood :
(g) Drought :

22. Wintering : Partial Complete

23. Whether the area is flooded annually : Yes/No

24. No. of days the area in a submerged condition in an year :

25. Age at tapping :

26. Time of tapping :

27. System of tapping :

28. No. of tapping days obtained in an year :

29. Yield obtained per day : ..... kg

30. Quantity of scrap obtained per day : ..... kg

31. Rainguarding done : Yes/No

32. Tapping rest given and days :

33. No. of labourers employed : Men Women Children Self

1. Weeding
2. Manuring
3. Spraying
4. Lime wash
5. Dusting
6. Tapping
7. Pannel protection
8. Processing of crop
9. Transporting of material
10. Any other item, specify

Place :

Date : Signature of the student