A COMPARATIVE STUDY OF THE PERFORMANCE OF CLONES UNDER CATEGORY No. 1 IN THE ESTATE AND SMALL HOLDING SECTORS OF PATHANAMTHITTA DISTRICT

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DISSERTATION

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THRISSUR

1991

DECLARATION

I hereby declare that this dissertation entitled **A comparative study of the performance of clones under Category No. 1 in the estate and small holding sectors of Pathanamthitta district** is a bonafide record of research work done by me during the course of research and that this has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title of any other University or Society.

Vellanikkara,
15--06--1991.

ABRAHAM, T.A.

CERTIFICATE

Certified that the dissertation entitled **A comparative study of the performance of clones under Category No. 1 in the estate and small holding sectors of Pathanamthitta District** is a record of research work done independently by Sri. T.A. Abraham 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. T.A. Abraham a candidate for the Post-Graduate Diploma in Natural Rubber Production agree that the dissertation entitled **A comparative study of the performance of clones under category No. 1 in the estate and small holding sectors of Pathanamthitta District** may be submitted by Sri. T.A. Abraham in partial fulfilment of the requirement for the Diploma.

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1. INTRODUCTION

Natural Rubber is one of the most versatile vegetable products. This material has many uses which makes it a strategic industrial raw material. The importance of natural rubber (NR) is of special significance since it has several special qualities. Further, it can be produced in nature without depending on high-priced and non-renewable petroleum resources. In India the first commercial plantation of rubber was started by European planters in 1902 at Thattackadu near Alwaye and the country is now the fourth major producer of natural rubber in the world.

Natural rubber is obtained from the latex of various rubber plants. Latex is present in 2500 species belonging to 900 genera distributed over 25 families. Hevea brasiliensis, the para rubber tree, is the most important source of natural rubber which supplies the natural rubber of commerce today.

The genus Hevea, a member of the Euphorbiaceae, grows wild in the Amazon basin and the adjacent areas of Brazil. The genus has ten species, but only H. brasiliensis is cultivated. This is on account of its superiority in terms of yield and quality of rubber. H. brasiliensis is a tall and sturdy perennial tree which attain a height of about 30 m. The tree has a straight trunk and has an open leafy crown with trifoliate leaves. The

tree is of deciduous nature. Wintering takes place usually in December-early January in South India, soon followed by refoliation and flowering. The flowers are unisexual and the sex ratio shows clonal variation. Latex is present in almost all parts of the plant. But only the bark of the trunk is usually exploited commercially. Latex vessels contain white or yellowish-white latex.

The area under rubber in India in 1990 is estimated at 4,40,000 ha. The production was 2,97,300 tonnes in 1989-90, compared to 15,830 tonnes in 1950-51. Similarly productivity has increased from 284 kg in 1950-51 to 1029 kg in 1989-90. The world NR production during 1989 is stated as 51,25,000 tonnes and consumption as 53,35,000 tonnes. The world's total rubber under the crop is 89,32,000 ha. The important rubber growing countries are Indonesia (31,11,000 ha in 1989), Malaysia (18,57,000 ha in 1989), Thailand (17,47,000 ha in 1989), China (5,87,000 ha in 1989), India (4,40,000 ha in 1989) and Sri Lanka (2,00,000 ha in 1989). The other rubber growing countries are Liberia, Nigeria, Vietnam, Zaire, Myanmar, Philippines, Ivory Coast, Cambodia, Brazil, Bangladesh and Cameroon.

Hevea brasiliensis is having a commercial life span of over 30 years and the selection of planting material is very important. The success of a rubber plantation is very much related to the planting material selected and hence utmost care should

be taken to select the correct clone. The performance of each clone is related to the genetic constitution and its interaction with the environmental conditions of the particular region. So the selection of planting material should be based on the genetic constitution of the clones and environmental parameters. The desirable genetic characters of a clone are, high initial and subsequent yield, increasing yield trend, high growth vigour, good branching habit, response to stimulation, resistance to stress conditions and tolerance to diseases. The important environmental conditions that are to be considered are soil characters like soil depth and texture, rainfall pattern and distribution, relative humidity, severity and duration of drought, etc. Planting materials are to be carefully picked up to maximise the productivity of the area subject to the constraints prevalent in the location. For this, information on the performance of planting material in varying agroclimatic conditions is a necessity. The ideal condition would be the choice of specific clones possessing characters suited to each locality. Classification of rubber growing soils in Kerala and Tamil Nadu has been made into five groups and an approach on the above concept requires enormous field evaluation and generation of adequate data.

The present study was taken up to evaluate the performance of three clones of H. brasiliensis both in the estate sector and in the small holding sector of Pathanamthitta District in Kerala.

It has also been intended to observe some of the secondary characteristics of these clones. All the three clones included in the study are approved by the Rubber Board (Government of India, Ministry of Commerce) in Category I of the Planting Material Recommendations. These pieces of information are necessary to make any change in the choice of planting material, which if in the right direction, will result in an increase in total production and productivity in the area.

2. REVIEW OF LITERATURE

Plant improvement through breeding and selection is the cheapest and most effective method to ensure progress in productivity. The most significant single factor responsible for the phenomenal advancement of total production of natural rubber has been an increase in productivity achieved through tree improvement. Productivity primarily depends on the genetic constitution of planting material and their adaptability to improved agrotechniques and response to environmental conditions.

It is of special mention that the Hevea germplasm available in the east represent only a very narrow range. Panikkar et al. (1980) reported that identification, collection and conservation of diversity of genotypes available in the centre of origin of the genus are essential for further tree improvement. Breeding programme in Hevea is carried out with the major objective of evolution of planting materials suitable to different regions and also with high yield potential. Marattukalam et al. (1980) reported that clones as planting materials have many advantages. The most important one is the uniformity shown by the members of each clone. All the individual tree of clone under uniform conditions show very little variations with regard to their different characters such as vigour and growth, bark thickness, yield, properties of latex, wintering, refoliation, nutritional requirements

and tolerance to diseases which will enable the planter to carry out cultural operations in a more easy, systematic and economic manner. Owing to uniform growth, the number of trees that have to be thinned out is always less than that for seedlings. So in the case of clones initial stand need be less than that required for seedling. Then the cost of planting material and maintenance per hectare is reduced. Uniformity in the properties of latex from clones makes it more useful for specific purposes where such uniformity is essential. With clones possessing different specific characteristics selection of materials suitable for different siutations is also possible. Hevea brasiliensis is propagated both by seed and through vegetative methods. During the initial periods of rubber cultivation only the generative method through seeds was followed. Vegetative method of propagation through budgrafting became popular subsequently. Budgrafting is currently the most popular method of propagation. The rubber trees grow on many types of soils which are deep and well drained. A warm humid equable climate with 21°C to 35°C temperature and a fairly distributed annual rainfall of not less than 200 cm per year are necessary for the good growth of the plant (Rubber Board, 1990). The laterite and lateritic soils are generally found to be very porous, well drained, moderately to highly acidic, deficient in available phosphorous and variables with regard to available potassium and magnesium. The red soils found in some areas are

characterised by their reddish to brown colour and fine loamy texture. These soils are also generally acidic and highly deficient in available phosphorous.

The climatic conditions prevailing in the rubber tract vary from region to region and from year to year particularly in case of annual rainfall. The southern parts of the tract enjoy almost equal distribution of rain through both South West and North Eastern monsoons. The northern parts receive mainly the South West monsoon only. The variations in temperature and humidity are not so marked as in the case of rainfall. The temperature remains warm and humidity remains high in general in all the rubber growing areas of Kerala. The cultivated area under rubber consists mostly of slopes and hillocks which are liable to soil erosion and leaching. Rubber cultivation in India at present is mainly confined to a narrow belt extending from Kanyakumari district and lying in general west of the western ghat and parallel to it for approximately 400 km. Expansion of rubber cultivation to non-traditional regions has proved effective and successful.

Pushpadas and Karthikakuttyamma (1980) reported that growth of rubber has been found satisfactory upto 450 m above mean sea level. At high elevation, temperature becomes unfavourable. At low temperature, the rate of biochemical and physiological processes generally decreases. At very low temperature desiccation

or death of tissues may result from freeze injury. In an experiment conducted at West Java experiment station to compare the performance of Hevea at two locations, one at 515 m and the other at 250 m above sea level, it was found that a considerable retardation of growth takes place at higher elevation. The plants at lower elevation reached tappability by the end of fifth year while the plants at the higher elevation came into tapping at the end of the seventh year only. Experiments indicated that the immaturity period was increased by six months for every 100 m rise in altitude. Bark thickness was also considerably lesser at high elevations. High yielding clones at lower elevations were not high yielders when planted at high elevations. In Sri Lanka, at high elevations high incidence of Oidium, retarded growth and poor bark renewal were also observed (Chandrasekhara, 1971, 1972). Similar observations have also been made in India (Rubber Research Institute of India, 1989, 1990).

Most of the rubber plantations in Kerala are found in the midland region which has elevations varying from a few metres in the west to about 450 m in the east. Even though the performance of rubber is comparatively poor under higher elevations, several cases of successful establishment of economic units can be noticed in some of these areas such as Wynadu in Kerala where distributed rainfall and good soil conditions are obtained (Pushpadas and Karthikakuttyamma, 1980).

A gently undulating topography or a slope in the range 5°-15° is reported to be ideal. The important physical properties of soil which affect growth of rubber are reported to be depth, drainage, texture and structure.

Wind and storms adversely affect rubber cultivation. The damage caused varies with the age of the tree and the nature and speed of wind. Young trees exposed to strong seasonal winds for prolonged periods become stunted in growth. The leaves become lacerated, crinkled and get dried up particularly on the margins and along the lacerations. The dried up portions are subsequently blown of resulting in a sparse foliage. Uprooting, trunk snap and branch break are the major wind effects on old trees. Shallow soil or high water table usually results in uprooting. Trunk snap and branch break are the consequences of unduly heavy development of the canopy. Rate of girthing on tapping and configuration of branches, both clonal characteristics, influence susceptibility to trunk snaps and branch break. Faulty and unbalanced nutrition is another pre-disposing factor causing wind damage (Pillai, 1980).

Yield performance in selected planting material in India have been studied by several authors. Among the recent studies Krishnankutty et al. (1982) reported that performance of planting materials, varied according to different agroclimatic zones. It is further reported that yield performance of clones in Malaysia

and India differ. In India rubber yields were generally less than that under Malaysian conditions in respect of all clones generally. Krishnankutty and Srinivasan (1985) studied the performance of 22 clones in important rubber growing areas, which also revealed that the mean yield of clones in Malaysia is more than that of India in respect of all materials except PB 86. Toms and Haridasan (1991) reported the stability figures of yield and also attempted a region wise analysis of yield of selected planting materials in India. Yield of different clones under commercial planting over a period of ten years was studied and reported and regional differences in the performance of planting materials was observed.

George et al. (1988) reported the performance of selected clones with reference to the planting policy of the sample estates covering 32 clones. It was reported that planting materials had profound influence on yield. Stability of yield of different planting materials was also studied and reported. Saraswathyamma et al. (1988) studied different planting materials, planting material recommendations, clone identification and choice of planting materials.

Cherian (1987) reported commercial yield of over 2000 kg in estates. Yield figures of estates which had a production figures of above 2000 kg per hectare was reported. Marattukalam and Premakumari (1987) studied the performance of a few Sri Lankan

clones and reported that they were wind prone but exhibited some good secondary characteristics like vigour in growth.

Saraswathyamma et al. (1988) narrated the work done for crop improvement in rubber by the Rubber Research Institute of India from 1954 onwards. Description regarding selection and evolution of clones, crop improvement technique adopted, vegetative multiplication etc. were presented. Short details of a few RRII clones were also given in the report. Saraswathyamma et al. (1988) studied the performance of few RRII clones. The results showed that planting material had region wise response relating to yield and other secondary characters. It was also suggested that planting materials should be selected based on the regional performance.

3. MATERIALS AND METHODS

Two large estates and 30 randomly chosen small holdings were selected for the study from four taluks of Pathanamthitta District (Annexure I and II). One of the large estates selected as Koothattukulam Estate (Velimala Rubber Company Limited, Kottayam under PTA 94 C), which has a total area of 105.58 ha out of which 10.12 ha is planted with GT 1 (1974 planting), 12.14 ha with RRIM 600 (1973 planting) and 1.34 ha planted with RRII 105 in 1973.

The second large estate was Thamarapally Estate of M/s Thamarapally Rubber Company Limited, Kottayam registered under PTA 75. It has got a total area of 113.31 ha, of which 17.20 ha is planted in 1980 with RRII 105, 3,64 ha is planted in 1970 with GT 1, and 17.24 ha with RRIM 600 planted in 1973 and 8.70 ha planted in 1970 with RRIM 600.

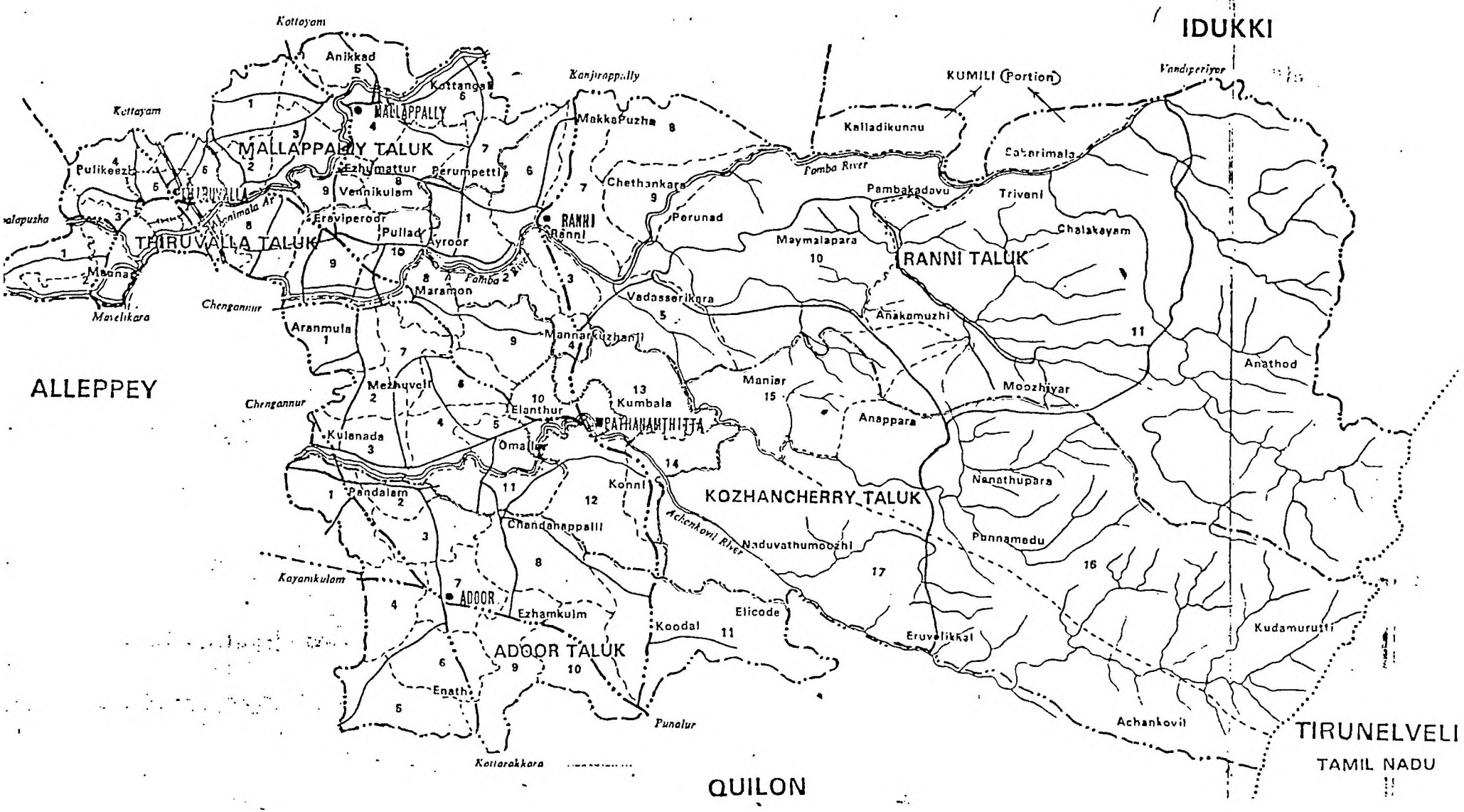
Thirty small holdings where all the major (Category No. 1) clones were planted were selected for study. Of the five taluks in Pathanamthitta District, four were covered, whereas in the fifth (Thiruvalla) no unit with all the materials was available. Fourteen small holdings were chosen in Ranny Taluk. In Kozhenchery, Adoor and Mallappally Taluks the number of small holdings chosen for the study were 13, two and one respectively.

ANNEXURE - I

PATHANAMTHITTA DISTRICT

SHOWING PANCHAYATS

SCALE 1 Cm = 2.5 Km



ANNEXURE - II

DETAILS OF ESTATE/SMALL HOLDINGS SELECTED FOR STUDY

Rubber Board Registration Number of the estate/ small holdings and name of ower.	Taluk	Planting material	Year of planting	Area in hectares
ESTATES				
Pathanamthitta 94C - Koothattukulam	Ranny	RRII 105	1973	1.34
Velimala Rubber Company Limited		RRIM 600	1973	12.14
		GT 1	1974	10.12
Pathanamthitta 75 C - Thamarappally	Ranny	RRII 105	1980	17.20
Rubber Company Limited		RRIM 600	1970	8.70
		GT 1	1970	3.64
SMALL HOLDINGS				
Kunnathur 272 - Koruthu Samuel	Adoor	RRIM 600	1976	0.70
Unregistered M.M. Thomas	Kozhencherry	RRIM 600	1975	0.45
-do- Rajamma Thomas	Kozhencherry	RRIM 600	1973	0.46
-do- K. Narayanan	Kozhencherry	RRIM 600	1971	0.81
-do- N.M. Papachen	Ranny	RRIM 600	1974	0.61
PTA.8239 - Annamma Thomas	Ranny	RRIM 600	1973	0.78
Unregistered Abraham P. Thomas	Ranny	RRIM 600	1971	0.75
PTA.9005 - Geevarughese Abraham	Ranny	RRIM 600	1968	0.41
PTA.8609 Jolly	Ranny	RRIM 600	1972	0.33
Unregistered Annamma Philip	Mallapally	RRIM 600	1973	0.38

Annexure - II contd.

Rubber Board Registration Number of the estate/ small holdings and name of owner	Taluk	Planting material	Year of planting	Area in hectares
Unregistered P.M. Thomas	Adoor	GT 1	1980	0.70
PTA.9404 - P.G. Jose	Kozhenchery	GT 1	1979	0.78
Unregistered O.T. Varkey	Kozhenchery	GT 1	1980	0.63
PTA.9688 Rajukutty Varughese	Kozhenchery	GT 1	1979	0.84
Unregistered C.J. Chacko & C.J. Samuel	Kozhenchery	GT 1	1979	0.86
PTA.8983 - Radhamony Kunjamma	Kozhenchery	GT 1	1976	0.80
Unregistered George Mathew	Kozhenchery	GT 1	1976	0.30
PTA.7835 V.T. Antony	Kozhenchery	GT 1	1978	2.12
Unregistered N.M. Pappachan	Ranny	GT 1	1974	0.63
PTA.832 - Samuel Thomas	Ranny	GT 1	1970	0.76
PTA.7835 - V.T. Antony	Kozhenchery	RRII 105	1979	2.11
PTA.1833 - Yohannan Mathew	Kozhenchery	RRII 105	1980	0.71
Unregistered P.S. Jose	Kozhenchery	RRII 105	1979	0.58
			1980	0.21
PTA.9511 Siji Abraham	Ranny	RRII 105	1979	0.22
Unregistered Thakamma Rajan	Ranny	RRII 105	1979	0.85
-do- Smitha Susan	Ranny	RRII 105	1981	0.43
-do- Samuel Thomas	Ranny	RRII 105	1980	1.62
-do- V.K. Idiculla	Ranny	RRII 105	1981	1.47
-do- Annamma John	Ranny	RRII 105	1979	1.06
-do- Varughese John	Ranny	RRII 105	1979	0.46

The details were collected by visiting the estates and personal report, with the aid of a proforma designed for the purpose. Data maintained at Rubber Board Regional Offices at Adoor, Pathanamthitta and Changanacherry and the Rubber Research Institute of India have also been referred. The yield performance of RRIM 600, GT 1 and RRII 105 have been studied and recorded from the first year of tapping onwards. The data obtained are yield figures for 10 years in respect of clones RRIM 600 and GT 1 that for first five year period for clone RRII 105.

Attempts have been made in the study to analyse the secondary characters like panel dryness, wind damage, pink disease, abnormal leaf fall, etc.

4. RESULTS AND DISCUSSION

The Pathanamthitta District of Kerala State represent an area suitable for rubber cultivation, the total area of the district is 2694.62 sq.km, the cultivated area being 1466.85 sq.km. This district has five taluks and the total area under rubber is 30,883 ha. Rubber plantation having an area of 20 ha and more in extent are classified by the Rubber Board as estates and those below this limit as small holdings. The total number of estates in the district is 30 and that of small holdings 22,570. Maximum number of estates (66.6 per cent) is in Ranny Taluk whereas the remaining area located in Kozhenchery and Adoor Taluks. Of the small holdings 59 per cent are located in Kozhencery and Ranny Taluks among which separate records are not available. The minimum number (4.1 per cent) of small holdings is in Mallappally Taluk (Table 1).

The topography of the area is highly undulating. The South West monsoon extends from June to September and the North East from October to November. The main occupation of the people is agriculture and about 80 per cent of the population depend, directly or indirectly, on agriculture. The district receives fairly high precipitation, much above the minimum requirement for rubber cultivation. During the eleven year period from 1980 to 1990 (inclusive) the average annual rainfall was 2695 mm, the average

Table 1: EXTENT OF AREA UNDER RUBBER IN PATHANAMTHITTA DISTRICT

Taluk	Large Estates		Small holdings	
	Number	Area (ha)	Number	Area (ha)
Kozhenchery	5	3713.19	13375	12786.16
Ranny	20	2526.27		
Adoor	5	1952.99	4497	5463.30
Tiruvalla	Nil		3771	3658.89
Mallapally	Nil		927	782.14
TOTAL	30	8192.45	22570	22690.49

number of rainy days being 139. The range of rainfall was from 2193.6 mm (1983) to 3330.2 mm (1988). The number of rainy days varied from 115 in 1986 to 166 in 1984 (Table 2).

4.1 Productivity

Yield performance of clones RRIM 600, GT 1 and RRII 105 in estate and small holdings are depicted in Tables 3 to 6. The initial average yield for first to fifth year of tapping for RRIM 600 in the estate sector is 1194 kg/ha/year. Similarly the average yield for the same period for GT 1 in estate sector is 1216 kg/ha/year and that of RRII 105 for first five year is 1528 kg (Table 3).

The initial yield for the 1st to 5th year of tapping in the case of small holdings for RRIM 600 is 1541 kg (Table 5). The annual yield obtained for GT 1 for the same period is 1096 kg/ha/year and that of RRII 105 2135 kg/ha/year.

The above results are in agreement with the earlier studies with regard to the yield performance of these clones. The findings of Krishnankutty et al. (1982), Krishnankutty et al. (1985), Joseph et al. (1991) do agree with the results of the present study. Joseph et al. (1990) studied the yield performance of different clones including RRIM 600, GT 1 and RRII 105 and published yield data for first five years and 6 to 10 year periods. The results published for RRIM 600 for 1st year is 1129 kg, for GT 1 corresponding figure is 1019 kg and for RRII 105 the first five year

Table 2: RAIN FALL DATA OF PATHANAMTHITTA DISTRICT

Year	Rainfall (cm)	Number of rainy days
1980	292.60	147
1981	291.11	133
1982	231.18	127
1983	219.36	121
1984	251.47	166
1985	269.33	144
1986	232.04	115
1987	262.79	143
1988	333.02	155
1989	313.66	133
1990	267.85	150

Table 3: YIELD PERFORMANCE OF CATEGORY NO. I CLONES FOR THE FIRST FIVE YEARS: IN LARGE ESTATES IN PATHANAMTHITTA DISTRICT

Clone	Average yield (kg/ha/year) 1st year	2nd year	3rd year	4th year	5th year	Mean for 5 years	All India
RRIM 600	655	1306	979	1324	1706	1194	1129
GT 1	253	1182	1347	1478	1820	1216	1019
RRII 105	927	1096	1456	1961	2203	1528	1412

Table 5: YIELD PERFORMANCE OF CATEGORY NO. I CLONES FOR THE 1st FIVE YEARS IN SMALL HOLDINGS IN PATHANAMTHITTA DISTRICT

Clone	AVerage yield (kg/ha/year)					Mean for five years	All India
	1st year	2nd year	3rd year	4th year	5th year		
RRIM 600	1167	1332	1625	1746	1837	1541	1129
GT 1	729	950	1127	1277	1401	1096	1019
RRII 105	1260	1802	2206	2575	2834	2135	1412

average yield is 1412 kg per year. In general, the performance of all the three clones as far as yield is concerned is better than the national average productivity as shown in Table 6. This can be attributed to the favourable factors prevailing in Pathanamthitta District. Good soil fertility and favourable rainfall pattern in the area might have contributed for comparatively better performance (Pushapadas et al., 1980).

Similarly the yield performance for 6th to 10th year period for RRIM 600 in estate sector is 1566 kg/ha/year and corresponding figures for GT 1 and RRII 105 are 1778 kg/ha/year and 2604 kg/ha/year respectively (Table 4).

In the small holding sector, the corresponding figures are 2093 kg/ha/year for RRIM 600, 1645 kg/ha/year for GT 1 and the yield data for RRII 105 is not available due to non-availability of adequate samples (Table 6).

Joseph et al. has presented the yield figures for 6th to 10th year period for estate sector in respect of clones RRIM 600 is 1327 kg and that of GT 1 is 1329 kg and for RRII 105 is 1556 kg. The yield results obtained in the case of all clones in the present study are on the higher side compared to the published results on average yield. This again supports the observation that growth and yield performance of rubber in this district is better on account of favourable factors.

Table 4: YIELD PERFORMANCE OF CATEGORY NO. I CLONES FROM 6th to 10th YEAR OF TAPPING IN LARGE ESTATES.

Clone	Average yield (kg/ha/year)					Mean annual yield for the five year period.	All India
	6th year	7th year	8th year	9th year	10th year		
RRIM 600	1829	987	1565	1849	1903	1566	1327
GT 1	1118	2399	1889	1938	1548	1778	1329
RRII 105	2342	2319	2709	2860	2794	2604	1556

Table 6: YIELD PERFORMANCE OF CATEGORY NO. I CLONES FROM 6th to 10th YEAR OF TAPPING IN SMALL HOLDINGS.

Clone	Average yield (kg/ha/year)					Mean annual yield for the five year period	All India
	6th year	7th year	8th year	9th year	10th year		
RRIM 600	1953	2034	2084	2192	2202	2093	1327
GT 1	1407	1523	1740	1913	NA	1645*	1329
RRII 105	NA	NA	NA	NA	NA	NA	1556

NA: Not available; * Mean yield for four years.

Change in tapping system is known to influence yield to a good extent. The difference observed may be due to higher intensities of tapping adopted as well. The practice adopted is to carry out tapping four days in a week. This system given an additional 40 days yield per annum. The increased yield performance recorded in the present study is also due to this factor.

The indications are that the clone RRII 105 is the highest yielder in the sample area, followed by clone RRIM 600. GT 1 has only the third position. However, all these clones have to find their due place in the planting programmes of Pathanamthitta District in future also.

4.2 Secondary characters

Panel dryness

Tapping panel dryness is a physiological disorder in most of the high yielding clones. In the case of RRIM 600 panel dryness is noticed in 6 per cent for ten year period and that of GT 1 for the same period is 4.5 per cent and in the case of RRII 105 it is 5 per cent for the first five years of tapping. Considering the ten year period the panel dryness incidence is not a serious menace in the cause of RRIM 600 and GT 1. Though in the present study, the incidence of brown bast in clone RRII 105 was only moderate, the clone has to be tapped with low intensity system as it is known to be susceptible with higher exploitation intensities.

Abnormal leaf fall

Regarding abnormal leaf fall disease, RRII 105 is highly tolerant and disease incidence is negligible. Five per cent incidence of abnormal leaf fall was noticed in the case of GT 1 and that in RRIM 600 is 40 per cent for the area observed based on the data for the last five years, although prophylactic measures were reported to be undertaken in the samples covered. So control measures have to be adopted. Saraswathyamma et al. (1980) has reported that the clones RRIM 600 and GT 1 are susceptible to abnormal leaf fall disease. RRII 105 is reported to be having fair tolerance to abnormal leaf fall. As clonal differences are noted in the rate of incidence of abnormal leaf fall disease under the normal general prophylactic measures, it appears that there is a need for a rational approach for different clones.

Pink disease

The clone RRIM 600 and RRII 105 are susceptible to pink, 10 per cent of RRIM 600 showed the incidence of pink and that under RRII 105 is 15 per cent and in the case of GT 1 occurrence of pink is only four per cent during the immaturity period. If detected and treated at the early stage full recovery of the affected trees is possible. Careful watch for disease detection and treatment is therefore warranted, especially for RRIM 600 and RRII 105.

Oidium

Regarding incidence of the Oidium, it is seen negligible in RRIM 600 after wintering when refoliation starts. On observation it is found that GT 1 wintering and refoliation are very late even upto the end of February and high incidence of Oidium is noticed during the entire refoliation period. RRII 105 shows partial wintering and Oidium is seen affecting new tender leaves at the time of refoliation and is comparatively low. The results published by Saraswathyamma et al. are in full agreement with the results obtained in the present study.

Wind damage

Incidence of wind damage was noticed in 5 per cent in the case of RRIM 600 and that of RRIM 105 was 7 per cent during the entire immaturity period. GT 1 showed only one per cent wind damage which is comparatively less. The reports of Saraswathyamma et al. (1987) are in full agreement with the present results. Most of the affected cases in the present study were branch snaps and uprooting or trunk snap was only limited.

In short as far as diseases are considered GT 1 in general appear more sturdy. However monitoring for disease incidence and adoption of appropriate control measures is necessary. Disease management on a clonal approach would appear necessary.

5. SUMMARY

Yield performance of the three clones RRIM 600, GT 1 and RRII 105 included in Category I of Planting Material Approval was assessed in Pathanamthitta District. Secondary characters like brown bast, abnormal leaf fall disease, pink disease, incidence of wind damage and incidence of Oidium was also studied.

The study was undertaken in two large estates and 30 small holdings by visits and personal interview, with the aid of a questionnaire.

The results obtained show that RRII 105 is the highest yielder in the region. It is also found that it has got tolerance to abnormal leaf fall disease. It is however susceptible to pink disease. Brown bast has to be kept under watch and tapping intensity reduced.

RRIM 600 keeps second position with regard to yield. This clone shows susceptibility to abnormal leaf fall and pink disease and tolerance to Oidium.

The present study revealed that GT 1 occupies the third position with regard to yield. The study also revealed that GT 1 has a fair degree of wind tolerance while it is seen to be susceptible to Oidium. It has got a good degree of tolerance to pink disease according to the results of the present study. The study also

revealed that incidence of brown bast is comparatively very negligible in the case of this clone.

The results obtained from the study strongly indicate that all the above three Category No. 1 clones namely RRII 105, RRIM 600 and GT 1 should be included to the selection of planting materials in the case of future planting also. While planting, all the agro-climatic specialities on the area can be considered and within the site positions can be earmarked for each cultivar. The results also point out the necessity of further crop improvement in Hevea to incorporate disease tolerance with high productivity. Control measures for various diseases to facilitate further improvement in rubber production and productivity also appear necessary.

REFERENCES

Chandrasekhara, L.B. 1971. Development in Hevea planting materials Ceylon. Jl. Rubb. Res. Inst. Ceylon. 48: 7-18.

Chandrasekhara, L.B. 1972. Recommended planting materials 1972. RRIC Bull., 7: 39-47.

Cherian, P.P. 1987. A miscellaneous in commercial rubber yields over 2000 kg/ha and on brown bast incidence. Rubb. Plrs. Conf. Kottayam. 1987. 14-17.

George, K.T., Joseph, T. and Joseph T. 1988. Evolution of the yield performance of the selected planting materials in the interest of the planting policy. Indian Journal of Natural Rubber Research, 1(2): 66-78.

Joseph, T. and Haridasan, V. 1991. Evaluation of planting materials under commercial planting. Third Report. Rubb. Board Bull. (latest issue).

Krishnankutty, P.N., George Jacob and Haridasan, V. 1982. Evolution of planting materials under commercial planting - first report. Rubb. Board Bull., 17(4): 18-25.

Krishnankutty, P.N. and Srinivasan, K.G. 1985. Evolution of planting materials under commercial planting materials - second report. Rubb. Board Bull., 20(2): 22-26.

Marattukalam, J.G. and Premakumari, D. 1987. Early performance of a few Sri Lankan clones in India. Rubb. Plrs. Conf. 1987, Kottayam, 8-13.

Marattukalam, J.G. Saraswathyamma, C.K. and George, P.J. 1990. Crop improvement through ortet selection in India. Rubb. Reporter (1990). pp. 5-8.

Panikkar, A.O.N. (1980). Breeding and tree improvement. Handbook of Natural Rubber Production in India. (Ed. P.N. Radhakrishna Pillai) Rubber Research Institute of India, Kottayam, pp. 35-41.

Pushpadas, M.V. and Karthikakuttyamma. 1980. Agroecological recommendations. Handbook of Natural Rubber Production in India. (Ed. P.N. Radhakrishna Pillai). Rubber Research Institute of India, Kottayam. pp. 86-110.

Pillai, P.N.R. 1980. Non-parasitic practices. Handbook of Natural Rubber Production in India (Ed. P.N. Radhakrishna Pillai) Rubber Research Institute of India, Kottayam, pp. 306-312.

Rubber Research Institute of India, Annual Report 1987-88.

Rubber Research Institute of India, Annual Report 1988-89.

Rubber Board, 1990. Rubber Growers Companion, Rubber Board, Kottayam.

Saraswathyamma, C.K., Marakkukalam, J.G. and Panikkar, A.O.N. (1988a. Rubber planting materials - A review. Crop improvement in India. Rubber Reporter, July-Oct. 1988. 53-56.

Saraswathyamma, C.K., Marattukalam, J.G. and Panikkar, A.O.N. 1988b. Rubber planting materials. A review. Classification and choice of planting materials. Rubber Reporter, Jan-April 1988. 149-153.

QUESTIONNAIRE FOR COLLECTION OF DATA ON THE PERFORMANCE OF CLONES UNDER CATEGORY NO.I

1. Name of Estate :
2. Location :
   District Taluk Village
3. Name and address of Owner :
4. Area under rubber (With year of planting, extent, planting material, No.of plants, spacing). : a) Immature rubber b) Mature rubber.
5. Type of soil and nature :
6. Topography :
7. Early History
   a) Intercropping :
   b) Leguminous cover :
8. Lie of the land
   a) Flat :
   b) Slopy :
   c) Steep :
9. Type of planting
   a) Replanting :
   b) Newplanting :
   c) Interplanting :
   d) Others :
10. Cultural Operations
   a) Contour line planting :
   b) Square planting :
   c) Pits size taken :
   d) Soil conservation by contour terraces :
   e) Individual terraces :
   f) Edakayyalas :
   g) Silt pits :
11. Method of planting
   a) Seed at stake planting/ Field budding :
   b) budded stumps :
   c) Polybag planting :
      Green bud :
      Brown bud :
   d) Stumped budding :
   e) Others :

12. Weeding

a) Clean weeding :

b) Slashing of weeds :

c) Weedicide application :

d) Others :

13. Manuring

a) Pit manuring (Compost/cowdung/Mussoriphos etc.) :

b) Type of mixtures :

c) Quantity :

d) Method of application :

e) Mulching :

14. Other Maintenance operations :

a) Prunning :

b) White washing :

c) Irrigation :

d) Firebelt :

15. Spraying/Plant protection Operations adopted :

Type of fungicide

a) Bordeaux Mixture :

b) Oil based fungicide dissolved in spray oil and doze. :

16. Disease incidence

a) Abnormal leaf fall :

b) Oidium :

c) Pink disease :

d) Shoot rot :

e) Root disease :

f) Deficiency of nutrients :

g) Others :

17. Natural Calamities

a) Wind damage :

b) Drought :

18. Wintering

a) Time :

b) Nature :

(....3)

19. Particulars of Mature area and Yield.

Year of planting	Extent	Year of opening for tapping	No. of trees opened	Type of planting material	No. of days tapped	Yield Year of tapping	Sheet Kg.	Scrap Kg.	Latex	Others	Total yield	Yield per hectare.	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)

20. Rain guarding adopted or not :

Yield stimulant applied and method of application and frequency. :

Time of tapping :

Panel. A, B, C, D, :
Depth of tapping
(deep/Shallow/Optimum depth)

21. Interplanting :

Other trees :

Medicinal plants :

22. Brown Bast incidence :

23. Growth of plants and Bark renewal Panel diseases :

24. Remarks if any :

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