MAJOR DISEASES AFFECTING RUBBER AND ITS CONTROL MEASURES ADOPTED BY SMALL GROWERS OF VAIKOM TALUK

BY

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DISSERTATION
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1992

DECLARATION

I hereby declare that this dissertation entitled Major Diseases affecting rubber and its control measures adopted by small growers of Vaikom Taluk is a bonafide record of original work done by me during the course of placement/training and that this dissertation has not formed the basis for award of any degree diploma associateship or other similar titles of any other University or Society

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20 01 1993

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CERTIFICATE

Certified that this dissertation entitled **Major diseases affecting rubber and its control measures adopted by small growers of Vaikom Taluk** is a record of research work done by **Sri A P Sreedharan** 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 committee of Sri A P Sreedharan a candidate for the Post Graduate Diploma in Natural Rubber Production agree that the dissertation entitled Major diseases affecting rubber and its control measures adopted by small rubber growers of Vaikom Taluk may be submitted by Sri A P Sreedharan in partial fulfilment of the requirement of the Diploma

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C O N T E N T S

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1 INTRODUCTION

Commercial rubber planting was started in India since 1902 The weather conditions prevailing in India especially in Kerala are more or less the same as that of Brazil, the native place of the para rubber Hevea brasiliancis (Muell Arg.). Being a rainfed crop rubber tree is prone to the attack of some diseases which are seen mainly during rainy season These diseases are affecting the rubber plants at various stages of growth and are reducing the growth considerably Incidence of diseases finally reduces the yield from the trees

In Kerala, different rainfall pattern is prevailing in the important areas of rubber planting Therefore, the extent of incidence of diseases in different rubber growing areas are also different In order to get a clear picture of the incidence of various diseases location specific study is found necessary The major diseases affecting the rubber are abnormal leaf fall, pink disease and powdery mildew

Disease management measures are always expensive and it is seen that about 10% of the total cost of cultivation is annually required for effective control of diseases in

a hectare. Details regarding the cost of planting, cost of upkeep, cost of disease control etc. can be available from the large estates as they keep records properly But the details are not available from small holdings because they do not keep such details for their future use

Hence, a study was taken up to evaluate the major diseases affecting rubber in the small holding sector of Vaikom Taluk of Kerala State and the control measures adopted by the small holding sector so that further strengthening of the extension strategies for that area

2. REVIEW OF LITERATURE

2 1 Abnormal leaf fall disease

The abnormal leaf fall disease of rubber was recorded in India during 1910 from the estates of Palappilly in Trichur district of Kerala State The attention of growers was drawn to this disease where healthy seeds could not be obtained for planting because of pod rot which was followed by defoliation In due course the disease spread to all other rubber growing districts At present it is the most destructive disease of rubber in India (Jayaratnam et al ,1980).

In 1876, Anton de Bary was the first to name the pathogen Phytophthora (plant destroyer) when he noticed potato late blight fungus Phytophthora infestans. The species of pathogen causing abnormal leaf fall disease is Phytophthora palmivora (Ervins et al ,1983)

2 1 1 The disease incidence

Incidence of the disease starts at the time of the South West monsoon under Kerala condition. A continous spell of rain of 250-300m for 7-10 days, without intermittant sunshine is congenial environment of leaf fall (Thomson and Pillai, 1976) Relative humidity of

98% is more conducive for the disease The mean temperature between 15 6°C and 28 9°C which is very much favourable for sporangial growth of the Pathogen and start of the leaf fall disease The disease caused by Phytophthora palmivora which spreads rapidly through the plantations until the disease assumes epidemic proportions (Tucker 1931, Wellman 1954). As the fungus attack not only the leaves but also the fruit, the green branches, and the stem (Petch 1936) Infection of shoots which is common on young plants during the monsoon season in phytophthora endemic areas lead to shoot die back (Rubber Board 1980, Radziah and Hashim, 1990)

Clones like PB 86, PRIM 600, PR 107, are found susceptible But clones like RRII 105, GT I, Gl I, BD 10 are tolerant (Rubber Board 1980)

Health of the infected trees are debilitated by leaf fall die back and shoot rot. Heavy leaf fall was noticed upto an extent of 50% in sprayed areas of susceptible clones (Rubber Board, 1989) Abnormal leaf fall disease observed to cause 9-16% of yield loss in susceptible clones of Hevea brazilianzis of 10-25 years of age (Rubber Board 87-88) The disease adversely affected the growth and bark renewal of the trees The disease increased plugging index and reduced the dry rubber content of the

latex (Sethuraj et al 1984). Moderately tolerant clones like RRII 105, GT 1, PB 217 and Gl I are likely get protection with lower dose of fungicides according to rainfall pattern of the concerned region (Jayaratnam et al 1987)

2.1.2 Control measures

Prophylactic spraying of 1% bordeaux mixture was more effective for the control of this disease and this is being adopted extensively by rubber growers at present An integrated approach combining the biological, cultural and chemical control methods is most beneficial (Radziah and Hashim, 1990) Ramakrishnan and Pillai (1961) found that Bordeaux mixture is superior to copper fungicides like Fytolan and organic sulphur fungicides like Dithane Z-78 Due to disadvantages of high volume spraying, low volume spraying of oil based copper oxychloride fungicide in diluent oil is done through micron sprayers, operated from the ground is also practiced

The disease can be controlled by crown budding The susceptible trees crown budded with BD 10, a tolerant clone even after 30 years of crown budding the tolerance displayed by these crown budded trees is remarkable. (Pillai et al 1980)

2.2 Pink disease

The pink disease of rubber caused by the fungus Corticium salmonicolor (Berk & Br) The disease first occured in Sri Lanka in 1870 (Petch, 1921) In south India the disease was first recorded in 1908. (Pillai and George 1980) The disease appears generally at the fork region of a tree where several branches arise at the same level from main stem (Sharples 1936). Pink disease attacks rubber trees of all ages once the woody part is developed, but more damage is caused in plants of age ranging from two to twelve years (Pillai and George, 1980)

2 2 1 Incidence of the disease

During the initial stages of infection superficial growth of cobweb like mycelia will be noticed on the bark The mycelial growth will be glistening white in colour After the mycelial stage the pathogen penetrate the bark and cause extensive damage to the internal tissues Exudation of latex is observed from the infected region Later the foliage will become yellowish in colour and then dries up The dried leaves will be noticed still sticking to the dried branches A number of sprouts arising from the position just below the infected region can also be seen In young plants of upto three years of age infection is mainly observed on the main stem at different

ıeıghts ın the regıon of brown bark In older trees the ınfectıon could be maınly at forkıng regıon or on the maın stem or prımary branches (Pıllaı et al 1980)

2 2 2 Control of dısease

Prophylactıc sprayıng of bordeaux mıxture on the maın stem forkıng regıon and maın branches was practıced ın all rubber growıng countıres Later on applıcatıon of 10 per cent bordeaux paste was recommended wıdely In advanced cases of ınfectıon bordeaux paste may be applıed on the ınfected regıon When ıt drıes up the surface may be scraped so as to remove all pathogen and the ınfected bark and the fungıcıde ıs applıed agaın upto 30cm above and below the ınfected regıon

Calıxın 2 per cent mıxed wıth ammonıated rubber latex ıs also recommended (Edathıl and Jacob 1983) Applıcatıon of Thırıde (Tetra methyl thıuram dı sulphıde) mıxed wıth petrolıum bye products lıke Mahathotex wax was also found effectıve (Edathıl and Pıllaı 1976)

A new fungıcıde carrıer pıdıvyl Chına clay compound was recommended wıth calıxın one per cent or propıconazole (Jacob and Edathıl 1986) Thırıde at a concentratıon of 7500 ppm also gıves good performance (RRII 1986) Hıgh pressure ınjectıon of streptomycın was also seen effectıve agaınst the dısease (RRII 1986)

2 3 Powdery mildew

The powdery mildew disease was first recorded in Java in 1918 (Sharples 1936) The disease is caused by the fungus Oidium heveae The disease affects plants of all ages from very young nursery seedlings upto mature plants The pathogen attacks very small brown leaves and cause them to fall off and on mature leaves while powdery patches are produced (Petch, 1921)

2 3 1 Incidence of the disease

Powdery mildew disease caused by Oidium heveae infects plants of all ages The fungal infection is observed between bud break till they are past the dark green stage or to the time cuticle matures which varies from clone to clone (Pillai et al 1980) Fully developed leaves however resist the severity of the infection

The young leaves, as a result of infection loose their shining appearance and attain a dull colour A white or ash coloured powdery coating develops on the tender leaves covering both upper and lower surfaces The leaves may appear crinkling and distortion of the leaf area caused due to uneven growth of leaf tissues In cases of severe attack in an estate the ground may be covered with a carpet of shed leaves and the trees will be almost denuded of leaflets retaining more or less bare leaf petioles on the trees with a broomstick appearance

The leaf petioles are later shed The trees will again refoliate and these new leaves may also be attacked if climatic conditions are favourable resulting in repeated defoliations The trees growing in poor eroded soils and replanted areas where the soil fertility status is very low the trees exhibit much slower rate of growth thereby exposing the leaves in a susceptible stage for infection (Ramakrishnan and Pillai 1962)

The climatic condition prevailing at the time of refoliation play a major role in determining the severity of disease Prevalance of overhanging mist or heavy dew cloudy days and cool nights and relative humidity of 75 to 80 per cent in the atmosphere at the time of refoliation are the environmental conditions which favour the disease development Light drizzles favour the onset and spread of disease (Petch 1936)

The economic impact of powdery mildew depends on the growth stage of the plants Severe disease which lead the trees bare retard growth of young plants thus prolonging the immaturity period in yielding plants severe and repeated attack of the disease reduce yield (RRII 1986)

2 3 2 Control of disease

The effective methods of controlling Oidium is dusting with sulphur dust Depending upon the intensity of disease three to six rounds of dusting may be required

at an interval of four to ten days to control the disease effectively using 11 to 14 Kg of 325 mesh fine sulphur dust per round per hectare through out the refoliation period Trials conducted at RRII have shown that systemic fungicide Bavistin at 0 2 per cent as a water spray is effective against powdery mildew disease in the nursery and in young plants (Thomson et al 1984)

Cultivation of clones resistant or tolerant to the disease saves the annual recurring expenditure on plant protection operations and provides a permanent solution (Pillai et al 1980)

In mature areas application of tridemorph 1 5% dust was found superior to sulphur dust Spray application of carbendazin 0 05 per cent also was found to give better control than the conventional wettable sulphur Repeated use of any systemic fungicide may lead to development of resistance to the fungicide by the pathogen Alternative use of systemic and non systemic fungicides are suggested (Jayaratnam et al 1987)

Powdery mildew caused by Oidium heveae results in severe defoliation of rubber in tropical rubber growing countries In severely affected areas if proper control measures are not adopted the yield falls such low levels

that tapping becomes uneconomic PB 86 showed 20 1 to 31 8 per cent crop loss and RRIM 600 13 5 to 28 5 per cent crop loss (Jacob et al 1992)

3 MATERIALS AND METHODS

Vaikom taluk of Kottayam district was chosen for the study Altogether there were 12 773 units in the Taluk comprising 5,700 Hectare The average size of the holding was 0 40 Ha The map of Vaikom taluk is given as Annexure I

Terrain of the land were slopy (62 units) undulating (29 Units) and flat (9 units) Elevation was between 6 metres and 26 metres above MSL Taluk map showing village wise details and the units surveyed is given in Annexure I and III Individual farmers were contacted and data collected regarding the incidence of abnormal leaf fall, pink and powdery mildew diseases (Name and address given as Annexure IV) The selected units were visited for the confirmation of data The informations were collected based on the questionnaire prepared, in advance in consultation with the experts (Annexure II) Details regarding different age groups year of planting, planting materials used, clone-wise nature of infection of each disease, number of trees affected, control measures adopted rate of recovery from the disease cost of plant protection measures adopted and knowledge of farmer in detection of disease and proper treatment were collected

The extent of the individual units surveyed ranged from 0 06 ha to 0.80 ha. There were 89 units having the extent below 0 50 ha. 11 units between 0 50 ha and 1 00 ha The details of the units surveyed are given in Annexure IV The village-wise distribution of the units surveyed is also given in Annexure III various control measures adopted by the growers and method of application were also evaluated Adoption of prophylactic treatment and its frequency of treatment were recorded External factors affecting the disease, intensity and proximity of the infected plantations of susceptible clones were also studied

The severity of the disease was assessed based on the scores given for each disease The details are as follows

Abnormal leaf fall disease and Powdery mildew

Mild	Infection below 25 per cent
Medium	Infection between 25 and 50 per cent
Severe	Infection above 50 per cent

Pink Disease

Mild	Initial cobweb stage
Medium	Latex oozing stage
Severe	Sprouts and drying stage

The data collected after detailed survey were tabulated Detection of the disease at the early stages of infection is important in the controlling of the disease Therefore the study was concentrated on the ability of the small growers to detect the disease at the early stages of incidence Control measures adopted and rate of recovery after treatment were studied Expenditure for chemical control difficulties in adopting the treatment and suggestions for improving them were collected and presented in tables

4 RESULTS AND DISCUSSION

Vaikom taluk comprises of fourteen villages Viz Chempu Velloor Mulakkulam Njeezhoor Kaduthuruthy Vadayar Kulasekharamangalam Vadakkemury Naduvile Vaikom Thalayazham Vechoor Kallara and Manjoor

Total area under rubber is about 5 700 Hectares (1 788 Ha of mature area and 3 912 Ha of immature area) Total number of holdings are 12 773 and all the holdings are small in size The size of the holding selected for the study was between 0 06 ha and 0 80 ha Important clones cultivated were RRII 105 RRIM 600 GT 1 and clonal seedlings Average yield obtained was 984 Kg/Ha/ Year Terrane is flat undulating and slopy An extent of 3195 ha was new planted and 2505 was replanted (Annexure 1)

4 1 Major Diseases Affecting Rubber in Vaikom Taluk

Major diseases found infecting rubber in Vaikom taluk were abnormal leaf fall pink and powdery mildew Out of the one hundred units surveyed 23 units were seen infected with abnormal leaf fall (area 5 91 ha) About 16 31 per cent of the trees in the surveyed area were found infected with the disease Infection of pink disease was found in

51 units (15 38 ha) only 3 09 per cent of the trees in the surveyed area were found infected Powdery mildew was observed in 99 units (area 31 26 ha) and 91 68 per cent of the trees were found infected with this disease Hence the powdery mildew infection was found to be more severe in the area surveyed

Combined infection of abnormal leaf fall pink and powdery mildew was another feature of this study A total of 48 trees were infected (0 30%) in an area of 1 24 ha (3 92%) Cross infection of powdery mildew and pink was another finding A total of 362 trees were seen infected in 50 Units (Table 1)

4 2 Abnormal leaf fall disease

4 2 1 Intensity of the disease

The data pertaining to the incidence of abnormal leaf fall disease is presented in Table 2 Nature of infection was mild in three units (1 92%) and medium in 12 (9 86%) severe infection was observed in eight units (6 89%) There was no infection in 77 units The results indicated that most of the units in the surveyed area was free from the disease

4 2 2 Clonal variation for abnormal leaf fall

Clonal variation for the disease infection is presented in Table 3 RRII 105 was the major clone in the

Table 1 Details of major diseases infecting rubber in Vaikom Taluk

Details of disease infection	No of Unit	Area(ha)	No of Trees
Total Surveyed	100	31 62	15534
Abnormal leaf fall	23	5 91 (18 69)	2535 (16 31)
Pink disease	51	15 38 (48 6/)	481 (3 09)
Powdery mildew	99	31 26 (98 86)	1/2/2 (91 68)
Abnormal leaf fall and Pink infection	00	00	00
Abnormal leaf fall and Powdery mildew infection	00	00	00
Abnormal leaf fall and Powdery moldew and Pink	6	1 24 (3 92)	/8 (0 30)
Powdery mildew and Pink disease	50	15 12 (/7 81)	302 (2 34)

The values in parentheses indicate percentage

Table 2 Intensity of Abnormal leaf fall disease

Nature of infection	No of Unit	Area (ha)	No of trees
Mild	3	0 61	170
Medium	12	3 12 (9 86)	1300 (8 /7)
Severe	8	2 18 (6 89)	1065 (6 85)
Total infection	23	5 91 (18 67)	2535 (16 4)
No infection	77	25 71 (81 33)	12999 (83 59)
Total	100	31 62	1553/

The values in parentheses indicate percentage

Table 3 Clonal variation for Abnormal leaf fall disease infection

Clonae	No of unit surveyed	No of unit infected	Mild		Medium		Severe	
			Unit	Area (Ha)	Unit	Area (Ha)	Unit	Area (Ha)
RRII 105	88	18	2	0 31	11	3 24	5	1 35
GT 1	2							
RRIM 600	3	1			1	0 24		
Clonal seedlings	7	4	1	0 06		-	3	0 71
-	-		-	-		-		
Total	100	23	3	0 37	12	3 48	8	2 06

surveyed area Out of the 23 units infected by abnormal leaf fall 18 were of RRII 105, four clonal seedling area and one RRIM 600 Two units of RRII 105 had mild infection 11 had medium and the other had severe infection About 4 90 ha with RRII 105 was seen infected out of the 5 91 ha One unit of RRIM 600 was seen infected out of the three units and nature of infection was medium Four out of seven units of clonal seedlings area were found infected with abnormal leaf fall No infection was noticed in any of the two units planted with GT 1 Though there was clonal variation for the disease incidence was observed, no concluding results could be drawn due to the inadequate number of units for different clone However the relatively low incidence of the disease in the surveyed area could be due to the relative tolerance of RRII 105 (Pillai et al.,1980)

4.2 3 Control measures adopted

Table 4 summerises the details related to the control measures adopted for abnormal leaf fall disease and the cost incurred Out of 100 units surveyed only eight (34 78%) units had taken prophylactic measures to prevent the disease Spraying was also done in another eight units after the infection of the disease Bordeaux mixture was used as the fungicide in the 16 (69 56%) units Inadequate knowledge and lack of facilities might be the reasons to limit the use of low volume sprayers in the sprayed areas

Table 4 Control measures adopted for Abnormal leaf fall disease

		No of holding	Percentage
	Units surveyed	100	
	Units infected	23	
1	Units where prophylactic spraying was done	8	34 78
2	Units where spraying was done after infection	8	34 78
3	Fungicide used		
	a) Bordeaux mixture	16	69 56
	b) Copper oxychloride	00	00
4	Sprayers used		
	a) Rocker sprayer	16	69 56
	b) Power sprayer	NIL	

		Actual cost	Cost on the basis of recommendation
		Rs Ps	Rs Ps
5	1) Cost of chemical	840 00	1225 00
	2) Cost of labour	1250 00	1250 00
	Total	2090 00	2475 00

6 Farmer adopting recommended control measures

Yes	8
No	15

For effective spraying of bordeaux mixture in one hectare of rubber plantation using rocker sprayer the cost on the basis of recommendation was Rs 2475/ including labour The actual cost incurred for the spraying of bordeaux mixture for the control of abnormal leaf fall disease was found to be Rs 2090 00 This shows that the quantity of chemicals used for spraying was inadequate

4 2 4 Awareness of growers in plant protection technique

Table 5 presents the data pertaining to the awareness of growers in plant protection technique Out of 2535 trees infected 705 trees (27 81%) have received prophylactic spraying Spraying was alone done in 1230 (48 52%) trees after the infection of the disease Out of 1935 trees treated 1140 (44 97%) trees recovered fully while 580 (22 87%) trees had partial recovery and 215 (8 48%) trees had no recovery Detection of disease by growers was rated as seven poor eight satisfactory and eight good This shows that the awareness of growers in plant protection measures were poor Though 69 56 per cent of growers could detect the disease satisfactorily they could save only 44 97 per cent of the trees from the disease Defective methods adopted for preparing bordeaux mixture was observed as the main reason for the infection of the disease in the sprayed areas Inadequate knowledge and lack of facilities were found to limit the use of low volume sprayers in the sprayed areas Extension activities

Table 5 Awareness of growers in Plant protection technique Abnormal leaf fall disease

	No	Percentage
No of holdings surveyed	100	
No of units infected	23	23
Total No of trees	15534	
No of trees infected	2535	16 31
No of trees treated	1935	76 33
No of trees with prophylactic spraying	705	27 81
No of trees sprayed after infection	1230	48 52
No of trees fully recovered	1140	44 97
No of trees partially recovered	580	22 87
No of trees with no recovery	215	8 48

Detection of disease

	No of units	Percentage
Poor	7	30 43
Satisfactory	8	34 78
Good	8	34 78
Total	23	

may be strengthened to educate the growers in preparing bordeaux mixture and its application No grower was found adopt low volume spraying though it is rather cheap

4 3 Pink disease

4 3 1 Intensity of the disease

Data pertaining to the incidence of pink disease is presented in Table 6 Out of the 100 units surveyed 51 units were found infected Mild infection was found in one unit (0 63%) Medium infection in 38 units (36 43%) and severe infection in 12 units (1 17%)

4 3 2 Clonal variation for pink disease

The clonal variation for the disease infection is presented in Table 7 Out of the four clones studied RRII 105 showed maximum infection Forty eight units out of 88 were seen infected with pink disease One unit of GT 1 and two units of RRIM 600 were also found infected One unit of RRII 105 had mild 37 had medium and 10 had severe infection of the disease An extent of 13 99 ha out of 15 38 ha was found infected with the disease in clone RRII 105 One unit of GT 1 had severe infection out of two Infection of pink disease was also found in two units of RRIM 600 out of three and no infection was noticed in the areas planted with clonal seedlings

Table 6 Intensity of infection pink disease

	No of Unit	Area(ha)	Trees
Mild	1	0 20 (0 63)	4 (0 02)
Med um	38	11 52 (36 43)	28/ (1 82)
Severe	12	3 66 (11 57)	79 (0 50)
No infectio ı	/9	16 24 (51 35)	15167 (97 63)
Total	100	31 62	1553/

The values in parentheses indicate the percentage

Table 7 Clonal variation for pink disease infection

Clone	Total No of holding		Nature of Infection					
			Mild		Medium		Severe	
	No surveyed	No infected	Unit	Area	Unit	Area	Unit	Area
RRII 105	88	48	1	0 20	37	10 75	10	3 04
PR 1	2	1					1	0 10
RRIM 600	3	2			1	0 77	1	0 52
Clonal seedling	7							
Total	100	51	1	0 20	38	11 52	12	3 66

4 3 3 Relationship between age of the tree and pink infection

The data presented in Table 8 indicate the incidence of Pink disease in trees of varying ages The incidence of disease was more in trees between 4 and 13 years Pillai et al 1980 reports that the infection was more in trees between 2 years and 12 years No conclusive result could be drawn as the number of units infected were less in surveyed areas However it points to the need for adoption of appropriate control measures even in older areas

4 3 4 Control measures adopted

Table 9 give the data pertaining to the control measures adopted against pink disease attack Out of the 51 units infected control measures were adopted only in 36 units Bordeaux paste was used as the fungicide Out of the 36 units control measures were adopted only 50 41 per cent A total of 121 trees (50 41%) recovered from the disease While 37 08 per cent (89) had partial recovery and there was no recovery in 15 41 per cent (37) of the trees Actual cost incurred for the treatment of the disease was Rs 162 00 including labour The cost on the basis of recommendation was Rs 425 00 per ha

Though Thiride was effective against pink disease no grower applied it due to lack of awareness Being a

Table 8 Relationship between age of the tree and pink infection and its percentage

Sl No	Age of tree	No of units	Total No of trees	No of trees infected	Percentage
1	3	1	190	3	1 57
2		6	965	32	3 31
3	5	1	590	36	6 10
	6	3	385	16	15
5	7	1	720	41	5 69
6	8	7	985	37	3 75
7	9	1	340	14	4 11
8	10	2	370	26	7 02
9	11	7	910	32	3 51
10	12	5	760	21	2 76
11	13	3	725	60	8 27
12	14	2	302	19	6 29

Table 9 Control measures adopted for pink disease

Adoption of control measures		Total	Percentage
1	No of units surveyed	100	
2	No of units infected	51	51
3	No of holders adopting control measures	36	70 58
	Fungicide used		

		Total	Actual cost of chemical Rs ps	Actual cost of labour Rs ps	Total Rs ps
	a) Bordeaux paste	36	101 00	61 00	162 00
	b) Thiride	Nil			
			Recommended Cost		
5	Farmers adopting recommended dose of control measures	8	225 00	200 00	425 00
6	Farmers adopting pro phylactic foliar spray	8			
7	Farmers adopting foliar spray covering fork region and trunk	Nil			
8	Awareness of farmers about Thiride	4 NOs			
9	Availability of Thiride - Not locally available				

10	Recovery	Trees	Percentage
	No of units treated	367	
	No of trees treated	240	65 39%
	No of trees recovered fully	121	50 41%
	No of trees recovered partially	89	37 08%
	No of trees without recovery	37	15 41%

petroleum based compound leaching away of thiride during rainy season is prevented Due to severe leaching bordeaux paste requires repeated application and hence cost increases Though four growers were aware of thiride it was not available for their use Therefore an awareness may be created among growers about thiride and its use About 34 78 per cent of the growers only undertaking prophylactic foliar spray against abnormal leaf fall and nobody was adopting foliar spray along with spray trunk and fork region of the trees This can be attributed for the disease infection

4 3 5 Method of preparation and application of Bordeaux paste

Table No 10 showed that methods of preparation and application of bordeaux paste was improper Out of 36 units treated only six growers preapred Bordeaux paste properly and eight units could apply properly Though 70 58 per cent of the growers think that the disease was serious and they were unaware of proper treatment methods against the disease

4 3 6 Nature of inspection of trees by growers

Regarding the frequency of inspection by growers to the plantation Table 11 showed that 13 72 per cent of the growers visit daily 35 29 per cent growers weekly while 50 98 per cent of the growers visit once in a month

Table 10 Method of preparation and application of Bordeaux paste

	Proper	Improper	Total
Method of preparation	6	30	36
Method of application	8	28	36

Growers view of the disease

	No of growers	Percentage
Serious	36	70 58
Not serious	15	29 41
Total	51	

Table 11 Nature of inspection of trees by growers for pink disease

No of units surveyed	100
Total No of trees	1553
Total Area	31 02 ha
No of units infected	51
Area infected	15 38 ha
No of trees infected	367

Nature of inspection	No of Unit	Percentage
Daily	7	13 72
Weekly	18	35 29
Monthly	26	50 98

Early detection and treatment reduces the intensity of the disease considerably More awareness is needed about this disease

4 3 7 Disposal of infected plant parts

Table 12 presents the details regarding the disposal of infected plant parts by the growers Though there were five units with trees having chopped crown and eight units with trees having pruned branches and twigs, no grower was found burning it properly Careless handling of the infected plant parts will cause the infection to the other trees also (Pillai et al ,1980)

RRII 105 was the main clone in the surveyed units Jayaratnam 1980 reported that RRII 105 have average susceptibility to the disease Out of the 51 units infected 48 of them were RRII 105 RRIM 600 had severe infection Out of the three units two units had infection and one GT 1 out of two had also severe infection though it was considered as less susceptible As the number of holding of GT 1 were very less no conclusion can be drawn regarding the severity of infection of the disease Bordeaux paste has only less sticking property while thiride being a petroleum compound have high sticking property and not leached during rainy season and is reported to be very effective in the treatment of pink disease But no grower was observed

Table 12 Disposal of infected plant parts

No of units with crown chopped trees	5
No of units with branches chopped trees	8
No of units burning the pruned branches and twigs	Nil

using it Use of thiride is comparatively cheap also Therefore the use of thiride may be popularised for the treatment of pink disease Besides 29 41 per cent of growers still believe that the disease was not so serious and hence they were reluctant to adopt control measures In the case of trees having chopped crown due to severe infection it will take time to develop new crown resulting drastic reduction in yield Therefore extension activities may be strengthened to educate the growers about the disease and its control

4 4 Powdery mildew

4 4 1 Intensity of the disease

Data pertaining to the intensity of the disease is presented in Table 13 Nature of infection was mild in seven units (5 34%) medium infection in 17 units (17 96%) and severe in 75 units (75 52%) One unit was found uninfected with powdery mildew among the surveyed units Refoliation was complete in 43 units (43 43%) and refoliation was spread over two months in 56 units (56 56%)

4.4 2 Clonal variation for powdery mildew disease

Table No 14 presents the data regarding the clonal variation for the disease Out of the 100 units surveyed 99 were found infected RRII 105 being the major clone

Table 13 Nature of infection Powdery mildew

		No of holding infected	Area (ha)	No of trees infected
	Total surveyed 100		31 62	1553
1	Mild	7	1 69 (5 3/)	790 (5 54)
2	Medium	17	5 68 (17 96)	2196 (15 /1)
3	Severe	75	23 88 (75 52)	11257 (79 0/)
/	Not infected	1	0 36 (1 13)	170 (1 09)
5	Defoliated/refoliated			
	a) Within 2 weeks	43	13 15 (42 06)	5513 (38 70)
	b) Spread over 2 months	56	18 /7 (59 08)	8729 (61 29

Values in parentheses indicate the percentage

Table 14 Clonal variation for Powdery mildew disease infection

Clone	Total No of holdings infected	Area	%	Mild		Medium		Severe	
				No of unit	Area (ha)	No of unit	Area (ha)	No of unit	Area (ha)
RRII 105	87	27 10	85 10	9	2 69	61	19 46	17	5 35
GT 1	2	0 70	2 21	-	-	2	0 70	-	-
RRIM 600	3	1 53	4 83	1	0 52	2	1 01	-	
Clonal Seedlings	7	1 93	6 10			2	0 26	5	1 67
Total	99	31 26	98 84	0	3 21	6	21 43	22	7 02

and was planted in 88 units found infected in 87 units (87 87%) Mild infection was observed in nine units medium infection in 61 units and severe infection was observed in 17 units All the two units of GT 1 and three units of RRIM 600 and seven units of clonal seedlings area were also found infected

4 4 3 Control measures adopted

Table No 15 presents the details of control measures adopted by growers for powdery mildew disease Fourteen per cent of growers (6 17 Ha) were observed to undertake control measures (19 75%) Sulphur mixed with talc (70 30) is being dusted Dusting was done only after the infection of the disease Dusting of the fungicide was recommended from the time of bud break at an interval of four to ten days to control the disease effectively using 11 to 14 Kg of 325 mesh fine sulphur dust per round per hectare In the dusted areas the growers had used the fungicide below the quantity recommended

Cost incurred for the purchase of chemical was also found less when compared to the cost on the basis of recommendation by Rubber Board Rupees 403/- only incurred as the cost of chemical and labour Where as it was Rs 660/ towards the cost for dusting at the recommended dose

Table 15 Control measures adopted for Powdery mildew

			Area	Trees
1	No of units surveyed	100	31 62	1553/
2	No of units infected	99	31 26 (98 86)	142/2 (91 68)
3	No of holding adopting control measures	1/	6 17 (19 73)	3050 (21 /1)

Time of adoption of control measures

		Before infection	After infection
			14
5	Rounds/Ha		3
6	Fungicide used	Recommended dose/ha	Below average dose/ha
	Sulphur dust		14
7			
	a) Cost of chemical	Rs 336 00	Rs 198 00
	b) Cost of equipment	Rs 75 00	Rs 75 00
	c) Cost of labour	Rs 125 00	Rs 130 00
	Total	Rs 536 00	Rs /03 00

The values is parentheses indicate percentage

Cost of plant protection measure per hectare

1 Abnormal leaf fall

Control measures adopted by small rubber growers were not sufficient to control the disease properly It was observed that the actual cost incurred for the purchase of chemical was far below than that was recommended by Rubber Board The cost incurred was Rs 840 00 for the purchase of chemical whereas the cost would be Rs 1225 00 as recommended for rocker spraying Thus the insufficient quantity of chemical used for spraying was the main reason for the infection of the disease in the sprayed plantations Control of the disease was almost total in the units where prophylactic spraying was adopted

2 Pink disease

In the control of pink disease the growers of the surveyed area were using only the half of the quantity of the chemical recommended by Rubber Board Therefore the control measures adopted were found to be inadequate The cost of chemical recommended for effective control of the disease was Rs 225 00 But the actual cost incurred was only Rs 101 00 It was clear that the use of insufficient quantity of chemicals was the main reason for the incidence of the disease in the surveyed units

3 Powdery mildew

The percentage of growers adopting control measures against powdery mildew was very low when compared to other

Table 16 Cost of plant protection measures per hectare

	Disease		Cost of chemical	Cost of labour	Total
1	Abnormal leaf fall disease	% of growers			
	Rocker spraying				
A	Bordeaux Mixture				
	a) Actual cost incurred	69 56(16/23)	8/0 00	1250 00	2090 00
	b) Cost as per recommendation		1225 00	1250 00	2475 00
2	Pink Disease	70 58(36/51)			
A	Bordeaux paste				
	a) Actual cost incurred		101 00	61 00	162 00
	b) Cost as per recommendation		225 00	200 00	425 00
3	Powder mildew	14 14(14/99)			
	Sulphur dusting				
	a) Actual cost incurred		198 00	130 00	328 00
	b) Cost as per recommendation		336 00	324 00	660 00

two diseases It was 69 56 per cent and 70 58 per cent against abnormal leaf fall and Pink disease respectively Per cent of growers adopting control measures against powdery mildew was observed to be 14 14 only Lack of proper awareness about the disease and control measures can be the reason Actual cost incurred for the purchase of chemical was Rs 198 00 It would be Rs 336 00 as per recommendation So the growers were not adopting recommended control measures against the disease It was observed that the quantity of chemicals to be used was only limited while the cost of labour was same in treatment of abnormal leaf fall and a little high in the treatment of powdery mildew But in the treatment of pink disease the labour cost was far below than the recommended

Effect of Different Control Measures Adopted in Controlling the Disease

The recommended control measure for abnormal leaf fall is prophylactic spraying of bordeaux mixture Out of the 23 units infected eight units had undertaken the prophylactic spraying Another eight units had sprayed after the infection of the disease About 610 (86 52%) out of 705 trees could be saved by prophylactic spraying Whereas 870 (70 73%) trees only recovered partially in the

Table 17 Effect of different control measures adopted in controlling the disease

Disease control measures adopted								
		No of holdings			Percentage			
1	Abnormal leaf fall disease	23						
A	Fungicide used		Prophylactic		After infection			
	a) Bordeaux mixture	16	8		8	69 56		
	b) Copper Oxychloride	Nil						
B	Method of application	No of trees saved	Fully	Partially	Fully	Partially	Non	
			610	95		870	360	
			TOTAL 705			TOTAL 1230		
	1) Rocker sprayer		16			69 56		
	2) Micron sprayer		NIL					
						No of Trees		
2	Link disease		51			367		
A	Fungicide used		36			270	70 58	

		No and percentage of trees recovered					
		No	Partial %	No	Complete %	Not recovered No	%
1	Bordeaux Paste	89	37 08	121	50 41	37	15 71
2	Thiride	NIL		NIL		NIL	

3	Powdery mildew	No of holdings		Percentage	
A	Fungicide used	99			
			No of trees treated		
1	Sulphur dust	14	3050	14 14	
B	Method of application	No of trees recovered			
		Fully	Partially	Not recovered	
1	Power duster	14	668 (4 63)	2520 (17 69)	510 (3 58)
2	Rocker sprayer		Nil	Nil	Nil

units when spraying was done after the infection of the disease

Infection of Pink disease was observed in 51 units but control measures were adopted only in 36 units Fungicide used was Bordeaux paste The control measures were adopted only in 70 58 per cent of trees (240) About 37 08 per cent (89) trees had partial recovery 50 41 per cent (121) trees had complete recovery while 15 41 per cent (37) trees had no recovery from the disease

Powdery mildew was seen infected 99 units out of the 100 units surveyed Number of units adopted control measures was only 14 and trees treated were 3050 (21 41%) Dusting of fine sulphur was the recommended control measure for powdery mildew Rate of recovery after the dusting was fully recovered 660 (4 63%) trees partially 2520 (19.69%) and no recovery 510 (3 58%) trees observed to be 14 14 only Lack of proper awareness about the disease and control measures can be the reason Actual cost incurred for the purchase of chemical was Rs 198 00 whereas it would be Rs.336.00 as per recommendation So the growers were not adopting recommended control measures against these diseases It is observed that the quantity of chemicals to be used is only limited while the cost of labour was same in the treatment of abnormal leaf fall and

a little high in the treatment of powdery mildew But in the treatment of pink disease the labour cost was far below than the recommended

Detection of Disease and Knowledge of Plant Protection Technique

Ability of the grower to detect abnormal leaf fall and pink was rated as 69 56 and 70 58 respectively Whereas the ability of the grower to detect powdery mildew was only 14 14 percent. Farmer's knowledge of plant protection technique was 34.78 in the case of abnormal leaf fall and 15 68 per cent in the case of pink disease Whereas 26 26 per cent of the growers could adopt plant protection technique in the case of powdery mildew therefore, growers should be given proper education to detect the diseases at an early stage and to undertake proper plant protection measures

Table 18 Detection of disease and knowledge of plant protection technique

		Abnormal leaf fall		Pink		Powdery mildew	
1	Total holdings infected	23		51		99	
		No	%	No	%	No	%
2	No of holdings where disease is properly detected and percentage	16	69 56	36	70 58	14	14 14
3	Farmers knowledge of plant protection technique No and percentage	8	34 78	8	15 68	26	26 26

Summary and Conclusions

5. SUMMARY AND CONCLUSION

The major diseases affecting rubber in Vaikom taluk were powdery mildew, pink and abnormal leaf fall Powdery mildew was more serious and infected about 99 per cent of the holdings surveyed. Dusting of sulphur at the time of refoliation can control the spread of the disease Use of the chemical at the recommended dose was not adopted by the growers This can be the main reason for the spread of the disease

In fection of pink disease was not so serious in the surveyed area About 10 7 per cent of the trees were seen infected Detection of the disease at the early stages of infection and treatment of the trees was more important in the control of pink. It was obvious that the farmers knowledge in plant protection techniques were poor No grower was seen adopting thiride treatment against pink though it was recommended as effective to bordeaux paste Lack of awareness of growers can be the main reason

Abnormal leaf fall was the least serious among the three diseases The clone RRII 105 showed average tolerance to the disease and that can be the reason for the mild infection of the disease in the surveyed units

The study showed extension activities among the growers were highly inadequate RRII 105 being the main clone the leaf retention during monsoon was satisfactory even without prophylactic spraying Therefore, prophylactic spraying was not seen as generally accepted practice among the growers of Vaikom taluk

Powdery mildew disease was very common in the surveyed units. But, many of the growers were neglecting it All clones were seen infected with the disease Repeated dusting of sulphur mixed with talc can control the infection effectively if sprayed at bud break Four to six rounds of dusting should be done for the control of the disease

Extra weeding in plantation become necessary due to leaf fall and hence maintenance cost is higher Unavailability of plant protection equipments was another difficulty faced by the growers To overcome these difficulties disease tolerant clones may be planted in future Moreover, the extension methods are to be strengthened to educate the growers about the diseases and its timely control.

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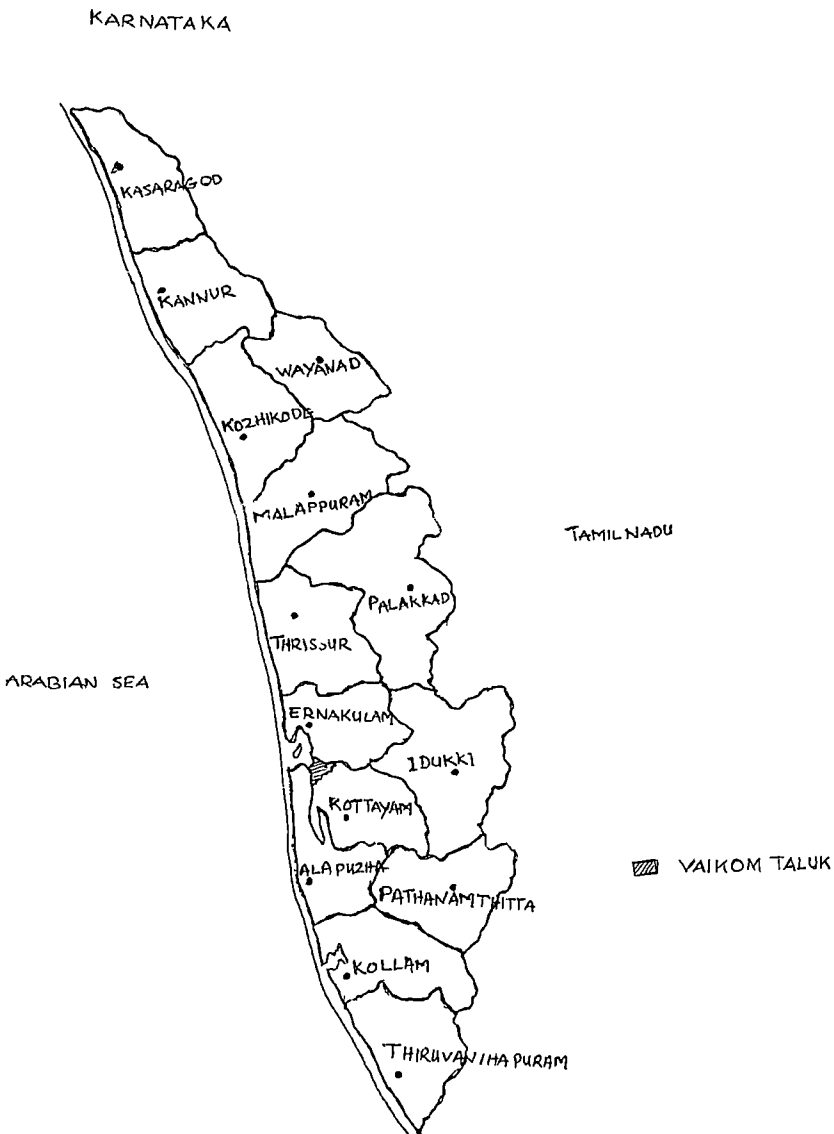
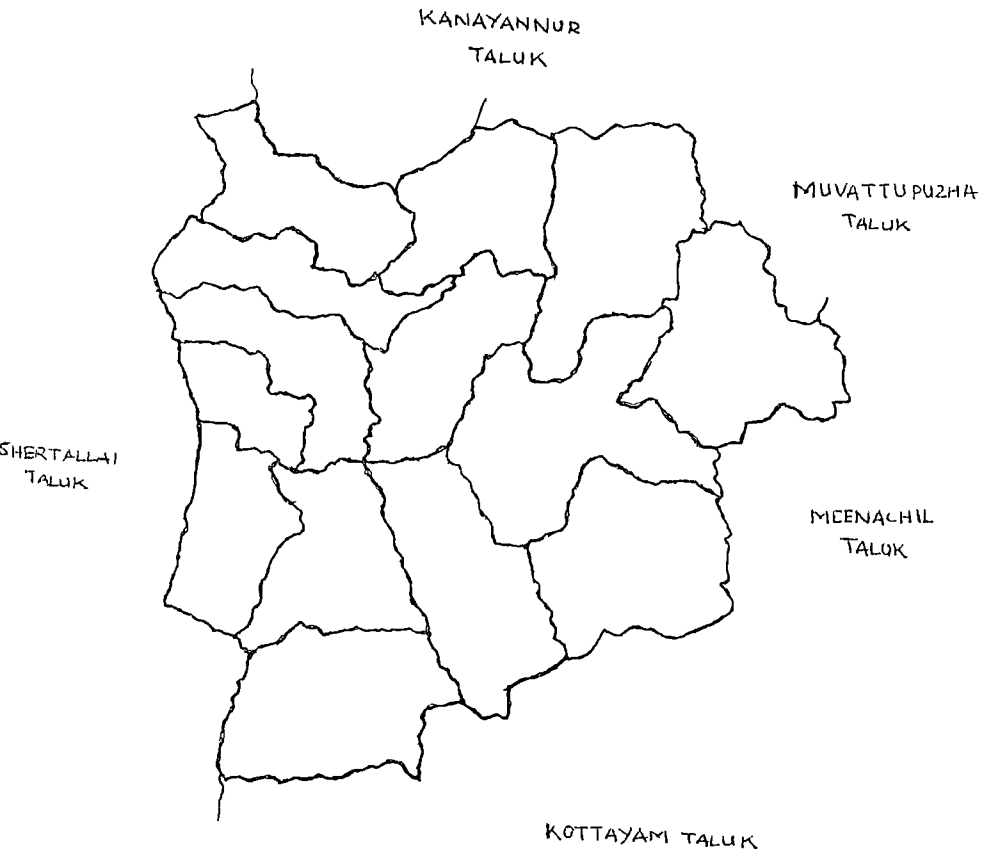
ANNEURE I

MAP OF KERALA



ANNEXURE 1b

MAP OF VAIKOM TALUK



ANNEXURE - II

Major diseasesaffecting Rubber and its control measures by Small rubber growers of Vaikom Taluk

PROFORMA

1	Name and address of the owner	:	
2	Register No /Permit No.		
3	Year of planting	:	Age
4	Extent of the area	:	Ha
	Terrane of land	:	Sloppy/Flat/Steep
6	Proximity of water source		Inside the plot/outside the plot
7	Approximate elevation	:	
8	Planting material		Clonal/Bud (Clone)
9	Average yield/Ha/Annum	:	
10	Proximity to other Estate	:	Adjuscent/ Kms
11	Location of the holding	:	
12	Disease incidence (Name of disease)	:	
13	How the extension activity reached him in identifying the disease	:	
14	Remarks	:	

12 1 PINK DISEASE

a) Nature of infection :

b) Intensity of infection : Mild/Medium/Severe

. .2/-

c) No of trees affected (Total present in the holding)

d) Trees with crown chopped Without treatment/Even after treatment

e) Control measure adopted Yes/No

i) Fungicide used Bordeaux mixture/Bordeaux paste/ Thiride others

ii) Mode of application

iii) Prophylatic spraying done or not HIgh volume/Low volume Micron/ Aerial/Not sprayed

iv) Whether sprayed on trunk fork branches with 1% bordeau mixture Yes/No

Date of spraying

Interval of spraying Monthly/2 months

v) Whether removed parts buried Yes/No

vi) Cost of control measures adopted 1 Cost of Chemical Rs

2 Cost of labour Rs

f) Reason for not adopting control measures

g) Nature of inspection by the grower Daily/Weekly/Monthly

h) If any infected plant is seen nearby Yes/No Age

i) Knowledge of the planter in disease symptoms and its detection Poor/Satisfactory/Good

j) Knowledge of the planter on plant protection technique Poor/Satisfactory/good

k) Extent of recovery

l) Additional information if any

m) Suggestions of the farmer

17 2 ABNORMAL LEAF FALL DISEASE

a) Nature of infection • Mild/Medium/Severe/No infection

b) Whether prophylatic spraying done or not — Yes/No

c) Chemical used — Bordequx Mixture/Copper Oxychloride

d) Method of spraying — Rocker/Power Sprayer/ Helicopter

e) Interval of spraying — Two months/once in a year

f) Spraying done after infection or before infection • — After/Before

g) Cost of spraying — 1 Cost of Chemical Rs

2 Cost of labour Rs

Total Rs

h) Efficiency of spraying • — Poor/Satisfactory/Good

i) Extent of damage to individual plant • — Mild/Medium/Severe

j) Knowledge of planter in preparation of Brodeaux mixture — Poor/Satisfactory/Good

k) Knowledge of the farmer in spraying techniques — Poor/Satisfactory/Good

l) In case of RRII 105 checking whether the plants are actually tolerant to abnormal leaf fall disease

Incidence

extent

severity

m) Extent of recovery

n) Other information if any

o) Reason for not adopting control measures, if not already adopted

12 3 POWDERY MILDEW DISEASE

a) Nature of infection	Mild/Medium/severe/No infection
b) Plant protection method adopted	Sulphur dusted/not dusted
c) Time of application of the fungicide	Before/After infection started
d) Intervel of sulphur dusting	Initial round/After 10 days/ after 20 days/after 30 days
e) Cost of dusting Cost of Chemical Cost of Labour	I round/ IInd round/IIIrd Round
f) No of trees defoliated/ refoliated	Within 2 weeks/spread over 2 months
g) Leaf retension after dusting	Good/Average/Poor
h) Knowledge of the farmer in dusting technique	Poor/Satisfactory/Good
i) Extent of recovery	a) Completely recovered b) Partly recovered c) No effect

j) Other information if any

k) Remarks

SIGNATURE

Annexure III

Village-wise distribution of units surveyed in Vaikom Taluk

Sl No	Name of Village	Total units	Serial No of Units
1	Chempu	9	43, 57, 58 59, 60, 62, 63, 64, 65
2	Velloor	3	54, 55, 68
3	Mulakkulam	12	26, 27, 28, 29, 49, 50, 56, 73, 74, 75, 76, 77
4	Njeezhoor	14	3, 4, 5, 6, 7, 18, 19, 20, 21, 22 23, 24, 25, 44
5	Kaduthuruthy	13	1, 2, 8, 16, 34, 35, 36, 41, 42, 51, 81, 82, 100
6	Vadayar	12	30, 31, 32 33, 37, 38, 39, 40, 52, 61, 66.
7	Kulasekharamangalam	4	67, 69, 70, 72
8	Vechoor	6	71, 78, 79, 80, 93 95
9	Kallara	16	17 45, 46, 47, 48, 83, 88, 89, 90, 91, 92, 94, 96, 97, 98, 99
10	Manjoor	11	9, 10, 11, 12, 13, 14, 15, 84, 85, 86, 87

Annexure IV

Name and Address of the surveyed units

Sl No	Name and address of the grower
01	Sri Joseph Augustine, Pulickal, Kattampack PO
02	Sri John Antony, Kottarathiparampil, Kattampack PO
03	Sri P K Santhakumaran, Santhimandiram, Kappumthala PO
04	Sri Chacko Paily, Kottarathiparampil Kappumthala PO
05	Sri Pailo Philip, Kottukappallil Kappumthala PO
06	Smt Mary Mathew, Madathikunnel Kappumthala PO
07	Sri Mathew Antony, Vadakkekara, Kappumthala PO
08	Sri Ulahannan Paul, Ettumamkaran Muttuchira PO
09	Sri Ouseph Mathew, Vengimikkal Parampu Manjoor PO
10	Sri K K Raghavan, Kattathukunnel Kizhakkethil, Manjoor PO
11	Sri K K Govindan, Kattathukunnel, Manjoor PO
12	Sri K J Antony, Kunnumthottiyil, Omalloor Manjoor PO
13	Sri P R Rajagopalan, Poothettukunnel, Omalloor Manjoor PO
14	Sri. K. Mathai, Thottathil, Manjoor PO
15	Sri Joseph, Kunnuthottiyil, Manjoor PO
16	Sri Thomas Mathai, Parambithadathil, Muttuchira PO
17	Sri Jose Mathew, Palaparampil, Kallara PO
18	Smt Lakshmi, Olippurathu, Njeezhoor PO
19	Sri P M Thomas, Thevarmattathil, Pazhuthuruthu PO
20	Sri P Ponnappan Nair, Karukappillil Thiruvampady PO

Contd

Sl No	Name and Address of the grower
21	Sri Lube Augusthy, Puthenpurackal, Thiruvampady PO
22	Sri Kuriakose M J , Kurukottil, Njeezhoor PO
23	Smt Bhavani, Olippurathu, Njeezhoor PO
24	Sri P D. Neelakandan Namboothiri Madathilparampil, Njeezhoor PO.
25	Sri Thomas Mathew, Odavallickal, Pazhuthuruthy PO
26	Sri K A George, Kumbalassery, Mulakkulam South PO
27	Sri Krishnan Nair, Mukkattu, Mevelloor. PO
28	Sri Damodaran, Pukkottel, Peruva PO
29	Sri Krishnankutty S., Kuttidayil, Peruva PO
30	Sri V S Narayanan Nair, Vrindavanathil, Thalayola - paramba PO.
31	Sri P V Thomas, Paruthikattil, Thalayolaparambu PO
32	Sri Varkey Mathew, Kalayil, Thalayolaparambu PO
33	Sri Ulahannan Joseph, Pattel, Thalayolaparambu PO
34	Sri Ramakrishnapillai, Kottarathil, Keezhoor. PO
35	Sri V Joseph, Meenpallil, Arunoottimangalam PO
36	Sri Augustine, Naduviledathu, Keezhoor PO
37	Sri Karunakaran Nair, Kottarathil, Keezhoor PO
38	Sri K J John, Kollamparampil, Thalayolaparambu PO.
39	Sri Narayanan Nair, Pattermadom, Keezhoor PO
40	Smt Pappi Kalyani, Manthakuthial, Keezhoor PO
41	Sri Kurian Joseph, Vadakkevettikuzhiyil, Poozhikol PO.
42	Sri C M Joseph, Chelekkal, Arunootimangalam PO

Contd

Sl No	Name and address of the grower
43	Sri T K Rajan, Rajamandiram, Brahmamangalam PO
44	Sri Varkey Joseph, Kazhanchikattil, Kappumthala PO
45	Sri Varkey Joseph, Manackaparampil, Ayamkudy PO
46	Sri Soman, P V., Padinjare Malieckal, Ayamkudy PO
47	Sri Ouseph Mathai, Nediyakala, Ayamkudy PO
48	Sri Kunjarkan Vasu, Padinjare Malieckal, Ayamkudy PO
49	Smt K Rajamma, Kalappurackal, South Mulakkulam PO
50	Smt Lakshmikutty Amma, Kalapurackal, South Mulakkulam PO
51	Sri Augusthy Luka, Parackal, Keezhoor PO
52	Sri P K Chacko, Mangottil, Keezhoor PO
53	Sri Luka Abraham, Arackal, Keezhoor PO
54	Sri K P Joseph, Kuttikottel, Keezhoor PO
55	Sri Kurian Ouseph, Kallakkattu, Keezhoor PO
56	Sri Manikandan Nair, Mangara, Mulakkulam South PO
57	Sri Kunjan Pappy, Navodayam, Brahmamangalam PO
58	Sri P P Uthuppan, Thadathil, Brahmamangalam PO
59	Smt Usha K., Karthika, Vadakara PO
60	Smt Mary Lukose, Makkiyil, Vadakara PO
61	Sri Narayanan Namboodiri, Velıman Kovil, Midayikunnam PO
62	Sri Muraleedharan.A V Ampalathumvelıyil, Vadakara PO
63	Sri Balakrishnan. P.V , Balakrishnan Bhavan, Vadakara PO
64	Sri Sankara Narayanan, Padinjarethekkinezhathu, Vadakara PO
65	Sri Damodaran Nair, Sindhu Bhavan, Vadakara PO
66	Sri Ouseph Mathai, Chakkalayil, Midayikkunnu PO

Contd

Sl No	Name and address of the grower
67.	Sri P K. Thomas, Puthenmanayil, Pothi. PO
68	Sri Kuriako Thomas, Puthan Manayil, Pothi PO
69	Sri Chacko Scaria, Plakottayil, Midayikunnu PO
70	Sri Mathan Mathew, Palachuvattil, Midayikunnam PO
71	Sri P.V Varkey, Palakottayil, Pothi. PO
72	Sri O. J Mathew, Oliyanattil, Pothi. PO
73	Smt Ambika Devi, Kunnathu, Peruva. PO
74	Smt Saraswathiamma, Kuthuvelil, Peruva.
75	Sri K K. Thomas, Kureethottathil, Peruva PO
76	Sri Ulahannan Markose, Kappikara, Peruva PO
77	Sri P P George, Manadiyil, Peruva PO
78	Sri Ouseph Varghese, Thekkeparampil, Valachira, Kaduthuruthy PO.
79	Sri Ouseph Issac, Thekkeparampil, Valachira, Kaduthuruthy PO.
80	Sri P T. Luckose, Pathukkary, Valachira, Kaduthuruthy PO
81	Sri K O Xavier, Kalaripparampil, Manjoor PO
82	Sri P.J Joseph, Panakkaparampil, Manjoor PO
83	Sri Purushothaman. V.R., Marangattil, Ayamkudy PO
84	Sri Varkey Issac, Vanchippurackal, Kaduthuruthy PO
85	Sri J J Thomas, Thiparampil, Muttuchira. PO
86	Sri. Ouseph, Thaiparampil, Muttuchira. PO
87	Sri. N.T. John, Namattathil, Manjoor. PO
88	Sri Sunny. P.K., Puthukkariyil, Kaduthuruthy PO

Contd

Sl No	Name and address of the grower
89	Smt Parvathi Àntharjanam, Kallara South PO
90	Sri Radhakrishnan Nair, Malikayil, Kallara South PO
91	Sri P N Narayana Pillai, Puthuparampil, Kallara South PO
92	Sri. P.U. Thomas, Parappurathu, Kallara South PO
93	Smt Padmakumari. K , Vattukulathil, Kallara South PO
94	Sri. Sukumaran, Puthenparampil, Perumthuruthu PO
95	Sri Chummar Joy, Thekkeputhanparampil, Perumthuruthu PO
96	Sri Kora, Mollethazhathu, Kallara South. Po
97	Sri Prabhakaran, Choorakuzhiyil, Kallara South PO
98	Sri Chandy, Kochuvarikkamanthottiyil, Kallara PO
99	Sri. Joseph, Moolekarottu, Kallara. PO.
100	Sri K.T Mathew, Kandarappallil, Manjoor PO