SURVEY ON INCIDENCE OF PINK DISEASE IN NEDUMANGAD TALUK OF TRIVANDRUM DISTRICT

Dissertation submitted in partial fulfilment of the requirements for the
P. G. Diploma in Natural Rubber Production
Faculty of Agriculture
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By

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1992

D E C L A R A T I O N

I hereby declare that this dissertation entitled **Survey on incidence of pink disease in Nedumangad taluk of Trivandrum district** is a bonafide record of research work done by me and that this dissertation has not previously formed the basis for award to me of any degree, diploma, associateship, fellowship or other similar type of any University or Society.

Vellanikkara,

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C E R T I F I C A T E

We, the undersigned members of the Advisory Committee of Shri. P. Paribalan, a candidate for the Post Graduate Diploma in Natural Rubber Production, certify that this dissertation entitled **Survey on incidence of pink disease in Nedumangad taluk of Trivandrum district** is a record of research work done independently by Shri. P. Paribalan under our guidance and supervision and that it has not previously formed the basis for award of any degree, diploma, associateship or fellowship to him.

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C O N T E N T S

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Introduction

1. INTRODUCTION

The para rubber, Hevea brasiliensis (Muell. Arg.), was introduced into India 112 years ago. It is a sturdy perennial tree growing to a height of about 25 to 30 m. Latex is present in almost all parts of the plant. The main rubber growing belt of India, the Western Ghat region, receives an annual rainfall of 1500-4000 mm. During the south west monsoon beginning from June to August, about 70 per cent of the total rainfall reaches this region and push the relative humidity to almost saturation level. This weather condition is quite different from that of the native land of rubber - Brazil, in South America.

In the Western Ghat region Phytophthora diseases, and pink disease caused by Corticium salmonicolor (Berk & Br.) are very severe resulting in considerable damage to rubber plants. Pink disease is one of the most common stem disease of rubber in most rubber growing countries. The first report on the incidence of pink disease on rubber in South India was in 1908 at Mooply valley area. The fungus usually develops during the wet monsoon and remains inactive during dry season. Since it is not an epidemic disease and its effects being not so spectacular as those of the abnormal leaf fall disease, it is frequently unnoticed and neglected

by many rubber growers particularly in the earlier stages of infection. The disease appear on any part of the stem but more predominantly on the fork region. The fungus attacks the bark all around the stem causing a ringbarking effect thus killing the portion above the point of attack. In neglected cases, the disease has been found to descend down the stem and damage the whole tree (Kaimal, 1953).

Pink disease in rubber is virulent during the rainy season in South India (Rubber Board Bulletin, 1962). The disease is of great significance during the immature period and in the early years of tapping, but in mature plantations, the damage caused is negligible. The loss could be upto the extent of 10 per cent in the early years if timely control measures are not adopted. As the canopy of the infected plant may be partially or wholly destroyed, the growth is retarded and tapping is delayed. Even when only one or two of the top branches are affected significant reduction in growth has been noticed.

Though investigations on the incidence of pink disease has been conducted in central and northern parts of Kerala by Rubber Research Institute of India, not much study has been made on the disease in southern Kerala. Hence this study on the incidence of pink disease was taken up with an objective of assessing the extent of damage in the small holdings of rubber in the Nedumangad taluk.

2. REVIEW OF LITERATURE

2.1 Early history of the disease

Pink disease affects numerous cultivated and wild host plants. The earliest record of the disease was on coffee from Ceylon in 1870. On Hevea it was first recorded from Java by Zimmerman in 1901 (Hilton, 1958; Ramakrishnan and Pillai, 1962). Since then it has been reported from various other countries and at present it is prevalent in most of the rubber growing areas.

Over 140 host plants have been recorded for this fungus from different parts of the world. In South India the disease has been known to infect several host plants of economic importance like rubber, mango, jack, tea, cashew, camphor, cinchona, orange, mangosteen and silver oak. Some cover crops like Desmodium ovaligolium and bush covers like Crotolaria spp. and several wild plants are also infected (Sharples, 1936; Wastie, 1976). It was first recorded on rubber in the country from Mooply valley around the year 1908. This was the first disease of rubber to be investigated in the country and control measures advocated (Anstead, 1914). At present it is prevalent in almost all rubber growing areas of Kerala, Tamil Nadu and Karnataka states and in the Andamans. Considerable damage is caused to young plants in the

districts of Cannanore, Calicut, Trichur, Ernakulam, Alleppey, Kottayam and Quilon. The incidence is rather mild in the Kanyakumari district of Tamil Nadu (Sharples, 1936; Ramakrishnan and Pillai, 1962).

2.2 Causal organism

Pink disease is caused by the basidiomycete fungus Corticium salmonicolor (Berk. & Br.) [Pellicularia salmonicolor (Berk & Br.) Dastur.]. Recently the name Phanerochoete salmonicolor (Berk. & Br.) Julich has been proposed (Johnson, 1989).

2.3 Symptoms

The characteristic symptoms of pink disease and the one from which it derives its name is the appearance of a salmon pink incrustation on the infected bark (Hilton, 1958). On the young plants the disease is seen on the main stem at varying heights, but on the older plants it may commence on the main stem especially at the forks where the branches arise or on the branches themselves. The stem of plants below three years is quickly infected and the bark all round the infected part may be destroyed resulting in a ringing effect that cause wilting and drying up of the upper portion. Dried leaves do not fall off but remain attached to the dead shoots.

In the initial stages, latex exude from the affected bark.

This is followed by the development of a superficial mycelial growth made up of fine white threads which soon envelop the affected portion. This stage is known as 'cob web stage'. The mycelium grows very fast upwards and downwards for a distance of two to three feet under favourable conditions, gradually developing a light pink colour. Meanwhile, large portions of the bark are killed and pieces may drop off exposing the wood. Copious flow of latex may also be noticed forming long streaks of blackened coagulated matter. Small light salmon pink coloured pustules are seen erupting through cracks in the bark and through lenticels. The whole circumference of the affected portion may bear these pustules. These represent a sterile stage of the fungus and may begin to appear soon after bleeding commences (Ramakrishnan and Pillai, 1962). This stage is called the 'necator' stage.

Another characteristic development is the formation of pink crusts on the lower surface of the affected branches or on the shaded side of the main stem. The crust is broken up by fine irregular cracks simulating hierogiyphic writings. The 'corticium' stage develops on the surface of these crusts as smooth pinkish white growths producing numerous basidia and basidiospores (Sharples, 1936; Hilton, 1958; Ramakrishnan and Pillai, 1962). The pink colour is prominent during the rainy season and immediately after. Later this colour fades away and may turn almost whitish. As a result of the death of the bark, some of the dormant buds on the stem

below the point of infection sprout and several new shoots are developed (Hilton, 1958).

The infection is usually located at the forks or where several branches arise close together on the main stem or along some of the branches. The prevalence of the disease in an estate or holding is often recognised only after the distal portions have been killed and the leaves have dried up. This happens only at later stages of infection (Ramakrishnan and Pillai, 1962).

2.4 Mode of infection

The fungus is capable of entering the tissues through unwounded bark. The cortical tissues are rapidly invaded. The superficial spread of the fungus is far in advance of internal spread. Though the hyphae have been observed inside the xylem vessels and even in the pith, the pathogen is more often confined to the cortical tissues. In the infected tree, the disease progresses internally in the bark. Externally the progress can be observed following the line of flow of rainwater down the stem. From the fork it may pass on to one or more branches. Small bits of infected bark carrying live mycelium of the fungus may be blown out by wind and may start fresh infection. Wind driven rain drops and other agents may also carry the fungus and help to spread infection. During the rainy months the spores of the fungus are disseminated, resulting in the spread of the disease (Pillai and George, 1980).

In a plantation the disease may occur at random, scattered or adjacent groups of plants may be affected.

2.5 Factors favouring infection

The disease occurs during the rainy season. In Kerala new infections are observed during the months of June, July and August. The drying of the branches becomes evident during September and October. The disease does not spread during the months from December to May. In Kanyakumari district new infections occur in October and early November also, as this region receives more of the North East monsoon. All factors which contribute towards increasing the atmospheric humidity inside the plantation favour the disease. A higher incidence of the disease has been noted in holdings with closely planted trees (having dense foliage) leading to higher humidity (Ramakrishnan and Pillai, 1962). But observations made in south east Asian countries have shown that there was less disease in higher density plantings (Hilton, 1958). Besides humidity, the atmospheric temperature and intensity of sunlight also influence the intensity of infection. During the months of December to April, the humidity is low and the temperature higher with hot and bright sun as compared to the rainy months. The maximum temperature during the period, December to May, varies between 31°C and 35°C, while from June to October it ranges from 26°C to 29°C. These factors keep the fungus dormant during the dry months and it resumes activity only with the onset of the rains.

Application of manures does not exert any influence on the incidence of the disease. Under field conditions trees exhibiting vigorous and luxuriant growth are often affected while neighbouring unthrifty trees escape infection. Pink disease is considered to be associated with the persistence of the dew-belt in the atmosphere (Ramakrishnan and Pillai, 1962). When the branches are high enough to escape its influence at night, the pathogen causes no trouble. The fungus is not a specialised parasite and many alternative hosts may be growing in the neighbourhood of rubber estates from which the disease can spread. Rubber plantations in the vicinity of cashew exhibit higher incidence of disease (Ramakrishnan and Pillai, 1962).

2.6 Clonal susceptibility of the disease

In South India the disease has been observed on all the clones under large scale planting. Unselected seedling plants are also affected. No comprehensive survey of all the clones available in the country has been made to assess the intensity of infection among them. But from the reports received from various holdings and from the data gathered during visits to different districts, it has been observed that large number of plants of Tjir 1, Tjir 16, BD 10, LCB 1320 and clonal seedlings of Tjir 1 are affected (Ramakrishnan and Pillai, 1962). The disease has also been noticed on Gl 1 and PB 86. In Malaysia the clones RRIM 501, RRIM 618, Tjir 1, Tjir 16, Pil B 84 and AVROS 214 have been recorded as very susceptible. Under South India conditions modern clones such as

PB 28/59, RRIM 600 (Pillai and George, 1980) and PB 217 (RRII, 1990) are found more susceptible to pink disease. RRII 105 is reported to have moderate tolerance to this disease (Bhaskaran Nair and George, 1969). The clones AVROS 186, AVROS 255, AVROS 308 and Djas 1 are classified as moderately susceptible. The disease is found to be more severe in the wetter parts of this country. There is evidence to indicate that susceptibility to pink disease is inherited. The higher incidence of the disease among the clonal seedlings of Tjir 1 is indicative of this. The root stock is also known to exert an influence on the incidence of the disease on certain scion clones (Ramakrishnan and Pillai, 1962). Clones exhibiting high resistance or immunity to the disease have not yet been found.

2.7 Economic importance

This disease is of great importance during the pre and early tapping years. In mature plantations the damage caused by it is negligible. As the canopy may be partly or wholly destroyed due to the disease the growth is set back appreciably, delaying the commencement of tapping in immature plantations.

2.8 Control measures

Bordeaux mixture is being recommended from the first decade of this century for the control of this disease in South India (Anstead, 1914). In the earlier years, coal tar or Bordeaux mixture

was used in South east Asian countries. Later, emphasis was on oil/tar mixtures (Hilton, 1958). During the post-war period a concentrated Bordeaux mixture with a sticker was introduced. This was made up of 7 to 10 parts of copper sulphate, 7 to 10 parts of quick lime and 1 to 2 parts of fish glue or rice paste in 100 parts of water. The application of this mixture at three weekly intervals during September to November gave adequate control (Ramakrishnan and Pillai, 1962).

In Malaysia, the use of asphalt/kerosene mixture which was being recommended for some years (Moore, 1938) was later found to be unsatisfactory (Newsam, 1958). Application of 0.5 per cent solution of Fylomac 90 (tetradecyl pyridinium bromide) applied by a brush or sprayer has also been reported to be satisfactory in Malaysia (Altson, 1953). The current advice given to the planters in the country consists of spraying Bordeaux mixture on every affected tree, repeating the operation as often as necessary as revealed by the inspection of the plants. This was found to be more satisfactory than prophylactic spraying of all the trees (Newsam, 1958).

In South India, the methods of control in vogue in earlier years have been application of Bordeaux mixture or tar on the affected bark. The dried branches were also pruned. Various trials have been carried out to arrive at the most efficient method. Application of tar is not recommended now since quality of the

tar available in the market is highly variable and the young bark in many of the clones is found damaged by the tar (Ramakrishnan and Pillai, 1962).

Trials were conducted with Bordeaux paste 1:1:10 and linseed-oil-copper-sulphate-lime mixture (one part copper sulphate, two parts lime and three parts pure linseed oil) (Ramakrishnan and Pillai, 1962). The copper sulphate was finely powdered and Quick lime was slaked with as little water as possible and then finely powdered. The two powders were thoroughly mixed and linseed oil added. The pastes were applied on the affected bark and to a distance of one foot above and below with a brush. The main stem and the base of the branches arising from near the affected portion were also treated. Satisfactory results have been obtained over two seasons and all the treated plants have recovered (Ramakrishnan and Pillai, 1962). But the mixture containing linseed oil is reported to be superior, as a single application, at the proper time was sufficient. However, the quality of the oil should be good. Otherwise the bark may be damaged. A mixture of copper oxychloride, lime and linseed oil proved unsatisfactory and damaged the bark. Trials with the oil based copper fungicide (copper oxychloride) was also proved to be harmful and all the treated plants exhibited heavy bark damage with copious exudation of latex (Ramakrishnan and Pillai, 1962).

Based on these results, the treatment of pink disease consist of the application of either Bordeaux paste or the linseed oil-copper sulphate-lime mixture. Treatment of the forks of the trees surrounding the affected ones is also advised. Periodic inspection of the holding, to mark the trees in the initial stages of infection and immediate treatment is necessary. Many of the growers notice the disease only in the advanced stages after the canopy exhibits dried foliage. Prompt action leads to the elimination of the disease while delayed action or neglect, results in unsatisfactory control or spread of infection. The adoption of the control measures in time is essential for the success of this operation.

Bordeaux mixture/paste has a disadvantage of copper contamination with latex in mature rubber (Wastie, 1969). To avoid this, Calixin 4 per cent in latex was recommended since 1974 for use on trees under tapping as well as on immature trees (Wastie, 1976; Edathil and Jacob, 1983). A single application is reported to give good control for upto three months. Unfortunately the need to climb the tree or the use of a ladder for applying the brush on formulation makes it impracticable when large number of trees are affected. Because of the high wastage during spraying (estimated at 15 to 20 times more chemicals than painting), it is not economical to use Calixin in a sprayable formulation (Rubber Board Bulletin, 1985). Studies are being directed towards the development of sprayable formulation that will be effective and economical to apply.

Thiride, a non-systematic fungicide (tetra methyl thiuram disulphide) was also found effective at 0.2 per cent, concentration incorporated in a petroleum compound like wax-rex treseal, mahathotex wax or Rubber kote (Edathil and Pillai, 1976).

Other materials showing promise include chlorothalonil and Trifoltan (Bordeaux mixture plus dithiocarbamate) (Rubber Research Institute of Malaysia, 1981). In the field experiments on the control of pink disease, Propiconazole, a new systemic fungicide at a concentration of 1000 ppm and Tridemorph (Calixin 10EC) at 10000 ppm was found effective when Pidivyl-China clay compound was used as the carrier. Bordeaux paste was also reported to be equally effective (Jacob and Edathil, 1986).

Materials and Methods

3. MATERIALS AND METHODS

The present survey was conducted covering all the 28 villages in Nedumangad taluk. Since major rubber growing tracts in Nedumangad taluk were planted with RRII 105 and RRIM 600, only these two clones were selected for the study. Hundred holdings were selected at random based on the records maintained at the Rubber Board Regional Office, Trivandrum. List of holdings selected is given in Appendix I. Plantations were visited personally and information collected directly from the growers based on a pretested questionnaire (Appendix II). The total surveyed area included 70.35 hectares. Plantings of RRII 105 ranged from first year to sixteenth year and that of RRIM 600 ranged from fourth year to nineteenth year. Size of the holdings varied from 0.08 hectares to 2.08 hectares for RRII 105 and 0.12 hectares to 2.81 hectares for RRIM 600. Besides the general information like area, name of clone, spacing, total number of plants and year of planting, specific informations about the disease like number of trees infected, loci of infection, stage at which the disease was detected, measures adopted for the control of the disease and extent of recovery were also collected by visiting the area and contacting the farmers. Information collected also include the farmers knowhow about the disease, its management and efficiency of the various extension methods formulated by the

Rubber Board for the purpose. The data collected were tabulated and percentage values derived for obtaining conclusive results. The rainfall data for the area were collected from the Nedumangad Taluk Office and is given in Appendix III.

Results and Discussion

4. RESULTS AND DISCUSSION

4.1 Incidence of pink disease in Nedumangad taluk

Out of the 100 units observed in the 28 villages, the disease incidence was noticed in 95 units indicating the widespread incidence of the disease in this taluk (Table 1). Out of the 70.35 hectares surveyed, 57.44 hectares (81.65%) was occupied by the clone RRII 105 and the rest (18.35%) by RRIM 600. RRII 105 was the popular clone in all the villages compared to RRIM 600. Among the villages, maximum incidence of pink disease in RRII 105 was observed in Palode (20.83%) followed by Vembayam (13.32%), while the minimum was recorded at Aruvikkara (2.34%). In the case of RRIM 600, maximum incidence occurred in Thekkada village (19.23%) followed by Pangode (10.00%) and the minimum was observed in Tholicode (1.22%) (Table 2).

Among the two clones studied the percentage of infection by pink disease was comparatively more in RRIM 600 (7.17%). In RRII 105 among the 32466 plants observed, 1955 numbers were found infected giving an infection percentage of 6.02. The clone RRIM 600 is known to be more susceptible to pink disease (Ramakrishnan and Pillai, 1962). Since the area occupied by RRIM 600 was relatively less in the surveyed area, it was not possible to draw

Table 1. Pink disease infection in the units surveyed in the Nedumangad taluk.

Sl. No.	Village	Number of units observed	Number of units infected
1.	Anad	4	3
2.	Aryanad	6	6
3.	Aruvikkara	2	2
4.	Kallara	5	5
5.	Koliyakode	3	3
6.	Kurupuzha	6	6
7.	Karuppooru	2	2
8.	Karakulam	4	4
9.	Manickal	3	3
10.	Mannoorkara	2	2
11.	Nedumangad	2	2
12.	Nellanad	3	3
13.	Panavoor	7	6
14.	Pullampara	2	2
15.	Palode	3	3
16.	Peringamala	2	2
17.	Pangode	4	4
18.	Perumkulam	4	3
19.	Tholicode	6	6
20.	Thekkada	3	3
21.	Thennoor	2	2
22.	Uzhamalackal	2	2
23.	Vembayam	4	4
24.	Vamanapuram	3	3
25.	Vithura	3	3
26.	Vellanad	4	3
27.	Veeranakavu	6	5
28.	Vattappara	3	3
	Total	100	95

Table 2. Extent of pink disease incidence in the village of Nedumangad taluk

Name of village	Clone RRII 105				Clone RRII 600			
	Area (ha)	No. of plants observed	No. of plants infected	Percentage	Area (ha)	No. of plants observed	No. of plants infected	Percentage
1. Anad	2.63	1420	90	6.34	NA	NA	NA	NA
2. Aryanad	2.38	1503	56	3.06	0.68	425	32	7.53
3. Aruvikkara	2.47	1452	34	2.34	NA	NA	NA	NA
4. Kallara	2.52	1346	152	11.29	NA	NA	NA	NA
5. Koliyakode	1.28	737	27	3.66	NA	NA	NA	NA
6. Kurupuzha	2.52	1248	49	3.93	0.40	225	3	1.33
7. Karuppoo ru	1.93	1085	28	2.58	NA	NA	NA	NA
8. Karakulam	1.90	1230	72	5.85	NA	NA	NA	NA
9. Manickal	0.86	537	42	7.82	NA	NA	NA	NA
10. Mannoorkara	0.47	300	28	9.33	0.62	400	30	7.50
11. Nedumangad	0.54	397	30	7.56	NA	NA	NA	NA
12. Nellanad	1.18	760	38	5.00	NA	NA	NA	NA
13. Panavoor	7.11	3947	372	9.43	0.53	320	25	7.81
14. Pullampara	1.73	800	52	6.50	NA	NA	NA	NA
15. Palode	1.60	840	175	20.83	1.72	915	24	2.62
16. Peringamala	0.40	280	12	4.49	NA	NA	NA	NA
17. Pangode	3.39	1890	50	2.65	0.61	300	30	10.00
18. Perumkulam	0.92	548	21	3.83	NA	NA	NA	NA
19. Tholicode	6.70	3739	107	2.86	2.56	1472	18	1.22
20. Thekkada	2.61	1155	130	11.26	2.81	1300	250	19.23
21. Thennoor	1.40	930	57	6.13	NA	NA	NA	NA
22. Uz hamalackal	0.40	220	11	5.00	NA	NA	NA	NA
23. Vembayam	1.92	1186	158	13.32	NA	NA°	NA	NA
24. Vamanapuram	1.21	750	25	3.33	NA	NA	NA	NA
25. vithura	0.40	235	6	2.55	2.98	1632	89	5.45
26. Vellanad	3.66	1880	47	2.50	NA	NA	NA	NA
27. Veeranakavu	1.72	1194	49	4.10	NA	NA	NA	NA
28. Vattappara	1.59	857	37	4.32	NA	NA	NA	NA
TOTAL	57.44	32466	1955	6.02	12.91	6989	501	7.17

NA = Particular clone was not available in the survyed area.

the clear difference between the two clones for the disease susceptibility.

4.2 Disease incidence with respect to age of plantation

The details of incidence of the disease in the clone RRII 105 is presented in Table 3. The results indicated that there exist some relationship between the age of the plant and disease incidence. Younger plants upto fourth year were found less (0 to 3%) infected whereas it was more (5 to 10%) from fifth year to twelfth year. Since the population under RRIM 600 was relatively less under different age groups no conclusions could be drawn with respect to the relation of age and disease incidence for RRIM 600.

The incidence of pink disease is reported to be related to the age of the plantation and is found to be more in the plantations of two to twelve year (Ramakrishnan and Pillai, 1962). The extra care given by farmers in the very young stages might have resulted in lower disease incidence upto the fourth year in the surveyed area. By the fifth year, the trees would be larger and the canopy closes. This could lead to retention of high humidity within the canopy, which in turn would have favoured the incidence of pink disease.

4.3 Detection of pink disease infection by farmers

Rubber growers of Nedumangad taluk were found aware of the symptoms and management practices of pink disease .

Table 3. Infection of pink disease in relation to age of the plant

Age	Area (ha)	Number of plants observed	Number of plants infected	Percentage
1.	0.35	165	Nil	--
2.	0.72	470	Nil	--
3.	1.15	705	19	2.70
4.	3.32	1548	14	0.90
5.	5.33	2868	146	5.09
6.	7.37	4229	308	7.28
7.	8.36	4812	335	6.96
8.	13.52	8113	594	7.32
9.	5.46	2882	169	5.86
10.	2.59	1499	103	6.87
11.	0.56	322	31	9.63
12.	5.20	2793	174	6.23
13.	1.74	1000	42	4.20
14.		Not available		
15.	1.01	550	18	3.27
16.	0.84	510	2	0.39
Total	57.44	32466	1955	6.02

The knowledge about the disease was rated and is presented in Table 4. More than 85 per cent had average or better knowledge about the disease.

The data collected showed that the farmers visited the field regularly so as to detect the incidence at the early stage itself. Sixtysix per cent of the farmers in the surveyed area were found to inspect the field at weekly or lesser intervals to detect the disease incidence (Table 5).

Farmers were found inspecting the field for this disease regularly from May to December (Table 6). In majority of the units, inspection was initiated during June-July and was concluded by November-December. In few units inspections started as early as in May. The inspection was started late in 13 units and was done only in August-September. In 19 units, the inspection was carried out only upto September. Such late starting and early closing of inspections led to leaving some of the plants undetected and untreated.

It was also observed that the farmers were able to detect the disease only at later stages, when the latex was found oozing from the infected area (Table 7). About 67 per cent of the infected trees were detected only at that stage. Early detection at cobweb stage was recorded only in 22.84 per cent of the surveyed units. Among the 59 units in which the farmers were not able to detect the disease sufficiently early, 23.73 per cent attributed to the

Table 4. Farmers knowledge about the disease

Knowledge of the grower	Number of units	Percentage
Good	16	16.84
Average	65	68.42
Poor	14	14.74
Total	95	100.00

Table 5. Inspection for detection of pink disease in infected units

Interval of inspection	Number of units	Percentage
Daily	21	21
Twice weekly	9	9
Weekly	36	36
Fortnightly	15	15
Monthly	19	19
Total	100	100

Table 6. Period of inspection for detection of pink disease incidence

Month	Start of Inspection		End of Inspection	
	No. of units	Percentage	No. of units	Percentage
May	20	21.05	--	--
June	36	37.89	--	--
July	26	27.37	3	3.16
August	11	11.58	13	13.68
September	2	2.11	3	3.16
October	--	--	10	10.52
November	--	--	24	25.26
December	--	--	40	42.11
January	--	--	2	2.11
Total	95	100.00	95	100.00

Table 7. Stage of detection of the disease by the growers

Stage of disease	Number of plants observed	Number of plants detected	Percentage
Cob web	39455	561	22.84
Latex oozing	39455	1653	67.31
Drying	39455	242	9.85
Total	39455	2456	100.00

continuous rains, hindering detection. Lack of skilled labour was the second serious problem in early detection. These factors prevented the early detection in nearly 60 per cent of the units (Table 8).

It was observed that 68.42 per cent of the infected units were situated within 200 metre of the mature rubber areas which were previously infected with the disease (Table 9). The nearby mature infected trees would have acted as good source of inoculum of the pathogen. The inocula from mature trees can easily be carried to the adjacent younger areas by wind and rain splashes.

4.4 Site of infection of the disease

The data collected revealed that the incidence of pink disease was more near first fork in both the clones studied (Table 10). In RRII 105, the incidence at first fork was 59.28 per cent and was 58.28 per cent for RRIM 600. Though the incidence of disease at trunk region was less, the incidence at branches above the first fork was considerable. Similar results have been reported earlier for the clones RRII 105 and RRII 203 (Jacob and Edathil, 1986). When the infection is high on branches above the first fork, treatment becomes difficult because of poor accessibility.

4.5 Control measures adopted

The farmers were found to adopt surgical procedures and chemical treatment for the control of the disease (Table 11 and 12).

Table 8. Reasons for not detecting pink disease during early stage

Sl. No.	Category	No. of units	Percentage
1.	Lack of skilled labour	9	15.25
2.	Continuous rains	14	23.73
3.	Not viscible from the ground	6	10.17
4.	1 and 2	11	18.64
5.	1 and 3	4	6.78
6.	2 and 3	11	18.64
7.	1, 2 and 3	4	6.79
Total		59	100.00

Table 9. Nearness of infected plots to other mature rubber area

Distance from mature rubber	Number of units infected	Percentage
Below 200 m	65	68.42
200-400 m	4	4.21
Above 400 m	26	27.37
Total	95	100.00

Table 10. Loci of infection of pink disease on the rubber trees.

Locus of infection	RRII 105			RRIM 600		
	No. of plants observed	No. of plants infected	Percentage of infection	No. of plants observed	No. of plants infected	Percentage of infection
Trunk	32466	314	16.06	6989	53	10.58
First fork	32466	1159	59.28	6989	292	58.28
Branches above first fork	32466	482	24.16	6289	156	31.14
Total	32466	1955	100.00	6989	501	100.00

Table 11. Surgical procedures adopted at the time of treatment against pink disease.

Mode of treatment	RRII 105		RRIM 600	
	Number of plants treated	Percentage of infected plants	Number of plants treated	Percentage of infected plants
No branches removed	1465	74.94	178	35.53
Branches removed	441	22.55	274	54.69
Crown removed	49	2.51	49	9.78
Total	1955	100.00	501	100.00

Table 12. Fungicides used for the control of pink disease

Fungicide used	Number of units	Percentage
Bordeaux paste	91	95.79
Thiride	4	4.21
Calixin	--	--
Total	95	100.00

Among the treated plants, branches and crown were found removed in 25 per cent of the infected trees in RRII 105, whereas it was as high as 64 per cent in RRIM 600 (Table 11). This shows that the intensity of the disease was considerably more in the case of RRIM 600 than RRII 105. The growth of the trees were found considerably affected when crown was removed as the nearby trees overgrew into the gap formed while removing the crown. The trees from which crown is removed would remain less productive throughout its life time.

It was observed that 95.75 per cent of the infected units used Bordeaux paste to control the pink disease. Thiride was used in 4.21 per cent and Calixin was not at all used in the surveyed area (Table 12). Bordeaux paste was found very popular among the small rubber holders for pink disease control as it is cheaper and can easily be applied. However, repeated applications were found required when the rains are heavy.

In the surveyed units, all the farmers knew the correct method of preparation and application of Bordeaux paste. Bordeaux paste was found applied initially without scrapping the infected area and was repeatedly applied after appropriate scrapping. Thiride was found applied only once after detecting the disease.

4.6 The recovery from the disease

The recovery percentage for pink disease in the surveyed

area was found to be high (Table 13). The affected plants detected at the early stage of infection recovered better. The recovery percentage for the plants detected and treated at cob web stage was 95.72 per cent for RRII 105 and 87.23 per cent for RRIM 600, whereas it was only 83.33 per cent and 85.00 per cent for RRII 105 and RRIM 600 respectively when detected and treated at drying stage.

The clone RRII 105 was found to recover better in the surveyed area as compared to RRIM 600. This may be due to high sensitivity of this clone to pink disease.

The high disease recovery obtained by farmers in this taluk can largely be attributed to their early detection and proper treatment.

4.7 Efficiency of the extension methods in disease management

The details collected during the survey also revealed the efficacy of different extension methods adopted at present. Among the various extension tools used, discussion with extension officers was observed to contribute more in disseminating the knowledge about this disease (Table 14). However the farmers relied a great deal on discussion with other growers as well. The information collected indicated that the frequent visit by extension personals and discussion with farmers or a small group of farmers is ideal in disseminating the knowledge about the disease. Large scale

Table 13. Recovery from pink disease in relation to the stage at which the disease was treated.

Stage of disease	RRII 105			RRIM 600		
	No. of plants infected	No. of plants recovered	Recovery percentage	No. of plants infected	No. of plants recovered	Recovery percentage
Cob web	514	492	95.72	47	41	87.23
Latex oozing	1219	1170	95.98	434	401	92.40
Drying	222	185	83.33	20	17	85.00
Total	1955	1847	94.48	501	459	91.62

Table 14. Source of information for detection and management of the disease.

Name of source	Number of units	Percentage
Rubber magazine	4	4.21
Newspaper	2	2.11
Seminars	1	1.05
Discussion with extension officers	15	15.79
Discussion with other growers	15	15.79
1 and 4	9	9.47
2 and 3	1	1.05
3 and 4	10	10.53
3 and 5	3	3.16
4 and 5	17	17.89
1, 3 and 4	6	6.32
1, 2, 3, 4 and 5	12	12.63
Total	95	100.00

seminars does not seem to contribute much in extension education. The necessity to popularise printing media like rubber magazine is also evident from the study (Table 14).

Most of the farmers indicated that the extension work now carried out is sufficient. However, twenty per cent of the farmers felt the need for more intensive extension work (Table 15). It was also observed that the farmers preferred direct field visit by extension officers for disseminating the knowledge about the disease rather than the other methods adopted (Table 16).

Table 15. Efficiency of extension work from the farmer's view

Sl. No.	Extent of extension work	Number of units	Percentage
1.	Sufficient	76	80.00
2.	Insufficient	19	20.00
	Total	95	100.00

Table 16. Farmers preference to the various extension methods adopted.

Sl. No.	Method	Number of units	Percentage
1.	Publication	2	2.11
2.	Seminar	3	3.16
3.	Field visit by extension officers	66	69.47
4.	1 and 3	2	2.10
5.	1 and 2	1	1.05
6.	2 and 3	19	20.00
7.	1, 2 and 3	2	2.11
	Total	95	100.00

Summary and Conclusion

5. SUMMARY AND CONCLUSION

The survey was conducted in Nedumangad taluk of Trivandrum district with an intention to assess the extent of pink disease incidence in rubber holdings extending upto 5 hectares in area. The results obtained revealed that the pink disease caused by Corticium salmonicolor (Berk. & Br.) is prevalent in all the 28 villages of Nedumangad taluk at varying intensities (1.22 to 20.83%). RRII 105 and RRIM 600 were the popular clones occupying the rubber growing tracts of Nedumangad taluk. Among these clones, the intensity and severity of the disease incidence was more for RRIM 600. It was also observed that the plants of the age group 5 to 12 years were more prone to the disease than the younger and older ones.

The rubber growers of Nedumangad taluk were found to be aware of the symptoms and management practices for the disease. More than 85 per cent of the farmers had average or better knowledge about the disease. They were found inspecting the plants regularly for the disease incidence except for the few, who left the plants undetected and untreated at the early stages of infection.

In the surveyed area the disease infection was found more near the first fork region in both the clones studied. The farmers were found to adopt surgical procedures and chemical treatment

for the control of the disease. Bordeaux paste was found more popular among the growers than thiride, whereas calixin was not at all used in Nedumangad. Efforts are to be taken to popularise the use of calixin and thiride among the farmers. Recovery from the disease was substantially good in the surveyed area. Early detection and proper management could completely control the disease to an extent of 96 per cent. The clone RRII 105 showed better recovery than RRIM 600.

The survey also revealed the relative efficiency of the various extension tools employed by the Rubber Board. Discussion with extension officers was found to contribute the maximum in disseminating the knowledge about the disease. The farmers were also found to rely upon the view of other growers indicating the control measure to be adopted. The details collected during the survey necessitates the need for further strengthening of the extension work operated by the Rubber Board. The farmers preferred direct field visit and discussion rather than conducting large scale seminars. The urgent need for popularising of printing media like rubber magazine among the farmers was also felt during the study.

To conclude, increased number of visit by the extension officers of the Rubber Board and group discussions will help in disseminating the knowledge about the disease and help early detection and treatment of pink disease of rubber in Nedumangad taluk of Trivandrum district.

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Appendices

APPENDIX I

LIST OF HOLDINGS (VISITED)

ANAD VILLAGE

1.	K.N. Salaudeen, Kalliyode, Panavoor, P.O., Nedumangad.	Unregistered
2.	M. Safia Beevi, M.S. Estate, Panavoor, P.O., Nedumangad.	Unregistered
3.	K. Vidhyadharan, Kamala Buildings, Puthenpalam, Anad, P.O.	Unregistered
4.	Kum. Beena, Venkidassery Veedu, Vattarathala, Panavoor, P.O.	Unregistered

ARYANAD VILLAGE

5.	Thresia, Myladumpara Veedu, Valiyakalungu, Parandode, P.O.	Unregistered
6.	Ramakrishna Pillai, Prabha Mandiram, Valiyakalungu, Parandode, P.O.	Unregistered
7.	P. Jayachandran, TC 5/95, Near Girls High School, Ambalamukku, Peroorkada, Trivandrum-5.	NED 1665
8.	P. Surendra Babu, Santhi Bhavan, Kallikadu, Mylakara, P.O., Kattakada.	NED 4945
9.	G. Sukumara Pillai, K.G. Bhavan, Valiyakalungu, Parandode, P.O.	Unregistered
10.	Vilasini S. Pillai, K.G. Bhavan, Valiyakalungu, Parandode, P.O.	Unregistered
11.	Elizabeth, Vipin Vilasam, Myladumpara, Valiyakalungu, Parandode, P.O.	Unregistered

ARUVIKKARA VILLAGE

12.	V. Kumara Pillai, Gopa Nivas, AKG Nagar, Peroorkada, Trivandrum.	Unregistered

13.	B. Samuel, Parakonathu Kizhekkumkara Veedu, Mylom, Trivandrum.	Unregistered

KALLARA VILLAGE

14.	Anandakumari Amma, Ananda Bhavanam, Thayamkode, Kodithookiyakunnu, P.O., Via. Kallara.	Unregistered
15.	C.R. Vimalakumari, Anakuzhy Puthenveedu, Parappil, Muthuvila, P.O.	Unregistered
16.	V. Prasanna, Prasanna Bhavan, Muthuvila, P.O., Mithrumala.	Unregistered
17.	G. Prabhakaran Nair, Ananda Bhavan, Thengonkode, Kodikuthiakunnu, P.O., Via. Kallara.	Unregistered
18.	K. Krishnan, Rohini Mandiram, Pulimath, P.O., Trivandrum.	Unregistered

KOLIYAKODE VILLAGE

19.	J. Tulasidharan, Ponguvila Puthenveedu, Aliyadu, P.O., Venjarammood.	Unregistered
20.	Sulfuth, P.K. House, Venjarammood, P.O.	Unregistered
21.	K. Ramakrishna Pillai, Padmavilasam, Mundackalvaram, Aliyaru P.O., Venjarammood.	Unregistered

KURUPUZHA VILLAGE

22.	Santhosh Kumar, Ananda Bhavan, Kurupuzha, Elavattom, P.O.	Unregistered
23.	Sivadasan, Nisha Bhavan, Nanniyode, Pacha, P.O.	Unregistered
24.	Joseph Regulas, Bose Buildings, Elavattom P.O	Unregistered
25.	N. Babu, Thadatharikathu Veedu, Vembu, Elavattom, P.O.	Unregistered

26.	B. Vasudevan, Mekkumpara Veedu, Kalasakuzhy, Paluvally, P.O.	Unregistered

KARUPPOORU VILLAGE

27.	R. Ushakumari, Preethi Estate, C/o Madhavan Nair, Preethi Bhavan, Karuppooru.	Unregistered
28.	M.K. Raveendran Nair, Meleplakal Veedu, Karuppooru, P.O.	Unregistered

KARAKULAM VILLAGE

29.	Joseph John, Ever Green Estate, Karakulam, Karakulam, P.O.	Part of NED 726
30.	Krishna Pillai Sankara Pillai, Kannanikonath Cheruthalackal, Jaya Vilasathu Veedu, Enikkara, Karakulam, P.O.	Unregistered
31.	P. Saradamma, Chokkenkattakalil Veedu, Karakulam, P.O.	Unregistered
32.	S. Lalitha Kumari, Lalithalayam, Enikkara, Karakulam, P.O.	

MANICKAL VILLAGE

33.	Lekha Sivadasan, Muralivilasam, Pulippara, Nedumangad, P.O.	Unregistered
34.	E. Abdul Samad, Chilayil Veedu, Ozhukupara, Kuthirakulam, P.O.	Unregistered
35.	M. Asanaru Pillai, Noushad Mandiram, Melekuttimoodu, Vellumannaday, P.O., Venjarammood.	Unregistered

MANNOORKARA VILLAGE

36.	A. Syed Kunju, C/o Abdul Sakar (PAH), K.P. House, Pachakkad, Mannoorkara, P.O.	Unregistered
37.	Bishop of Vellayambalam Churh, Trivandrum.	Unregistered

NEDUMANGAD VILLAGE

38.	G. Balakrishnan Nair, Saraswathy Vilasom, Arasuparambu, Nedumangad, P.O.	Unregistered
39.	C. Meenakshi, Neduvilakathu Veedu, Chenchuppooru, Vencode, Nedumangad, P.O.	NED 6414

NELLANAD VILLAGE

40.	Pathummal Beevi, Vallikkadu, Thadatharikathu Veedu, Vattayam, Vellumannady, P.O.	Unregistered
41.	A.S. Dhanuja, Chembakamangalam, Keezhaikonam, Vamanapuram, P.O.	Unregistered
42.	N. Purushothaman Pillai, Radhakrishna Vilasam, Murukkonam, Venjarammood, P.O.	Unregistered

PANAVOOR VILLAGE

43.	George Motha, St. Lourdes Estate, Attukal, Panayamuttom, P.O.	NED 2566
44.	R. Sainaba Beevi, Vazhappanayil, Panavoor, P.O.	NED 1239
45.	Appukuttan Nair, Roadarikathu Veedu, Karikkuzhy, Panavoor, P.O.	NED 2283
46.	Nazeena Beevi, Rodarikathu Veedu, Pattathil Veedu, Kalliyode, Panavoor, P.O.	Unregistered
47.	Madana Mohanan Nair, Vellamangalam, Estate, Panavoor, P.O.	Unregistered
48.	L.E. Stephen, Thavarakuzhy House, Panavoor, P.O.	Unregistered

PULLAMPARA VILLAGE

49.	S. Laila Beevi, Anakuzhy, Pullampara, Pullampara, P.O., Nedumangad.	Unregistered
50.	B. Subaitha Beevi, Ooranionpurathu Veedu, Chullalam, Koonamaya, P.O.	Unregistered

PALODE VILLAGE

51.	Ajayakumar, Ajaya Estate, Jai Vilasam, Pacha, Palode.	Unregistered
52.	Thomas George, Ananda Bhavan, Near Govt Hospital, nedumangad.	Unregistered
53.	K. Gopimohan, Vinayaka Estate, S.K. House, Palode, Pacha, P.O.	Unregistered

PERINGAMALA VILLAGE

54.	R. Baby, Block No. 30, Ex-Servicemen's Colony, P.O., Pacha Palode.	Unregistered
55.	M. Mohammed Ismail, Shija Manzil, Elavupalam, Peringamala.	Unregistered

PANGODE VILLAGE

56.	Ramachandran Nair, Vrindavan, Chippanchira, Karimancode, P.O.	Unregistered
57.	Abdul Rassac, Aysha Manzil, Vakkom, P.O.	Unregistered
58.	S. Vasudevan Pillai, Apsara Bhavan, Kakkanikkara, Vattakkarikkakom, P.O.	Unregistered
59.	A. Joy, Rodarikathu Veedu, Vattakkavikkakam, P.O.	Unregistered

PERUMKULAM VILLAGE

60.	P.M. Kamaluddin, K.S. House, Poovachal, P.O., Via. Kattakkada.	Unregistered
61.	A. Chellappan Nadar, Sandhya Vilasam Banglow, Poovachal, P.O.	NED 5732
62.	G. Pathroe, Ambika Vilasam Banglow, Kattakuzhy, Thekkumkara, Poovachal, P.O.	Unregistered
63.	A. Padmanabhan Nair, Padma Vilas, Poovachal.	Unregistered

THOLICODE VILLAGE

64.	V. Kurian, Asha Estate, Lekshmi Estate Quarters, Chennampara, Vithura, P.O.	Unregistered
65.	K. Velappan, Shunmughavilasam, Thottumukku, Vithura, P.O.	Unregistered
66.	K. Somasekharan Nair, Money Estate, Mani Mandiram Chayam, Vithura, P.O.	Unregistered
67.	G. Raveendran Nair, Charupara, Chayam, Vithura, P.O.	Unregistered
68.	M. Miyaru Kunju, Kohinoor, Tholicode, P.O.	Unregistered
69.	T. Thomas, Madathil, Vithura, P.O.	Unregistered

THEKKADA VILLAGE

70	L. Vijayalakshmi Thankachi, Prempriya, Thycadu, Trivandrum-14.	NED 2930
71.	A. Pushpavally, Manjappara Geetha Nivas, Cheeranikkara, P.O., Vembayam.	Unregistered
72.	B. Assam Beevi, Rajula Bhavan, Kallikkad, Cheeranikkara, P.O.	Unregistered

THENNOOR VILLAGE

73.	A. Aisha Beevi, Kunnumpurathu Veedu, Daivapura, Peringamala.	Unregistered
74.	M.C. Antony, Thaiparambil, Vithura, P.O.	Unregistered

UZHAMALACKAL VILLAGE

75.	K.S. Vishnu Sarma, Lakshmivilasathu Madom, Kulappada, P.O.	Unregistered
76.	Ramananth Sarma, Lakshmivilasthu Madom, Kulappada, P.O.	Unregistered

VEMBAYAM VILLAGE

77.	Subaida Beevi, Hameedia Building, Nannattukavu, Pothencode, P.O.	Unregistered
78.	D. Sulochana, Prasanthan Cottage, Seon Hill, Vembayam, P.O.	Unregistered
79.	A. Jameela Beevi, Valavookonam Veedu, Nannattukavu, Pothencode, P.O.	Unregistered
80.	L. Ushakumari, Usha Bhavan, Thekkade, Vembayam, P.O.	Unregistered

VAMANAPURAM VILLAGE

81.	D. Sreeja, Vilayil Veedu, Thekkinkadu, Nagaroor, P.O., Kilimanoor.	Unregistered
82.	K. Prabha, Kalabhavan, Mudiyurkonam, Kottukkunnam, P.O., Vamanapuram.	Unregistered
83.	S. Sudhamani, Geetha Mandiram, Pattamvila, Thumbode, Kallara, P.O.	NED 1858

VITHURA VILLAGE

84.	S.Muralidharan Nair, Branch Post Master, Kallara, P.O.	Unregistered
85.	D. Krishnan Nair, Charuvilakathu Puthen Veedu, 26th Stone, Kallara, P.O.	Unregistered
86.	V. Chandrika Sreekantan Nair, Kanjipalam Estate, 26th mile Stone, Kallara, P.O.	Unregistered

VELLANAD VILLAGE

87.	G. Thankappan Nair, Sreenilayam, Kalathara, Mundela, P.O.	NED 1219
88.	A. Kesavan Nair, Chotti Bhavan, Veliyannoor, P.O.	Unregistered

89. K. Chellappan Pillai, Ambilikuzhy Veedu, Valiyara, Vellanad, P.O. — NED 670

90. K. Varijakshan Nair, Lakshmi Vilas, Vellanad, P.O. — NED 5019

VEERANAKAVU VILLAGE

91. Thankappan Nair, Muthayalkunnu Veedu, Chaykulam, Veeranakavu, P.O. — Unregistered

92. G. Chandrasekharan Nair, Ajith Vihar, Pattakulam, Veeranakavu, P.O. — Unregistered

93. T. Rassalam, Raghes Bhavan, Chaykulam, Veeranakavu, P.O. — Unregistered

94. Geethakumary, Manoj Bhavan, Anacode, Veeranakavu, P.O. — Unregistered

95. Radhamma, Prasath Bhavan, Anacode, Veeranakavu, P.O. — Unregistered

96. K. Krishnan Nair & G. Sudhakumary, Sukrishna, Madathikkonam, Veeranakavu, P.O. — Unregistered

97. Jayanthi, C/o Kadavalloor House, Muthiyavila, Kattakada, P.O. — Unregistered

VATTAPPARA VILLAGE

98. C. Gopinathan Nair, V.G. Bhavan, Kuttiyani, Panthalacode, P.O., Nedumangad. — Unregistered

99. V. Varijakshan, Pournami, TC 11/1165, Nanthancode, Trivandrum. — Unregistered

100. T. Sooriyakumari & S. Sreedharan, Soubhagya, Kurissadi, Nalanchira, P.O., Trivandrum. — NED 1160

APPENDIX II

QUESTIONNAIRE

SURVEY ON INCIDENCE OF PINK DISEASE IN NEDUMANGAD TALUK OF TRIVANDRUM DISTRICT

Name of the student: PARIBALAN, P.

Admission Number : 91-PD2-06.

1. Name of Owner :
2. Name of holding :
3. Address including the registration number :
4. Total area under rubber :
5. Area under young rubber (upto 12 years) :

6.

Area under Tapping					Area not Tapping				
Year of planting	Clone	Extent	Spacing	No. of plants	Year of planting	Clone	Extent	Spacing	No. of plants

7. Pink disease details.

CLONE RRII 105

Year of planting	Total Number of plants	No. of infected trees	No. of incidence at trunk	No. of incidence at first fork	No. of incidence above fork

CLONE RRIM 600

Year of planting	Total Number of plants	No. of infected trees	No. of incidence at trunk	No. of incidence at first fork	No. of incidence above fork

(a) Pink disease detection and treatment.

RRII 105			RRIM 600		
Cobweb stage	Latex oozing bark decaying stage	Drying stage	Cobweb stage	Latex oozing bark decaying stage	Drying stage

(b) Number of trees recovered after treatment.

RRII 105			RRIM 600		
Cobweb stage	Latex oozing bark decaying stage	After drying	Cobweb stage	Latex oozing bark decaying stage	After drying

(c) How treatment was done

RRII 105			RRIM 600		
No branches cut	Branches cut	Crown removed comp-letely	No branches cut	Branches	Crown removed comp-letely

8. Control measures a) Detection.

RRII 105

Frequency of inspection	Number of labourers engaged	Start of inspection rounds	End of inspection rounds

RRIM 600

Frequency of inspection	Number of labourers engaged	Start of inspection rounds	End of inspection rounds

(b) Chemical treatment.

RRII 105

Bordeaux paste	Thiride	Calixin	Any other

RRIM 600

Bordeaux paste	Thiride	Calixin	Any other

Preparation of Bordeaux paste

Prepared as per recommendation: Yes/No

If no, why change made? Lack of knowledge/
For convenience/
Other reasons.

Problems in detection and treatment of pink disease

Weather early detection could be made? Yes/No

If no, the problems in detection: Lack of skilled labour/
continuous rains/
not visible from ground
etc.

Problems in the method of treatment

(i) Treatment done as per recommendations covering 1 foot above and below on all branches. Yes/No

(ii) Treatment done only at infected spot: Yes/No

Whether repeated treatment was required: Yes/No

Nearness to other mature rubber plantations (infected) : Yes/No

If yes, distance ..... metres.

Knowledge of the grower about the disease: Good/Average/Poor

Source of information to the grower: Rubber magazine/
News papers/
Seminars/
Discussion with
extension officers/
Disucssion with
other growers

Does the grower think that the extension facility available is adequate. Yes/No

Which of extension method is more applicable to the grower? Publications/
Seminar/
Field visits by
extension officers.

Signature of the Grower: Signature of the Student:

APPENDIX III

RAINFALL DATA OF NEDUMANGAD TALUK FOR 1991

Month	Rainfall in mm
January	79
February	34
March	70
April	213
May	123
June	796
July	297
August	142
September	Nil
October	332
November	205
December	32