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# COCONUT ROOT (WILT) SURVEY

## 1996



**DEPARTMENT OF AGRICULTURE**  
**GOVERNMENT OF KERALA**

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കേരളം

**DEPARTMENT OF AGRICULTURE**  
**GOVERNMENT OF KERALA**

# 1997

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appropriable production oriented developmental programmes especially during the Ninth Five Year Plan period at the State and National levels.

Government of India in response to the scheme submitted by the State have suggested to undertake a fresh survey to assess the latest position regarding the extent of severity as well as intensity of the spread of disease in close collaboration with Coconut Development Board and C.P.C.R.I. In pursuance of the direction of Government of India, Secretary (Agri.), Govt. of Kerala convened a meeting of the officials of the Agriculture Department, Coconut Development Board, C.P.C.R.I., and the Bureau of Economics and Statistics, Government of Kerala on 24-02-96 in which the objective and methodology of the proposed survey was discussed in detail. Later, another meeting was held on 13-3-1996 in the Agriculture Secretary's chamber with the participation of all concerned. The above meetings decided to conduct a survey in all the eight disease affected districts i.e., from Thiruvananthapuram to Thrissur.

According to the schedule the survey commenced by 1st June 1996 and was completed by 30th August 1996. The Deputy Director of Agriculture (Hort) was appointed as District Monitoring officer to monitor the progress of survey. The survey was carried out by the youth registered under the scheme 'One lakh Youth in Agriculture'. An attempt has also been made to project the strategies that could be adopted for the development of coconut in the state in the light of the results obtained from the survey.

In this context I express my sincere thanks to Dr. M.Aravindakshan, Chairman, Coconut Development Board for having provided necessary financial

## PREFACE

Coconut palm is one of the most important cash crops grown in Kerala which plays a very important role in the socio-economic development of the State. It contributes about 15% of the annual income and 35 % of the agricultural income of the State. Eventhough kerala is known as the land of coconut, the productivity of the palms is not promising and it is very low compared to other coconut growing states. Existence of large number of senile and unproductive palms, prevalence of debilitating root(wilt) disease, small size of holdings and poor management of the palms, are the major reasons attributed to the low productivity of the crop.

The coconut root(wilt) disease prevalent predominantly in Kerala is a serious malady affecting coconut production in the State. Though the disease has been reported after the floods of 1882 in the erstwhile state of Travancore, it has since then spread to eight districts of Kerala stretching from Thiruvananthapuram to Thrissur. Isolated, incidence has been reported from the other districts of the State and also from the neighbouring districts of Tamil Nadu. According to earlier survey report the loss estimated due to the disease was 968 million nuts. The total estimated monetary loss on all these counts, on the basis of 1987 price of coconut was of the order of about Rs. 3000 million.

In this context, it was felt necessary to update the information on the extent of severity of the disease. This is an essential pre-requisite for formulating

assistance and guidance to undertake the survey. I thank all the other agencies for their effective participation in the programme.

I would like to make special mention for the expert opinion and technical guidance received from Smt. Minnie Mathew, former Secretary (Agriculture) Sri V.T. Markose, Director, Coconut Development Board, Kochi, Sri. S. Sadasivan, former Director of Agriculture, Dr. Jacob Mathew, Principal Scientist, C.P.C.R.I., Kayamkulam, Dr. J.J.Soloman, Principal Scientist, C.P.C.R.I., Kayamkulam.

The document contains information on the methodology, its implementation, enumeration of data and analysis. It is hoped that the results of this survey will be useful in the formulation of the appropriate development programme for coconut.

G. Thankappan,  
Director of Agriculture.

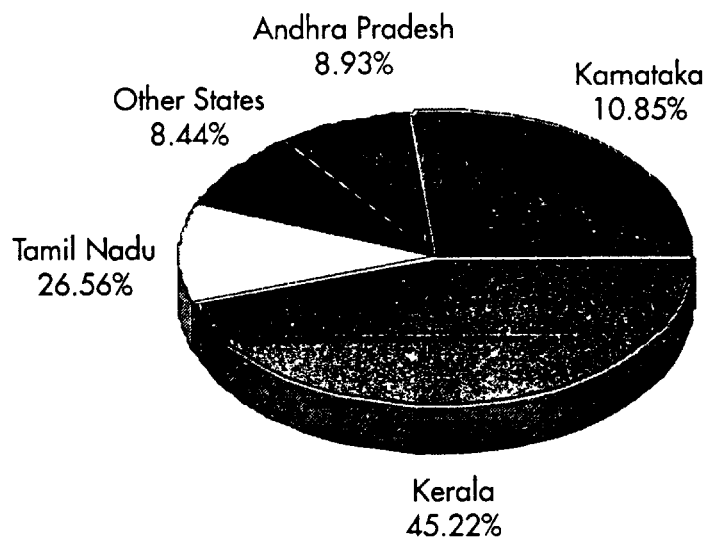
## HIGHLIGHTS

1. Period of Survey : 1.06.1996 to 30.08.1996
2. Areas surveyed : Right root (Wilt) Affected Districts.
3. Areas completely surveyed : Thiruvananthapuram and Thrissur Districts.
4. Areas surveyed in other Districts : 10% of the Total Panchayats
5. Krishi Bhavans involved : 238
6. No. of Enumerators involved : 2800
7. No. of Household covered : 11,24,737
8. Total NO. of palms surveyed ('000 Nos.) : 101998
9. Total No. of Root (wilt) Free Palms ('000 Nos.) : 77460
10. Total No. of Diseased Early Palms ('000 Nos.) : 16550
11. Total no. of disease advanced palms ('000 Nos.) : 7988
12. % of disease incidence : 24.05%
13. Amount required to cut and remove Disease Advanced palms @ Rs.200/- : 160 crores.
14. Cost of survey : 78.54 lakhs
15. Funding Agency : Coconut Development Board, Kochi.

## INTRODUCTION

Coconut is considered to be "Kalpavriksha" in view of its versatile contribution to mankind, every part of the tree and its products finding an economic use. Coconut is the main stay of the rural economy in view of its multifarious contribution to income and employment. It is one of the most important sources of vegetable oil. Nearly 7% of the vegetable oil production in the country is accounted for by coconut oil. Copra, the main product of the palm which has an oil yield of upto 65% is perhaps the richest material for vegetable oil extraction. The crop is the only one in the lauric oil groups, presently produced in the country and therefore enjoys a unique position among the major oil seed crops. The crop supplies raw material for a number of important industries. Among the coconut based industries in India, coir manufacture, copra processing, oil milling and distillery require special mention. The coir industry which provides direct employment for more than 5 lakh workers, depends on this crop for its raw material. In Kerala coconut processing and related activities provide direct employment to over one million people. The crop sustains about 20 million families directly or indirectly for their livelihood in the country. The foreign exchange earned by coconut through export of coir is around Rs.200crores. It is the largest source of fuel in rural areas where the crop is under cultivation. The availability of fuel from the coconut palm is estimated to be around 50 Kg. per annum.

Coconut is grown in more than 80 countries of the world with a total production of 54 billion nuts. India occupies the first position in the world production of coconut followed by Indonesia and Philippines. The average productivity of coconut in the country is 7760 nuts per hectare.

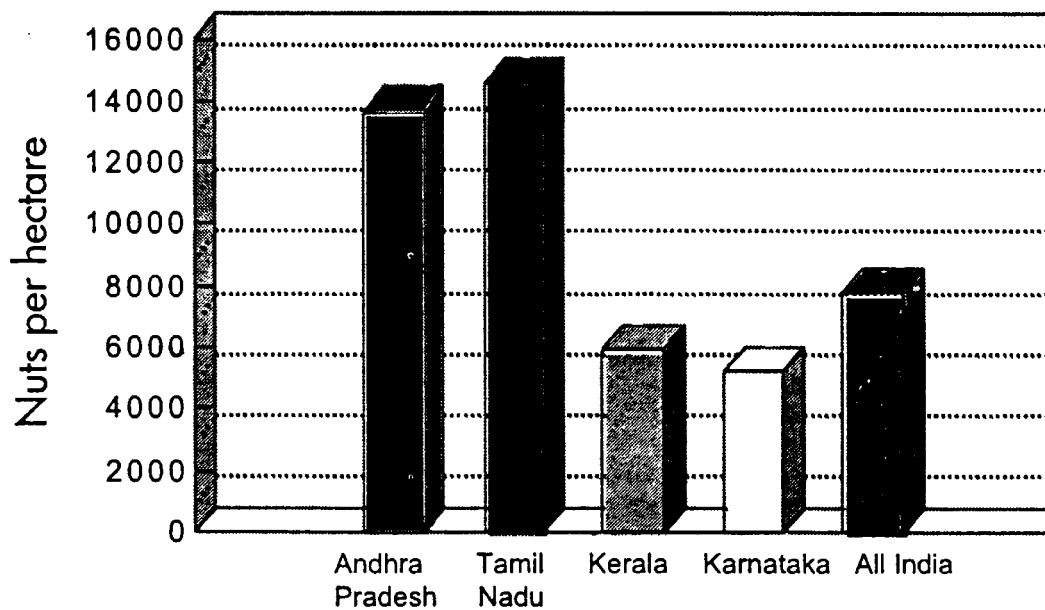


### 1.1. MAIN COCONUT GROWING STATES

Kerala is the main coconut growing state with an area of 911.0 thousand hectares and production of 5335.1 million nuts followed by Tamil Nadu (298.6 thousand hectares and 4345.7 million nuts), Karnataka (263.8 thousand hectares and 1364.1 million nuts) and Andhra Pradesh (86.6 thousand hectares and 1181.4 million nuts). The above four southern states put together accounts for 90 per cent of the total production in the country.

### 1.2. PRODUCTIVITY IN INDIA

The average productivity of coconut in the country is 7760 nuts per hectare. Among the four major coconut growing states Tamil Nadu has the highest



Productivity of coconut in major states

productivity (14554 nuts/ha). Andhra Pradesh has a productivity of 13642 nuts/ha followed by Kerala (5856 nuts/ha) and Karnataka (5171 nuts/ha).

The trend of area, production and productivity of coconut in recent years shows that there is steady and continuous improvement in area under the crop as well as in productivity from Sixth Five Year Plan onwards. The area which was around 6.51 lakh hectares in 1980-81 has increased consistently over the next one and half decades and has reached to a scale of 9.1 lakh hectares by the end of 1994-95. In productivity also the performance during the period had been quite impressive which increased from 4618 nuts per ha. in 1980-81 to 5856 nuts per ha. during 1994-95. The annual growth in area coverage and productivity works out to 2 and 2.7% respectively. All these favourable trends gave a new impetus for growth in coconut production which touched a peak level of 5335.1 million nuts by the end of 1994-95. In Kerala alone the increase

in area during the last 10 years is around 2 lakh hectares and a large chunk of the newly planted area is yet to attain stability in yield. Trends in area, production and productivity of coconut in Kerala is given in Table - 2.

### 1.3. STATUS OF COCONUT IN KERALA'S ECONOMY

- ❖ Coconut is a versatile crop in all its respects to Kerala - it is a food crop, it is an oil seed crop, it is a beverage crop, it is a fibre yielding crop, it is a horticultural crop, it is a plantation crop and it is a small holder crop and an eco-friendly crop.
- ❖ It is the crop which has the largest coverage in net area under cultivation in the State accounting for over 38%.
- ❖ It provides the raw material support for the traditional industries like coir, oil milling etc.
- ❖ It is estimated that about 5 million people in Kerala are dependent on this crop for livelihood and employment.
- ❖ It is the largest source of fuel for meeting the household requirement in Kerala.
- ❖ The crop accounts for about 15 percent of the annual income and 35 percent of the agricultural income of the State.
- ❖ Coconut is essentially a small holders' crop in Kerala.

### 1.4. PERFORMANCE OF THE CROP IN KERALA

While the crop has its presence in all the coastal states, the region comprising Kerala, Karnataka, Tamil Nadu and Andhra Pradesh accounts for over 92 percent

of the area and production of coconut in the country. Eventhough Kerala State is considered to be the homeland of coconut, its relative share in terms of area and production in the country is fast declining. Country-wise area and production of coconut, Area under coconut and percentage share of different States, Production of coconut in India, Productivity of Coconut in different states, Productivity of Coconut in India, Price trend of Coconut, Copra and Coconut Oil in Kerala for the last 13 years from 1983 and price trend of Vegetable Oil are appended in Annexure II to VII.

#### 1.5. ROOT(WILT) DISEASE

The earliest record of the outbreak of the disease was from Erattupetta area of Meenachil taluk, Kottayam district, around 1874. It became significantly evident after the great floods of 1882 (Butler, 1908, Varghese, 1934). The disease which was reported initially from three independent locations each about 50 Km. apart in the erstwhile State of Travancore has since then spread and now occupies a continuous area of 4,10,000 ha. in eight out of fourteen districts of the State. Isolated disease pockets are also observed in the northern districts of the State and the bordering districts of Tamil Nadu. The disease intensity in the contiguous diseased tract ranged from 1.5% in Thiruvananthapuram district to 75.6% in Kottayam district. The annual loss due to the disease is estimated to be about 968 million nuts (Anon. 1985).

The disease is non-lethal but debilitating and palms of all age groups are affected. Delayed flowering and reduction in yield are observed in palms contracting the disease in the prebearing age. The disease is prevalent in all

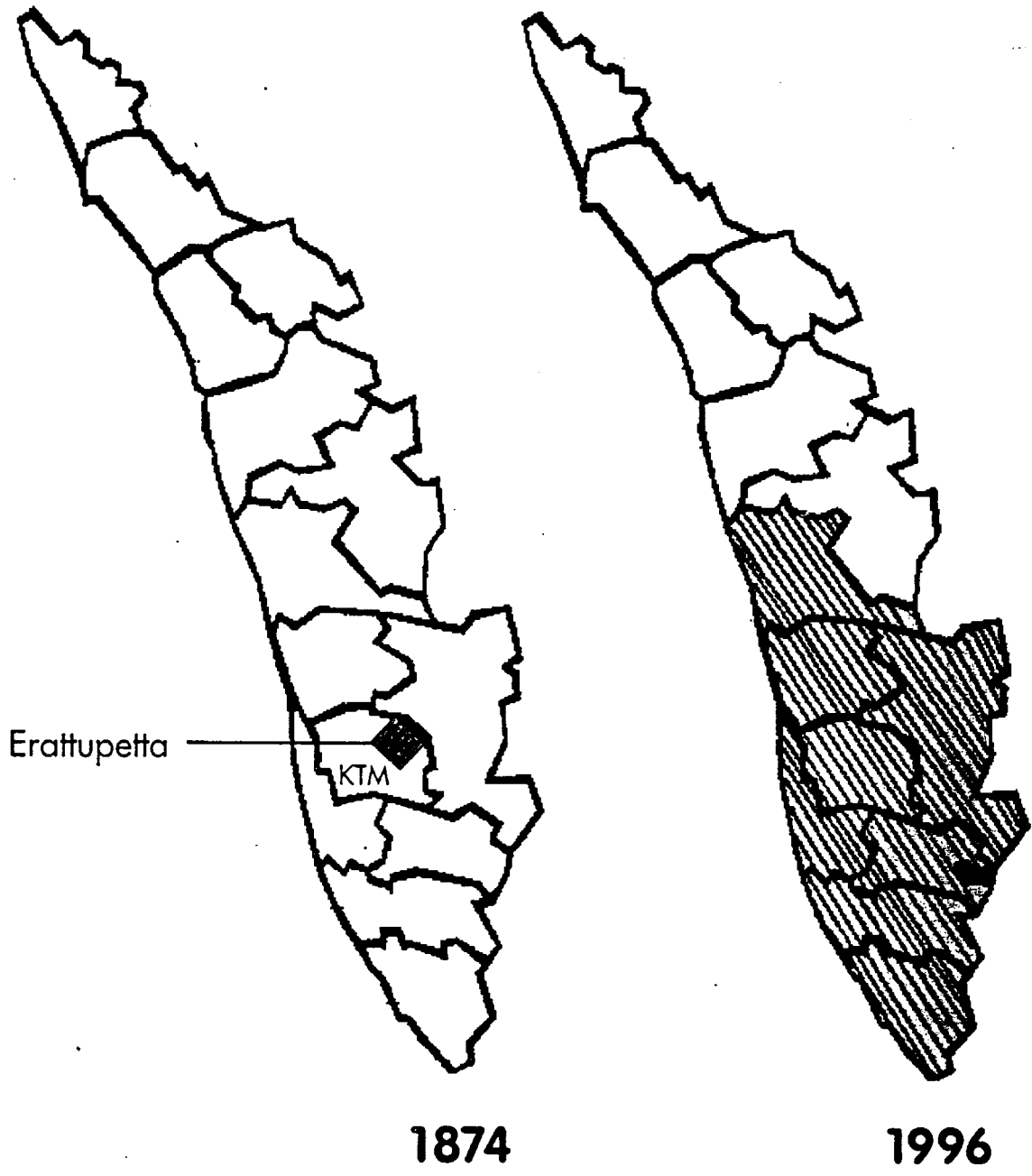
major soil types. The spread is faster in sandy loam, sandy alluvial and in heavy texture clayey soils than in laterite. The disease incidence is relatively higher in waterlogged low lying areas adjacent to rivers and canals and in Kari soils. The pattern of spread is erratic and occurs in jumps or leaps (Pillai, Sasikala and Mathew, 1980).

The most consistent and diagnostic symptom of the disease is the characteristic bending of the leaflets termed 'flaccidity' (Radha and Lal, 1972). Foliar yellowing and marginal necrosis are the other associated symptoms. An indexing method for quantifying the disease giving due weightage to the three symptoms has been developed (George and Radha, 1973). Rotting of root system, drying up of spathe and necrosis of spikelets are also observed in certain cases (Menon and Pandalai, 1959). Radha *et al* (1962) reported reduction in yield of nuts upto 80% in palms in advanced stages of disease. The nuts from diseased palms have thinner husk and fibres are definitely weaker and less firm (Varghese, 1934). The kernel is thinner and never dries upto into hard brittle copra but remains soft and flexible. The oil content is very much reduced and the oil loses its flavour as well.

### **Etiology**

The sporadic occurrence and the spreading nature of the disease implies the involvement of a pathogen as the cause of the disease. A number of biological agents such as fungi, bacteria and nematodes are reported to be associated with the disease. However, pathogenicity experiments with these organisms singly and in combination failed to reproduce the symptoms of the disease, thereby, ruling out their involvement in disease causation (Joseph and Lily, 1991,

# COMPARISON OF ROOT WILT DISEASE



■ Disease Affected

Jayasankar and George, 1991, Sosamma and Koshy, 1991). Although the involvement of a virus or a virus-like agent was implicated with the disease (Shanta and Menon, 1959; Summarwar *et al.*, 1969; Maramorosch and Kondo, 1977) no virus could either be isolated or consistently observed in diseased plant tissues. Polyacrylamide gel electrophoretic analysis of isolated nucleic acid from diseased palms also does not substantiate the association of a viroid (Randles and Hatta 1980). Investigations on soil and nutritional aspects indicated no direct involvement of major and micronutrients in the disease incidence (Cecil and Amma, 1991). The application of micronutrients and Mg although did not prevent fresh incidence of disease (Davis and Pillai, 1996) it had a decidedly favourable response on the yield of diseased palms. The prebearing age was reduced by 9 months by the application Mg and the response was more on diseased palms compared to healthy ones (Cecil and Amma, 1991). Foliar application of 2% Magnesium sulphate solution at quarterly intervals markedly decreased yellowing (Varkey *et al.*, 1979). The physiological and biochemical changes observed in diseased palms are suggestive of a pathogen mediated altered host metabolism than of a physiological disorder (Mathen *et al.*, 1991).

Presence of mycoplasma-like organisms (MLOs) in the sieve tubes of tender roots, submeristem, leaf bases of developing leaves and rachilla of tender inflorescence of diseased palms had been reported (Solomon *et al.*, 1983). This observation generated indepth study to ascertain the constant association of MLOs with the disease and to establish its role as the etiological agent of the disease.

Constant association of MLOs with the disease has since been established with the finding of the organism in seventy five diseased palms and their absence in fifty healthy palms studied. The palms examined are of various age groups, intensities of disease and from different locations. Histopathological staining techniques for visualising MLOs under optical microscope has also been standardised.

An inventory of putative insects on coconut was made using various traps and through direct examination of coconut foliage. This led to the identification of a leaf hopper *Sophonia greeni* and a plant hopper *Proutista moesta* besides lace bug *Stephanitis typica* (Rajan and Mathen, 1984, 1985). Vector role of lace bug has been conclusively established with the finding of MLOs in bugs allowed to feed on diseased palms for known periods (Mathen *et al.*, 1987) and also through transmission experiment (Mathen *et al.*, 1990). Field experiments are in progress to find out whether the control of aerial insects could prevent fresh incidence of disease. The disease also could be experimentally transmitted from coconut to periwinkle a known and accepted mycoplasmal indicator host through dodder laurel *Cassytha filiformis* (Sasikala *et al.*, 1988).

The organisms could not be cultured in cell-free medium. The present approach to propagate MLOs in plant tissues maintained in tissue culture media appears promising.

Since plant mycoplasmas defy culturing *in vitro* differential chemotherapy is universally accepted as the test tool to provide circumstantial evidence for the mycoplasmal etiology of a disease. In a field experiment with antibiotics, remission

of symptoms was observed in 53% of palms treated with 3 and 6 g a.i. of Oxytetracycline hydrochloride. Contrastingly, palms treated with penicillin and distilled water deteriorated over the pretreatment status (Pillai et al., 1991)

#### 1.6. MANAGEMENT OF ROOT (WILT) AFFECTED COCONUT GARDENS

Coconut root (wilt) disease is not lethal, but it debilitates the production potential of the palms. The disease is caused by Mycoplasma-Like Organisms. Though no therapeutic control of the disease is available till date, it has been possible to evolve a technology to increase the productivity of the diseased palms. This comprises scientific and balanced fertilisation, application of organics, cultivation of compatible crops in the interspaces of coconut, eradication of disease advanced and uneconomic palms, planting of quality seedlings, plant protection measures to control other pathogens and pests of coconut, prevention of drought and water logging and restructuring of other perennial crop species.

Root (wilt) disease is not caused by any nutritional deficiency. However, apparently healthy palms in the disease affected areas and also early diseased palms respond well to scientific and balanced fertilizer application. It is necessary to supply 500g. nitrogen, 300g phosphorus, 1000 g potassium and 500 g magnesium oxide to each palm in two splits in a year when sufficient moisture is available in the soil. For the purpose, it is sufficient to apply 1.1 Kg. urea, 1.5 Kg. mussorie phos, 1.7 Kg. muriate of potash and 500 g. Magnesium sulphate to each palm. Under rainfed condition, one-third of these fertilizers should be applied at the start of the monsoon (April-May) and the remaining two-third towards the end of the monsoon (September-October). Wherever irrigation

facilities are available fertilizers can be applied in four equal splits during the months of January, April, August and October. Even for hybrids these fertilizer doses will be sufficient.

Application of organics to the soil will improve the physical structure and the capacity to retain water and nutrients. It will be beneficial to supply 50 Kg. cow dung or compost to each palm in a year. It will be also desirable to cultivate green manure crops in the cococut basins. The same may be ploughed into the soil. After the application of first dose of chemical fertilizers, seeds of Peuraria (10 g) can be sown into each basin, which can grow to produce approximately 18 Kg. of green manure in four months. This can be incorporated into the soil during the applications of second dose of fertilisers.

Intercropping with elephant foot yam, ginger, yam, colocasia, etc. in rotation in coconut gardens can substantially increase production of coconut. Cultivation of fodder grasses and maintenance of milk cows in heavily diseased gardens facilitates organic recycling. Irrespective of the disease condition of the palms this helps to increase the yield considerably. Whenever intercrops are cultivated, both the coconut and the intercrop need separate fertilisation.

Palm waste recycling is another important management practice in which palm waste like spathe, bunch parts, leaf, coconut husk, coir pith etc., is buried in the coconut basin. This enables to recycle palms own parts and to meet many of the micronutrient requirement, thus enabling better nutrient balance.

Disease advanced palms will be uneconomical and do not respond to care and management. Such palms are to be eradicated. Likewise, in the sparsely diseased areas (north of Trichur) even early diseased palms irrespective of the age and productivity should be eradicated. This will not only remove the foci of infection but also prevent the spread of the disease to newer areas. Even juvenile palms which take up the disease before the onset of flowering need be removed. Such young palms will never bear properly. Spraying of 0.1% Endosulphan or Monocrotophos to the leaves of disease affected palms before removal will be beneficial in suppressing insect vector to some extent. After eradication, quality seedlings may be planted in the garden if sufficient space is available.

Leaf rot is another disease normally found super imposed on the coconut root (wilt) affected palms which can drastically reduce the yield of the palms. This disease can be controlled by spraying fungicides (Bordeaux mixture 1%, Indofil M-45, 0.4% and phytolan 0.5%) in a sequential manner, three times a year. Rhinoceros beetle and red palm weevil which affect coconut palms are to be properly controlled.

Drainage should be provided for increasing aeration in the soil and more of soil should be applied in low lying areas to facilitate production of raw roots. In summer 600-900 litres of water may be applied to each palm once in 4-6 days. Scientific results show that coconut responds well to drip irrigation. The population of unwanted trees can be reduced and other perennial crop species restructured by cutting the branches. This will ensure more sunlight to the palms.

By adopting increased management practices the yield of root(wilt) affected palms can be increased by more than 23 nuts/palm/yr. on an average. The response was much higher in apparently healthy and disease early palms.

#### Points to Remember

- ✪ Remove disease advanced uneconomic palms
- ✪ Remove all diseased juvenile palms
- ✪ Eradicate every diseased palm in newer areas
- ✪ Apply balanced doses of fertilisers
- ✪ Add 50 Kg. Farmyard manure per palm per year
- ✪ Grow green manures in basins
- ✪ Intercrop only with compatible crops
- ✪ Adopt mixed farming and recycle of palm waste.
- ✪ Control leaf rot by spraying fungicides.
- ✪ Protect from red palm weevil and rhinoceros beetle
- ✪ Irrigate during summer and avoid water logging
- ✪ Restructure perennial trees to reduce shading.

#### 1.7. PAST WORK DONE

A detailed survey on the intensity of root (wilt) disease and its impact on production was conducted last in 1984 under the joint auspices of CPCRI, Coconut

development Board, Centre for Development Studies, Department of Agriculture, Bureau of Economics and Statistics and Kerala Agri. University. The century old root (wilt) disease of coconut has been slowly but steadily spreading from its primary foci of occurrence in Kottayam district to both Southern and Northern directions. The disease is now prevalent in eight out of fourteen districts of the Kerala State, intensities ranging from 1.52% in Trivandrum to 75.62% in Kottayam, the mean percentage of disease incidence being 32.31. In a survey conducted in 1976 the loss estimated due to the disease was 340 million nuts while the survey during 1984 showed that the loss has increased to 968 million nuts. It was observed that the incidence and intensity of the disease varied considerably among the districts. The extent of incidence of the disease, in both bearing and non bearing categories of palms taken together, was higher in Kottayam district (75.6%) followed by Alappuzha (70.7%), Pathanamthitta (37.2%), Ernakulam (34.5%), Idukki (34.2%) and Kollam (28.6%). In Thrissur the disease incidence was 2.6 percent. The lowest incidence of 1.5 percent was in Trivandrum district.

#### **1.8. BACK-GROUND OF THE SURVEY**

The report on the 1985 root (wilt) survey had indicated that it is possible to keep the dreadful disease under check without spreading to new areas and thereby contain it within the disease affected areas by total removal of all disease affected palms irrespective of their age in the two border districts of Thiruvananthapuram and Thrissur and all the diseased young palms in pre-bearing age and older ones in the advanced stages of the disease in the remaining districts. Therefore cut and removal of diseased/senile palms was included as an important component under the coconut development board scheme for

"Integrated farming in coconut small holdings for productivity improvement". But as the targets allotted to the state under cut and removal were very meagre compared to the actual requirement, the department had submitted a comprehensive scheme with a time bound schedule for cut and removal of diseased/senile palms requesting central assistance to the tune of Rs.360.28 crores.

Govt of India in response to the scheme submitted by the State have suggested to undertake a fresh survey to assess the latest position regarding the extent of severity as well as intensity of the spread of the disease in close collaboration with CPCRI and the Coconut Development Board. Govt of India have specified that the survey report of the said survey will be undertaken and be brought out before the commencement of the Ninth Five Year Plan so that it could be used for developing appropriate strategies and targets during the Ninth Plan.

In pursuance of this direction of Govt of India, Secretary (Agriculture), Govt of Kerala convened a meeting of the officials of the Agriculture Department, CPCRI, Coconut Development Board and the Bureau of Economics and Statistics, Govt of Kerala on 24-2-1996 in which the objectives and methodology of the proposed survey was discussed in detail. Later, another meeting was held on 13-3-1996 in the Agriculture Secretary's Chamber with the participation of all concerned.

The above meetings decided to conduct a survey in all the eight disease affected districts i.e. from Thiruvananthapuram to Thirssur. In view of the heavy financial commitment involved in conducting complete enumeration in all the 8

districts, it was decided to restrict complete enumeration in the two border districts of Thiruvananthapuram and Thissur. In the case of other districts only 10% of the total panchayats was proposed to be covered.

## **2. OBJECTIVES**

1. To estimate the extent of spread and intensity of incidence of coconut root (wilt) disease in the disease affected eight districts of the State.
2. To assess the incidence of major pests and diseases.
3. To assess the management practices in coconut gardens like organic manure application, chemical fertilizer application, irrigation and plant protection measures.

## **3. METHODOLOGY**

### **3.1. LOCATION AND PROCEDURE FOR SURVEY**

The survey was conducted in all the eight districts from Trivandrum to Thrissur. In the case of border districts viz. Trivandrum and Thrissur complete enumeration in all Panchayats was done to assess the disease intensity. In other six districts viz., Kollam, Pathanamthitta, Alappuzha, Kottayam, Idukki and Ernakulam a sample survey was conducted in 10% of the total Panchayats of each districts selected at a random basis. Complete enumeration was done in these selected Panchayats. List of panchayats surveyed appended in Annexure-VIII.

### **3.2. CONCEPTS AND DEFINITION**

For identifying the palms, the following concepts were used.

### **Root (wilt) Free (RWF)**

A palm which is not affected by root (wilt) disease is defined as Root (wilt) Free (RWF) irrespective of the fact that the palm is affected by other diseases or pests.

### **Diseased early (DE)**

A palm having disease intensity up to and including 50 index points based on symptoms such as flaccidity, yellowing and necrosis is categorised as diseased early (DE).

### **Diseased Advanced (DA)**

A palm manifesting disease intensity above 50 index points is categorised as diseased advanced (DA).

## **3.3. MODE OF OBSERVATION**

The owners of the plot were contacted and information regarding irrigation, cultural practices and cropping pattern were ascertained. The palms were then classified into bearing and non-bearing and each category again into three different groups namely Root (wilt) Free (RWF), Diseased Early (DE) and Diseased Advanced (DA). Root (wilt) affected palms were painted in yellow colour. All palms identified as DE palms were given\* mark and D.A. palms will get\*\* mark. Observations were recorded in the prescribed proforma (Appendix - IX)

## **3.4. TRAINING**

Systematic and exhaustive training was imparted to the personnels in stages. The Assistant Director of Agriculture at Block Level and Deputy Director of Agriculture of the eight districts were exposed to the theoretical aspects, followed

by adequate training on the field operations and the survey methods, at CPCRI, Regional Station, Kayamkulam. In turn Agriculture Officers and Agricultural Assistants were imparted training on the above aspects at District level. The field level enumeration was carried out by the youths registered under the State Plan Scheme "One lakh youth in Agriculture". Systematic and exhaustive training was given to enumerators at Krishi Bhavan Level by D.D.As/A.D.As/A.Os.

## 4. RESULTS

### 4.1. INCIDENCE OF THE DISEASE

In the disease affected tract stretching from Trivandrum in the south to Thrissur in the north the incidence and intensity of the disease varied considerably among districts (Fig.1.A). The extent of incidence of the disease was highest in Alappuzha (48.03%) followed by Pathanamthitta (37.8%), Kottayam (36.5%), Idukki (33.56%), Ernakulam (33.0%) and Thrissur (6.19%). The lowest incidence of

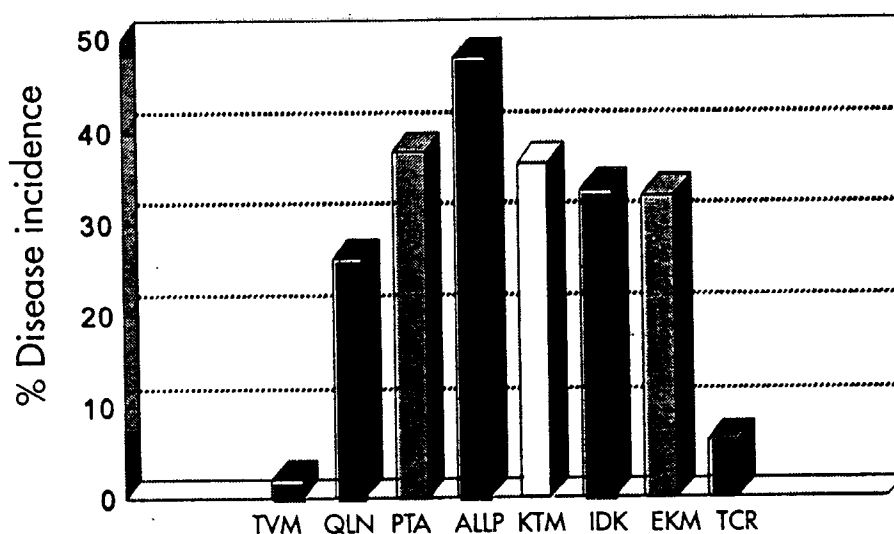
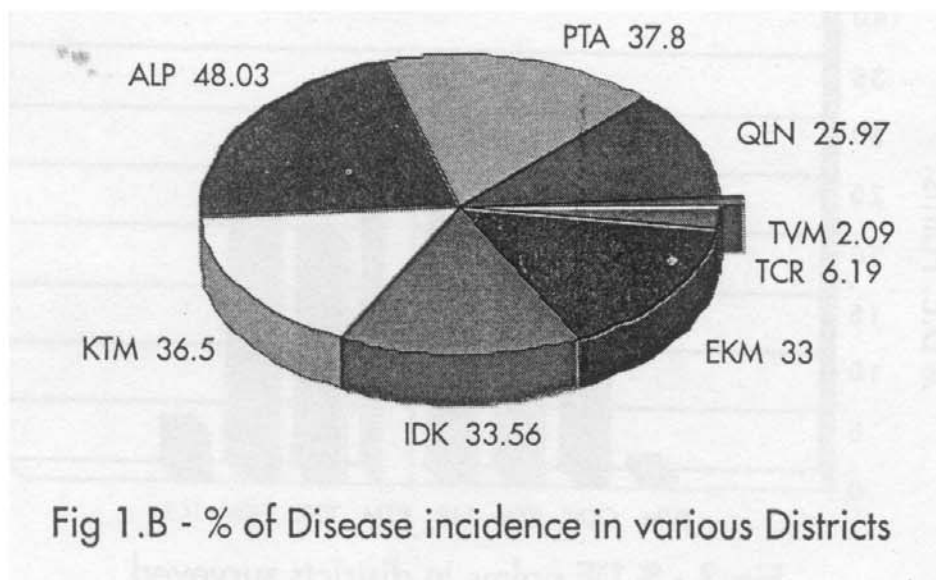


Fig 1.A - % of Disease Incidence

2.09 percent was in Trivandrum. The data is picturised in Fig.1.b. through a Pie-chart. The details of disease incidence district wise is given Table 1.



It was observed that RWF palms was highest in Trivandrum followed by Thrissur, Kollam, Ernakulam, Idukki, Pathanamthitta, Kottayam and Alappuzha (Fig.2).

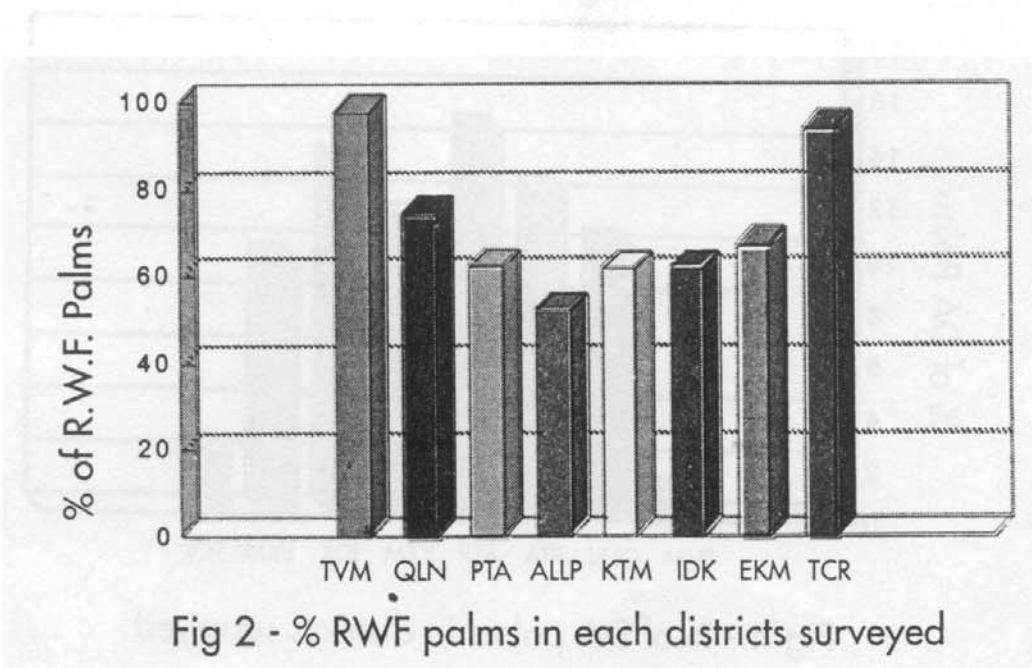


Fig.3 represents the intensity of Root (wilt) disease with early symptoms. The highest number was seen in Alappuzha followed by Kottayam, Pathanamthitta, Ernakulam, Idukki, Quilon, Thrissur and Trivandrum.

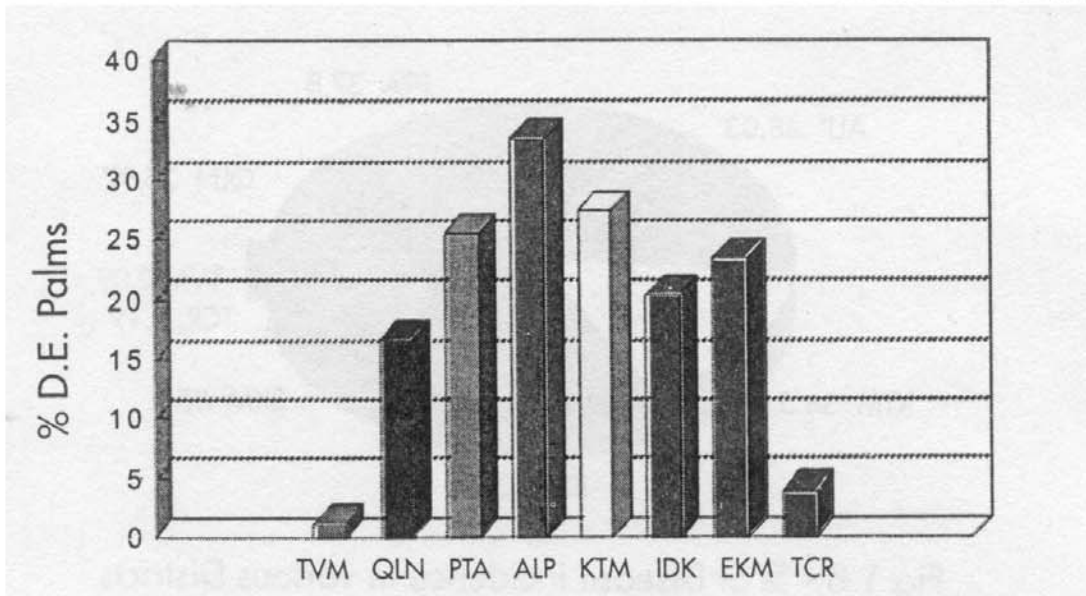


Fig 3 - % DE palms in districts surveyed

Fig.4 shows the extent of Root (wilt) Disease with advanced symptoms in the districts surveyed. The highest incidence was noticed in Alappuzha followed by Idukki, Pathanamthitta, Kottayam, Kollam, Ernakulam, Thrissur and Trivandrum.

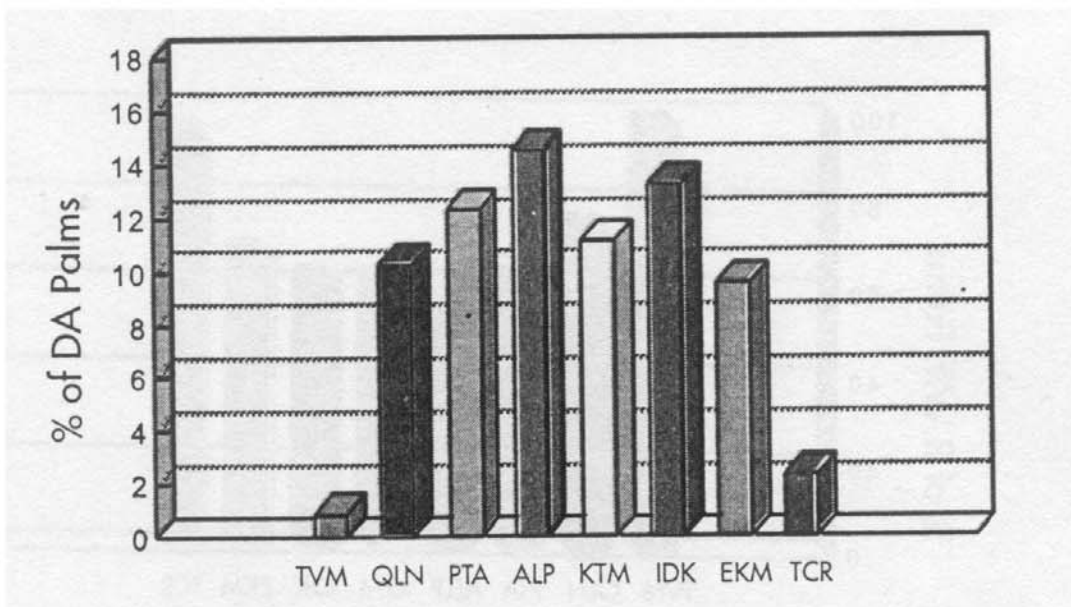


Fig 4 - % of DA palms in districts surveyed

Fig.5.A represents % DA + DE to total number of palms in the districts surveyed. Fig. 6. represents the relative population of Palms with Disease Early symptoms and palms with Disease Advanced symptoms in the respective districts surveyed.

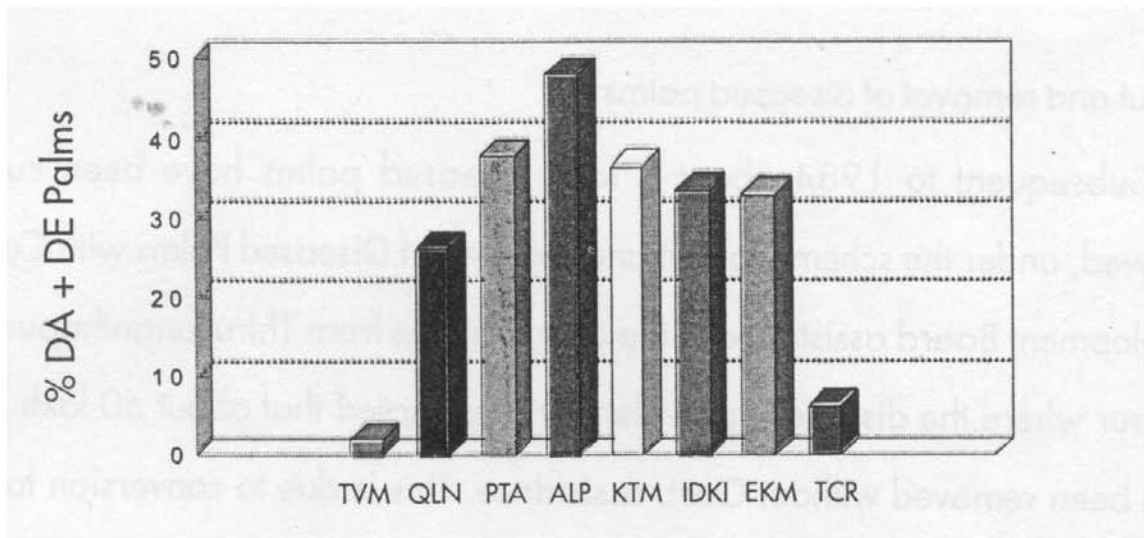


Fig 5 - % of DA + DE Palms in districts Surveyed

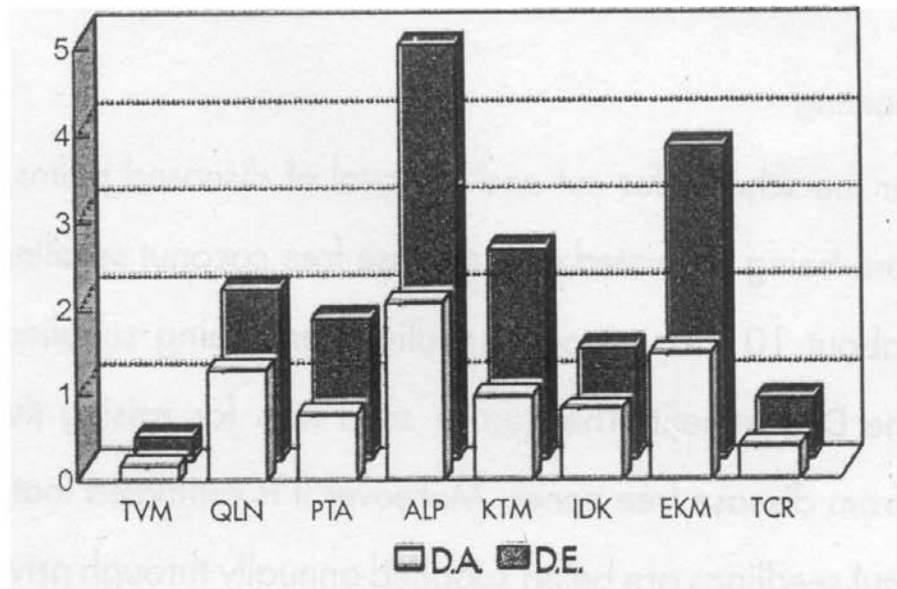


Fig 6 - Relative population of D.A. & D.E. palms in districts surveyed

The data on Root (wilt) Free palms, Disease Early palms, Disease Advanced palms in the concerned Panchayat, district-wise is shown in Table 3 to 10.

## 4.2. RESULTS AND DISCUSSION

During 1984 survey the overall disease incidence was 32.37% but as per the current survey the disease has reduced to 24.05%. Various reasons can be attributed to the reduction of the disease incidence.

### a) Cut and removal of diseased palms

Subsequent to 1984 about 9 lakh diseased palms have been cut and removed, under the scheme for cut and removal of Diseased Palms with Coconut Development Board assistance in the eight districts from Thiruvananthapuram to Thrissur where the disease is prevalent. It is estimated that about 50 lakh palms have been removed without Govt. assistance. This is due to conversion to other crops like Rubber. Besides coconut trunk is largely used for furniture manufacture. It is also used as a source of fire-wood.

### b) Fresh Planting

As per the scheme for cut and removal of diseased palms, palms cut and removed are being replanted with disease free coconut seedlings. Besides this, annually about 10 lakh coconut seedlings are being supplied for replanting through the Department. The quality seed nuts for raising the seedlings are collected from disease free zones. Moreover it is estimated that about 20 to 30 lakh coconut seedlings are being supplied annually through private agencies for replanting. Paddy lands are also been converted to coconut garden. All the above factors have contributed to an increase in total area under disease free coconut palms. This in turn have resulted in a reduction in the overall percentage of disease incidence.

#### **c) Better Management Practices**

Adoption of integrated management practices is another factor which has contributed to reduction in the disease incidence. During the last 10 years various extension methods adopted by Department of Agriculture and Coconut Board and publicity through mass-media have helped the farming community to become aware of the disease management practices. By adopting better management practices to coconut it has been possible to reduce the disease incidence.

#### **d) Crop Conversion**

Statistics reveal that Diseased coconut gardens are being converted to other plantation crops like rubber in the district of Kottayam, Idukki, Pathanamthitta and Kollam.

### **4.3. FUTURE STRATEGY**

The intensity of the damage caused by the Coconut root (wilt) disease in the continuously disease affected tract has been brought out by this survey. Hence in the light of the data generated a suitable strategy can be formulated to contain the century old disease. It will be worth while to evaluate some relevant scientific achievements.

The cause of the malady reported nearly a century ago, has now been elucidated to be Mycoplasma Like Organisms (MLO) through its consistent presence in different tissues of the root (wilt) affected palms under the electron microscope and its conspicuous absence in the disease free palms.

Encouraging results have been obtained both in the farmers' garden as well as all the Research Institutes' Farms in support of the concept of "live with coconut root (wilt) disease"

In the light of the above technological information it is necessary to develop strategies for containing the disease as well as for the better maintenance of the disease affected areas. The following approaches are suggested:

**a) Strategy for the Diseased Advanced Palms**

According to the present survey it is estimated that about 80 lakh palms have attained disease advanced symptom. Under the circumstances the primary requirement is the eradication of such palms that have contracted the disease before bearing. Among the bearing palms that process of eradication shall receive priority for those which are in the advanced stage of the disease. The programme of eradication shall commence in a simultaneous manner from north to south and south to north. By eradicating 20 lakhs, per year it will be possible to cut and remove Diseased Advanced Palms in a span of 4 years with a total financial outlay of Rs.160 crores. However the present rate of subsidy of Rs.200/- per palm which was fixed during 90-91 is comparatively very low. The rate of subsidy has to be increased to Rs.500/- per palm. In the other districts North of Thrissur the State Government is already providing Rs.500/- per palm. As per the revised rate, the total amount required will be Rs.400 crores. Considering the heavy budgetary requirement, State Government will not be in a position to meet the requirement. Therefore liberal central assistance is inevitable to contain the century old disease.

## b) Enhancing the productivity of disease affected palms

Returning to the remaining stock of palms in the heavily infected areas the strategy would be to enhance the productivity with an increase in income from unit area.. In order to achieve this it is important to formulate several production models comprising balanced fertilization, plant protection, irrigation, cultural practices and crop combination to suit the needs of the farmers and agro-climatic conditions. For transplanting these models into actual farm conditions, a Comprehensive Programme for Coconut Development has to be drawn up and implemented.

### 4.4. SUMMARY AND RECOMMENDATION

The century old root (wilt) disease of coconut has been slowly but steadily spreading from its primary foci of occurrence in Kottayam District to both Southern and Northern direction. The disease now occurs in eight out of the fourteen districts of the Kerala State in intensities ranging from 2.09% in Thiruvananthapuram to 48.03% in Alappuzha, the mean percentage of disease incidence being 24.05%

It is possible to keep the disease under check and contain it within the present eight districts of its occurrence by the total removal of all the diseased palms irrespective of their age. The total number of such palms to be removed comes to 2.45 crores. A planned programme to undertake this massive operation is to be undertaken so that the disease spread is restricted to eight districts. The financial requirement involved and operational strategy to be followed are to be formulated taking into account the on going efforts in bringing down the damage due to root (wilt) disease, being implemented by different agencies.

In the remaining six districts where the disease intensity is rather high, removal of diseased young palms in the pre-bearing age and older ones in advanced stages of the disease is worth undertaking since these palms are unlikely to respond to any treatment.

While the efforts to identify varieties resistant to the disease are being intensified, there are no better methods right now than eliminating the foci of infection which can help to reduce the spread of the disease and to maintain the remaining palms at optimum level of management so that the returns to the farmer from cococut are improved and the total production of coconut in the state goes up.

Table - 1

## COCONUT ROOT (WILT) SURVEY - DISTRICT-WISE DETAILS

Sl.No.	Particulars	TVM	QLN	PTA	ALLIPPY	KTM	IDK	EKM	TCR	Total
1.	No. of Panchayats surveyed	89	8	6	8	8	5	9	105	
2.	No. of enumerators engaged	1802	155	88	168	149	102	161	175	
3.	No. of households covered	548506	47505	23681	43839	25436	15437	45967	374366	
4.	Palm Population									
a.	Total No. of Root (wilt) Free Palms ('000 Nos.)	20464	9306	3949	7372	5416	4135	10258	1660	77460
b.	Total No. of disease Early Palms ('000 Nos.)	252	1970	1621	4756	2406	1264	3594	687	16550
c.	Total No. of Disease Advanced Palms ('000 Nos.)	185	1294	779	2057	980	825	1461	407	7988
d.	Total No. of Palms ('000 Nos.)	20901	12570	6349	14185	8802	6224	15313	17654	101998
e.	Percentage of disease incidence	2.09	25.97	37.80	48.03	38.46	33.56	33.01	6.19	24.05

Table - 2

### YEAR-WISE AREA, PRODUCTION AND AVERAGE YIELD OF COCONUT IN KERALA

Year	Area in '000 ha.	Production in Million nuts	Average yield (Nos. per/kg.)
1	2	3	4
1957-58	463.27	3199	6832
1958-59	475.68	3248	6832
1959-60	492.54	3365	6430
1960-61	500.76	3220	6430
1961-62	504.82	3247	6130
1962-63	539.26	3305	5985
1963-64	554.99	3262	5864
1964-65	558.99	3273	5864
1965-66	586.31	3293	5616
1966-67	609.58	3425	5618
1967-68	636.72	3593	5625
1968-69	686.06	3834	5588
1969-70	707.84	3956	5589
1970-71	719.14	3981	5536
1971-72	730.26	4054	5539
1972-73	745.43	3921	5260
1973-74	744.83	3703	4972
1974-75	748.17	3719	4971
1975-76	692.95	3439	4963
1976-77	694.99	3348	4817
1977-78	673.48	3053	4533
1978-79	660.63	3211	4860
1979-80	662.66	3032	4576

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1	2	3	4
1980-81	651.37	3008	4618
1981-82	652.88	3024	4632
1982-83	674.38	3184	4721
1983-84	682.28	26.2	3814
1984-85	687.48	3453	5000
1985-86	704.68	3377	4792
1986-87	706.11	3173	4494
1987-88	775.37	3346	4315
1988-89	866.47	3841	4432
1989-90	832.17	4358	5017
1990-91	870.02	4232	5289
1991-92	863.06	4641	5377
1992-93	877.01	5124	5843
1993-94	882.29	5129	5885
1994-95	911.00	5335	5856
1995-96	982.10	5905.7	6013

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Table - 3

**REPORT ON COCONUT ROOT (WILT) SURVEY**  
(Panchayat wise)

**THIRUVANANTHAPURAM**

Sl. No.	Name of Local body	Rootwilt free palms	Disease early palm	Disease advanced palms	Total palms	% of disease incidence
1	2	3	4	5	6	7
1.	Kodappanakkunnu	138540	2	1	138543	-
2.	Vattiyookavu	226972	6	3	226981	-
3.	Ulloor	191226	363	160	191749	0.27
4.	Kadakampally	164314	11	-	164325	-
5.	Attingal Municipality	230024	5769	3888	239681	4.029
6.	Vakkom	150218	3783	2694	15695	4.133
7.	Azhoor	251179	1879	1033	254091	1.146
8.	Mudakkal	259002	3869	4457	267328	3.115
9.	Kizhivillam	207224	5015	1077	213316	2.855
10.	Kadakkavoor	175770	9368	3210	188345	6.678
11.	Angeno	67814	3648	585	72047	5.875
12.	Chirayinkeezhua	174181	14334	7168	195683	10.988
13.	Balaramapuram	287516	6	-	287522	-
14.	Pallichal	283850	-	-	283850	-
15.	Vilavoorkal	150278	-	-	150278	-
16.	Nemom	278910	5	-	275615	-
17.	Vilappil	303274	-	-	303274	-
18.	Murukil	181642	-	-	181642	-
19.	Maranalloor	334140	1	-	334141	-
20.	Kalliyoor	278957	-	-	278957	-
21.	Varkala	216700	2500	1815	221015	1.952
22.	Edava	140611	781	576	141968	0.956
23.	Elakamon	198206	2109	1166	201481	1.625
24.	Chemmaruthy	265611	1927	665	268203	0.966
25.	Vettoor	143640	691	870	145201	1.075
26.	Cherunniyoor	174330	8205	3568	186103	6.326
27.	Othoor	136122	1652	997	138771	1.946

1	2	3	4	5	6	7
28.	Manampoor	216848	1641	1097	219586	1.246
29.	Aryancode	172115	163	157	172335	0.185
30.	Ottasekharamangalam	121154	308	285	121747	0.487
31.	Kallikkad	98008	2	2	98012	-
32.	Amboori	75172	4200	1483	80555	7.054
33.	Vellarada	174986	1287	898	177171	1.233
34.	Perumkadavila	233836	3	-	233839	-
35.	Kunnathukal	338797	32	12	338841	0.012
36.	Kollayil	175900	-	-	175900	-
37.	Perumpazhuthoor	306449	136	61	386646	0.064
38.	Andoorkonam	366404	4225	3195	373824	1.984
39.	Pthencode	260462	1331	414	262207	0.665
40.	Kazhakkuttom	260602	101	11	260714	0.043
41.	Attipra	183751	47	-	183798	0.025
42.	Mangalapuram	389562	491	349	390402	0.215
43.	Kadinakulam	238928	10	-	238938	0.004
44.	Sreekariyam	366434	847	972	368253	0.493
45.	Kattakkada	287557	788	769	289114	0.538
46.	Poovachal	269119	2043	1326	272488	1.236
47.	Kuttichal	164157	3769	1966	169892	3.375
48.	Vellanad	322154	3049	1646	326849	1.457
49.	Aryanad	184172	3319	3823	191316	3.733
50.	Uzhamalakkal	148441	2282	2520	153243	3.133
51.	Tholikkode	134659	7393	5041	147093	8.453
52.	Uzhamalakkal	148441	2282	2520	153243	3.133
53.	Vithura	110635	3165	2830	116630	5.14
54.	Pangode	138877	8127	7209	154215	9.944
55.	Kallara	158931	25255	14003	198189	15.808
56.	Vamanapuram	161744	5829	7074	174647	7.388
57.	Nellanad	155752	3949	4206	163907	4.975
58.	Pullampra	167630	6930	5150	179710	6.722
59.	Manickal	192536	7061	5784	205381	6.254
60.	Nanniyode	187748	5916	6698	200362	6.295
61.	Peringammala	176406	8330	6422	191158	7.717
62.	Karavaram	249132	6388	6972	262492	5.089

1	2	3	4	5	6	7
63.	Kilimanoor	196447	4098	4938	205483	4.397
64.	Nagaroor	290280	10448	10224	310952	6.648
65.	Pazhayakunnummel	209934	5149	12376	227459	7.705
66.	Madavoor	205126	2603	3162	210891	2.734
67.	Pulimath	216583	21652	10718	248953	13.002
68.	Pallickal	151380	4216	2486	158082	4.239
69.	navaikulam	343265	1969	2025	347259	1.150
70.	Karakulam	386216	335	339	386890	0.174
71.	Aruvikkara	239865	448	417	240730	0.359
72.	Vembayam	301238	779	807	302824	0.524
73.	Panavoor	132557	8825	7225	148607	10.800
74.	nedumangad	206486	3318	5015	214819	3.879
75.	Parassala	166721	31	-	166752	0.018
76.	Karode	284217	1	-	284218	-
77.	Kulathoor	316421	-	-	316421	-
78.	Poovar	173201	30	40	173271	0.040
79.	Thirupuram	300984	391	51	301426	0.146
80.	Chenkai	348943	1014	262	350219	0.364
81.	Athiyannoor	210767	-	-	210767	-
82.	Kanjiramkulam	232623	-	-	232623	-
83.	Vizhijam	195422	-	-	195422	-
84.	Neyyattinkara	88816	-	-	88816	-
85.	Kottukal	344274	-	-	344274	-
86.	Karumkulam	194326	-	-	194326	-
87.	Venganoor	339572	-	-	339572	-
88.	Thiruvallam	480801	-	-	480801	-

Table - 4

**REPORT ON COCONUT ROOT (WILT) SURVEY  
(Panchayat Wise)**

**KOLLAM**

Sl. No.	Name of Panchayat	RWF Nos.	DE Nos.	DA Nos.	TOTAL Nos.	%
1.	Thekkumbhagom	135903	17687	13964	167554	18.890
2.	Pathanapuram	56745	3441	2943	63129	10.113
3.	Eravipuram	86580	44948	31632	163160	46.936
4.	Momtro Island	129609	21222	16722	167433	22.662
5.	Vettikkavala	210763	11148	10298	232209	9.236
6.	Kulathupuzha	83369	20498	12123	115990	28.124
7.	West Kallada	122046	33680	14729	170455	28.400
8.	Soorand South	129453	49418	30261	209132	38.100

Table - 5

**REPORT ON COCONUT ROOT (WILT) SURVEY  
(Panchayat Wise)**

**PATHANAMTHITTA**

Sl. No.	Name of Panchayat	RWF Nos.	DE Nos.	DA Nos.	TOTAL Nos.	%
1.	Anicadu	49956	24949	9406	84311	40.748
2.	Kozhencherry	35680	15356	5193	56229	36.545
3.	Kadapra	121285	43865	19399	184549	34.280
4.	Pazhavangadi	54726	26785	7273	88784	38.861
5.	Kadampanad	74670	29749	21968	126387	40.920
6.	Adoor	58576	21350	14667	94593	38.076

Table - 6

**REPORT ON COCONUT ROOT (WILT) SURVEY  
(Panchayat Wise)**

**ALAPPUZHA**

Sl. No.	Name of Panchayat	RWF Nos.	DE Nos.	DA Nos.	TOTAL Nos.	%
1.	Perumbalam	69491	24242	3993	97726	28.292
2.	Kadukkara	117910	61885	17491	197286	40.234
3.	Kanjikuzhy	110070	81691	52520	244281	54.941
4.	Kainakary	91133	56598	12710	160441	43.198
5.	Cheppad	136164	58591	24241	218996	37.824
6.	Palamel	74459	31585	27773	133817	44.358
7.	Chettikulangara	86717	162840	67012	316569	72.607
8.	Thiruvanvandoor	90056	23153	10749	123958	27.350

Table - 7

**REPORT ON COCONUT ROOT (WILT) SURVEY  
(Panchayat Wise)**

**KOTTAYAM**

Sl. No.	Name of Panchayat	RWF Nos.	DE Nos.	DA Nos.	TOTAL Nos.	%
1.	Ettumanoor	74393	52582	24155	151130	50.775
2.	Kallara	73823	26031	11144	110998	33.492
3.	Vazhappally	84974	15263	11354	111591	23.852
4.	Bharananganam	77195	9532	7111	93838	17.736
5.	Poonjar	39567	9090	6200	54857	27.872
6.	Panachikkad	81713	88915	8111	128739	75.366
7.	Uzhavoor	88879	56348	7746	152973	41.899
8.	Parathodu	42158	42155	26031	110344	61.794

Table - 8

**REPORT ON COCONUT ROOT (WILT) SURVEY  
(Panchayat Wise)**

**IDUKKI**

Sl. No.	Name of Panchayat	RWF Nos.	DE Nos.	DA Nos.	TOTAL Nos.	%
1.	Kudayathur	16932	22836	6094	45862	63.081
2.	Pampadumpara	127881	12527	2726	143134	10.731
3.	Vandiperiyar	36197	1642	475	38314	5.525
4.	Bisonvalley	41540	22571	7022	71133	41.602
5.	Karimannoor	175000	62000	63000	300000	41.666

Table - 9

**REPORT ON COCONUT ROOT (WILT) SURVEY  
(Panchayat Wise)**

**ERNAKULAM**

Sl. No.	Name of Panchayat	RWF Nos.	DE Nos.	DA Nos.	TOTAL Nos.	%
1.	Karukutty	208170	46938	26112	281220	25.976
2.	Vengoor	135723	42505	13280	191508	29.129
3.	Edavanakkad	46158	58092	15180	119430	61.351
4.	Thrikkakara	151834	20005	12218	184057	17.507
5.	Karumalloor	118851	51472	28829	199152	40.321
6.	Kavalangad	157685	29728	15043	202456	22.114
7.	Palakuzha	65509	49574	9888	124971	47.581
8.	Thiruvankulam	33701	24723	6354	64778	47.975
9.	N. Parur Municipality	64933	21176	13028	99137	34.502

Table - 10

**REPORT ON COCONUT ROOT (WILT) SURVEY  
(Panchayat Wise)**

**THRISSUR**

Sl. No.	Name of Panchayat	RWF Nos.	DE Nos.	DA Nos.	TOTAL Nos.	%
1	2	3	4	5	6	7
<b>1. Chalakkudy</b>						
1.	Chalakkudy(M)	159221	29587	10702	199510	20.194
2.	Kadukutty	127628	31426	21267	180321	29.222
3.	Kodassery	26559	15038	11999	289596	9.336
4.	Koratty	201451	13276	6647	221824	9.184
5.	Mellor	236167	14854	9103	260124	9.210
6.	Pariyarm	196761	32348	20536	249645	21.184
7.	Vettilappara	47813	826	795	49434	3.279
<b>2. Vellangallur</b>						
8.	Padiyoor	208530	34393	14197	257120	18.898
9.	Poomagalam	83297	22572	8001	113870	26.849
10.	Puthenejra	184155	15939	8125	208219	11.557
11.	Vellangallur	265430	38792	10845	315067	15.754
12.	Velookara	218193	22590	68644	309427	29.485
<b>3. Irinjalakuda</b>						
13.	Iringalakuda	101652	25304	13025	139981	27.382
14.	Karalam	159116	14743	3925	177784	10.500
15.	Kattoor	119699	12675	12409	144783	17.325
16.	Muriyad	167568	10013	5033	182604	8.240
17.	Parappukara	199115	12374	6827	218316	8.795
18.	Porathissery	172484	12300	5400	196184	9.022
19.	Aloorr	297943	41512	6767	346222	13.945
20.	Annamanada	254474	37275	16529	308278	17.453
21.	Kuzhur	191858	15859	11744	219461	12.578
22.	Mala	227302	20505	61473	309280	26.506
23.	Poyya	188236	16518	9422	214175	

1	2	3	4	5	6	7
4. Kodungallur						
24.	Edavilangud	137800	4447	1992	-	-
25.	Eriyad	259756	51266	6132	-	-
26.	Kodungallur	151535	3415	2200	-	-
27.	Methala	74400	5600	500	-	-
5. Mathilakam						
28.	Edathiruthy	313603	16553	6205	336361	6.75
29.	Kaipamangalam	222933	15759	4332	243024	8.26
30.	Mathilakam	227872	13812	4047	245731	7.26
31.	Perinjam	204904	19829	6170	230903	11.26
32.	S.N. Puram	309901	19590	5713	335204	7.55
6. Cherpu						
33.	Avinissery	77253	-	-	77258	-
34.	Cherpu	171802	1340	775	173917	1.216
35.	Koorkanchery	98226	-	-	98226	-
36.	Ollur	118721	-	-	118721	-
37.	Paralam	101020	167	350	101537	0.509
38.	Vallachira	66492	2803	1800	71095	6.474
7. Anthikad						
39.	Anthikad	179051	303	64	179418	0.2
40.	Chazhoor	222063	4553	2091	228732	2.904
41.	Manaloor	250431	24	20	250525	0.0176
42.	Thanniyam	259934	3879	2222	266035	2.293
8. Thalikulam						
43.	Engandiyoor	187008	-	-	187008	-
44.	Nattika	121353	12	18	121383	0.025
45.	Thalikulam	157304	-	-	157304	-
46.	Valappad	293929	4585	1305	299819	1.965
47.	Vatanappilly	194047	-	-	194047	-
9. Kodakara						
48.	Alagappanagar	109463	518	346	113167	0.763
49.	Kodakara	215658	8850	5259	229767	6.141
50.	Mattathur	294052	12021	3051	309124	4.876

1	2	3	4	5	6	7
51.	Nenmanikkara	101285	527	399	102211	0.906
52.	Pudukkad	127812	2359	524	130695	2.206
53.	Trikkur	127227	1025	333	126585	1.056
54.	Varantharappilly	242050	2067	3363	24748	21.941
10. Wadakkanchery						
55.	Dosamang alam	61787	-	-	61787	-
56.	Erumapetty	118688	-	-	118688	-
57.	Kodangodo	149281	-	-	149281	-
58.	Mullurkkara	69343	-	-	69343	-
59.	Mundathicode	106163	-	-	106163	-
60.	Thekkumkara	161505	-	-	161505	-
61.	Varavoor	89806	4	3	89813	0.008
62.	Vellor	170724	40	-	170764	-
63.	Wadakkanchery	143553	-	-	143553	-
64.	Chelakkara	160022	-	-	160022	-
65.	Kondazhi	87162	-	-	87162	-
66.	Panjal	82441	-	-	82441	-
67.	Pazhayannur	130907	-	-	130907	-
68.	T. Mala	78074	-	-	78074	-
69.	Vallathol Nagar	63734	-	-	63734	-
11. Chowannur						
70.	Kunnamkulam (M)	43040	-	-	43040	-
71.	Purkulam	76939	-	-	76939	-
72.	Kadavallur	177212	-	-	177212	-
73.	Kattakampal	150504	-	-	150504	-
74.	Chowannur	116615	-	-	118615	-
75.	Choondal	179358	-	-	179358	-
76.	Arthat	137687	-	-	137687	-
77.	Kandanisery	153205	-	-	153205	-
12. Pavaratty						
78.	Elavally	153935	-	-	153935	-
79.	Pavaratty	159219	-	-	159219	-
80.	Mullassery	134095	-	-	134095	-
81.	Venkitangu	229632	-	-	229632	-

1	2	3	4	5	6	7
13. Puzhakkal						
82.	Adat	100766	-	-	100766	
83.	Arimpur	125657	-	36	125694	
84.	Ayyanthole	76810	-	-	76810	
85.	Tholur	102555	-	-	102555	
86.	Kaimparamba	119439	-	-	119459	
87.	Avannr					
88.	Killannur					
89.	Chavakkad	162400	-	-	162400	
90.	Guruvayoor	100442	-	-	100442	
91.	Kodappuram	137617	-	-	137617	
92.	Orumanayoor	84062	-	-	84062	
93.	Pookode	268587	-	-	268587	
94.	Punnayoor	244964	-	-	244964	
95.	Punnayurkulam	164000	-	-	164000	
96.	Thaikkad	93200	-	-	93200	
97.	Vadakkokad	178544	-	-	178544	
14. Ollukkara						
98.	Thrissur (M)	108158	-	4	108162	-
99.	Kolazhy	81113	197	-	81310	-
100.	Vilvattam	56963	63	20	67046	0.124
101.	Madakkathara	121569	11	3	121583	0.012
102.	Nadathara	133869	145	-	134014	-
103.	Pananchery	278673	16	105	278794	0.043
104.	Puthur	248716	315	2	249083	0.127
105.	Ollukkara	106072	10	-	106082	-

## COUNTRY WISE AREA AND PRODUCTION OF COCONUT

Year	Indonesia		Philippines		India		Srilanka	
	Area	Production	Area	Production	Area	Production	Area	Production
1	2	3	4	5	6	7	8	9
1988-89	3284	11107	3110	11810	1426	8541	419	2484
1989-90	3394	11658	3112	11940	1472	9359	419	2532
1990-91	3405	11686	3093	11291	1514	9700	419	2184
1991-92	3583	12555	3077	11405	1529	10080	419	2296
1992-93	3593	12547	3075	11328	1538	11240	419	2164

Year	Thailand		Malaysia		Others		Total	
	Area	Production	Area	Production	Area	Production	Area	Production
1	10	11	12	13	14	15	16	17
1989-89	397	1150	326	839	1701	9733	10663	45664
1989-90	393	1140	323	989	1717	9645	10830	47220
1990-91	389	1103	320	770	1569	9764	10709	45998
1991-92	389	1103	315	883	1603	9714	10915	48036
1992-93	336	1128	310	800	1580	9706	10851	49028

Source- Coconut Development Board

## Annexure - II

## AREA UNDER COCONUT AND PERCENTAGE SHARE OF DIFFERENT STATES ('000 HA)

STATE	1980-81	81-82	82-83	83-84	84-85	87-88	88-89	89-90	90-91	91-92	92-93	93-94
Kerala	666.2 (61)	66.6 (61)	655.5 (59)	682.3 (59)	689.3 (58)	775.4 (58)	816.9 (57)	832.2 (57)	854.1 (55)	846.3 (54)	877.0 (54)	881.6
Karnathaka	171.5 (16)	176.4 (16)	178.9 (16)	190.3 (16)	193.9 (16)	213.1 (16)	220.3 (15)	226.3 (15)	232.9 (15)	238.6 (16)	238.6 (15)	252.2 (15)
Tamil Nadu	116.0 (11)	116.2 (11)	143.0 (13)	137.1 (12)	152.8 (13)	189.5 (14)	214.2 (15)	225.9 (15)	226.4 (15)	240.3 (15)	249.0 (15)	270.3 (17)
Andhra Pradesh	42.4 (04)	43.3 (04)	44.6 (04)	46.6 (04)	47.0 (04)	48.5 (04)	52.0 (04)	59.0 (04)	61.2 (03)	63.4 (04)	71.7 (04)	79.9 (05)
Sub Total	996.1 (92)	1002.5 (92)	1025.0 (92)	1056.2 (91)	1083.0 (91)	1226.5 (91)	1303.4 (91)	1343.4 (91)	1384.6 (91)	1388.6 (91)	1471.9 (91)	1484.0 (91)
Non traditional states	87.2 (08)	88.3 (08)	88.3 (08)	109.4 (09)	109.8 (09)	119.5 (09)	122.1 (09)	128.8 (08)	129.3 (09)	149.3 (09)	145.7 (09)	147.6 (09)
TOTAL	1083.3 (100)	1090.8 (100)	1113.3 (100)	1165.6 (100)	1192.8 (100)	1346.0 (100)	1425.5 (100)	1472.2 (100)	1513.9 (100)	1537.9 (100)	1617.6 (100)	1631.6 (100)

Figures in brackets are percentage share of states

Source : Directorate of economics and Statistics, Government of India

## Annexure - III

## PRODUCTION OF COCONUT-INDIA (MILLION NUTS)

STATE	1980-81	81-82	82-83	83-84	84-85	87-88	88-89	89-90	90-91	91-92	92-93	93-94	% in-crease
Kerala	3036.4 (53)	3005.7 (54)	2444.3 (43)	2602.0 (45)	3395.0 (49)	3346.0 (46)	4215.0 (49)	4357.6 (46)	4527.3 (470)	4206.1 (42)	5236.2 (46)	5586.4 (45)	84
Karnataka	890.0 (16)	917.6 (16)	930.1 (16)	990.9 (17)	1011.1 (15)	1096.5 (15)	1134.6 (13)	1156.5 (12.5)	1201.6 (12)	1227.6 (12)	1251.19 (11)	1340.8 (11)	51
Tamil Nadu	1132.0 (20)	1019.2 (18)	1650.0 (29)	1368.1 (24)	1627.5 (24)	1578.5 (22)	1917.8 (22)	2312.4 (24)	2358.3 (27)	2755.8 (25)	2817.3 (27)	3281.9 (27)	190
Andra Pradesh	175.3 (03)	178.9 (03)	178.8 (03)	192.4 (03)	194.5 (03)	480.3 (07)	511.2 (06)	564.8 (07)	730.6 (7.5)	959.2 (9.5)	1081.3 (9.5)	1103.5 (9)	529
Sub Total	5233.7 (91)	5121.4 (92)	5203.2 (92)	5153.4 (89)	6228.1 (90)	6501.3 (89.4)	7778.6 (91.1)	8491.3 (91.6)	8817.8 (90.9)	9148.7 (90.7)	10386.7 (91.3)	11312.6 (91.60)	116
Non tradi-tional states	486.3 99)	462.0 (8)	461.1 (8)	645.5 (11)	659.2 (10)	768.8 (10.6)	762.8 (8.9)	877.5 (8.4)	882.4 (9.1)	930.9 (9.3)	988.2 (8.7)	1042.4 (8.4)	114
TOTAL	5720.0 (100)	5583.4 (100)	5664.3 (100)	5807.9 (100)	6887.3 (100)	7270.1 (100)	8541.4 (100)	9368.8 (100)	9700.2 (100)	10079.61 (100)	1374.9 (100)	12355.0 (100)	116

Figures in brackets are Percentage to total

Source: Directorate of Economics and Statistics, Government of India

## Annexure - IV

## PRODUCTIVITY OF COCONUT (NUTS/HA)

STATE	1980-81	81-82	82-83	83-84	84-85	87-88	88-89	89-90	90-91	91-92	92-93	93-94	% in- crease
Kerala	4558	4509	3712	3813	4925	4315	516	5236	5239	4970	5738	6336	39
Karnataka	5190	5202	5199	5207	5215	5145	5150	5155	5159	5145	5247	5316	2
Tamil Nadu	9758	8771	11533	9979	10650	8329	8953	10192	10417	11468	11314	12142	28
Andhra Pradesh	4134	4132	4009	4138	4138	9842	9831	11098	11938	15129	15080	13811	234
Southern States	5911	5654	6113	5784	6232	6908	7274	7920	8118	9178	9347	9401	59
India(*)	5280	5109	5008	5084	5774	5401	5992	6357	6407	6593	7032	7572	43

(\*) Includes non-traditional states also

Source : Directorate of Economics and statistics, government of India

## Annexure - V

**PRODUCTIVITY OF COCONUT IN INDIA 1993-94 (NUTS/HA.)**

State/UTs	Productivity	Ranking
Andhra Pradesh	13811	4
Assam	6615	7
Goa	4669	11
Karnataka	5316	10
Kerala	6336	8
Maharashtra	18797	1
Orissa	5716	9
Tamil Nadu	12142	5
Tripura	434	13
West Bengal	14706	3
Andaman	3496	12
Lekshadweep	9393	6
Prondicherry	16526	2
All India	7572	-

## Annexure - VI

**PRICE TREND OF COCONUT COPRA AND COCONUT OIL  
IN KERALA FOR THE LAST 13 YEARS FROM 1983**

Year	Coconut (Rs.per 1000 nuts)	Copra (rs./Qnti.)	Coconut Oil (Rs./Qnti.)
1983	1770	1362	2089
1984	3150	2186	3348
1985	1950	1300	2011
1986	1850	1404	2169
1987	2900	1799	3030
1988	3150	2099	3119
1989	2410	1595	2465
1990	2760	1802	2755
1991	3950	2680	4147
1992	4460	3055	4642
1993	4030	2646	4042
1994	3430	2188	3328
1995	3600	2341	3555

Source: Market Wing of Department of Agriculture.

Annexure - VII

**PRICE TREND OF VEGETABLE OIL (RS/QTL)**

(Average wholesale price from April to July)

Name of Oil	1985-86	86-87	87-88	88-89	89-90	90-91	91-92	92-93	93-94	94-95	% Change Over 1985-86
Groundnut	1520	2047	2466	2004	2323	2906	3562	3072	3207	3207	129
Mustard	1189	1637	2315	1812	1775	2355	2909	2490	2663	2983	150
Safflower	1439	2023	2261	2065	2401	2485	3719	3275	3052	3288	128
Sesamum	2349	1918	2307	1797	2153	2656	3063	2680	2872	3427	46
Linseed	1128	1572	2242	1826	1728	2701	3004	2546	2546	2673	137
Coconut	1707	2433	3158	3061	2237	3039	4284	4576	3879	3523	106

(\*) Average wholesale price from April to July

Source:- Cocount Development Board

**PANCHAYATS SURVEYED IN  
COCONUT ROOT (WILT) SURVEY**

- Methodology : (1) Complete enumeration in all Panchayats and Municipal areas in the two border districts of Trichur and Trivandrum (84 panchayats and 5 Municipal areas in Trivandrum Dist.) (98 panchayats and 7 Municipal areas in Trichur Dist.)
- (2) Complete enumeration in 10% of the randomly selected panchayats (including Municipal areas) from each of the six districts. The following are the selected units :

Quilon	Pathanamthitta	Alleppey	Kottayam	Idukki	Ernakulam
1. Thekkumbhagam	Kadapra	Thiruvandur	Panachikadu	Kudayathoor	Edavankkad
2. Eravipuram	Anicadu	Chettikulangara	Vazhappally	Karimannur	Trikkakara
3. Mandro Island	Pazhayangadi	Cheppad	Ettumanoor	Pampadumpara	Karukutty
4. Vettikavala	Kozhencherry	Perumbalam	Kallara	Vandiperiyar	Thiruvankulam
5. Kulathupuzha	Adoor	Kadakarappally	Bharananganam	Bison Valley	Karumalloor
6. W. Kallada	Kadampanadu	Kanjikuzhi	Parathode		Vengoor
7. Sooranadu S.		Kainakery	Poonjar		Kavalangad
8. Pothupuram		Palamel	Uzhavoor		Palakuzha
					Parur
<b>(8/75+3)</b>	<b>(6/58+2)</b>	<b>(8/71+5)</b>	<b>(8/73+4)</b>	<b>(5/51+1)</b>	<b>(9/86+8)</b>
Total : 89 + 105 + 44 = 238					

## PROFORMA FOR THE CONDUCT OF SURVEY

Date	Sl.No.	Name & Address of the farmer	Survey No.	Area	Yield	Palms removed	Major diseases	Major pests
1	2	3	4	5	6	7	8	9

Coconut palm population													Garden mgmt. (*)				Remarks						
Pre-bearing			Bearing			Total			Organic	Chem.	Irrigation	Plant Protection											
<= 5 years	> 5 years		<= 15 years	15-50 years	>50 years				RWF	DE	DA	DE	RWF	DE	DA	Total							
10	11	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39

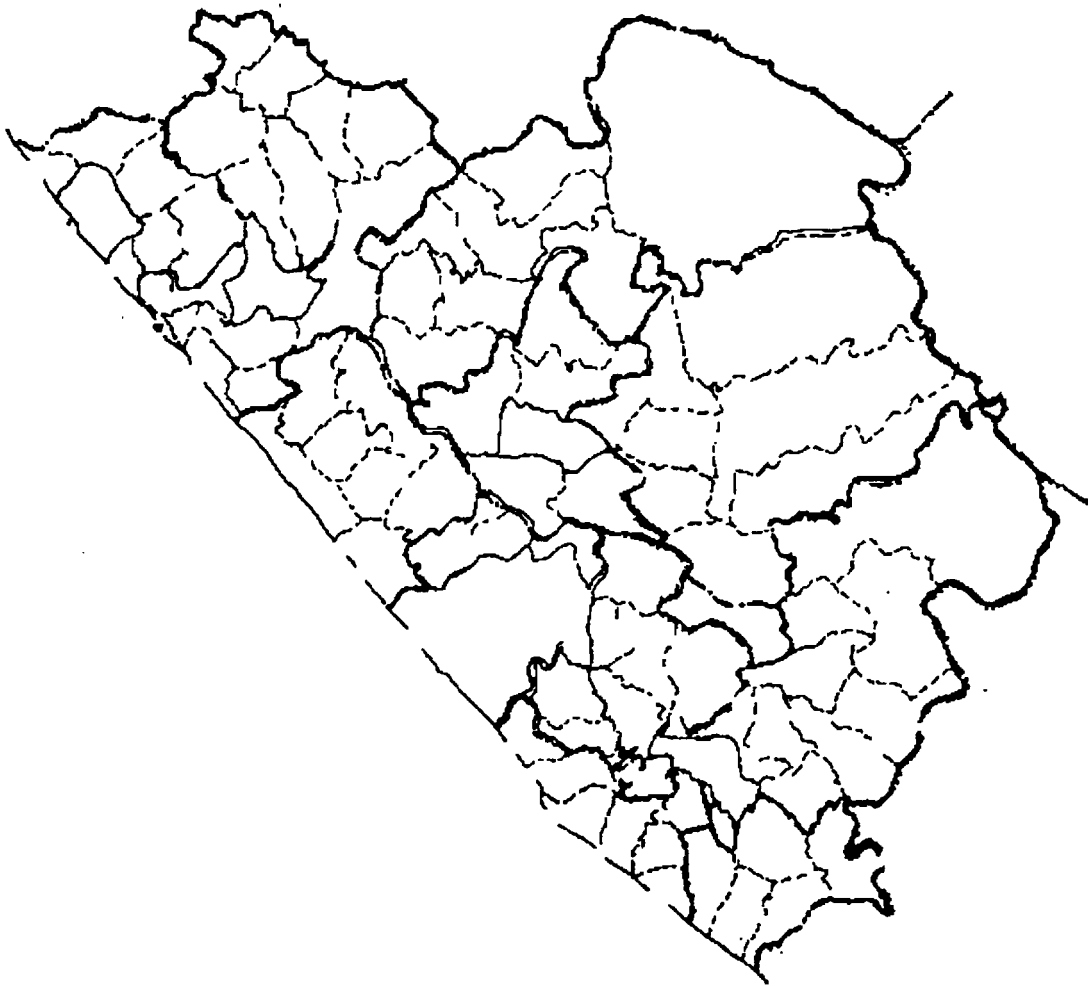
Legend

RWF - Root (wilt) free

DA - Disease Advanced

DE - Disease Early

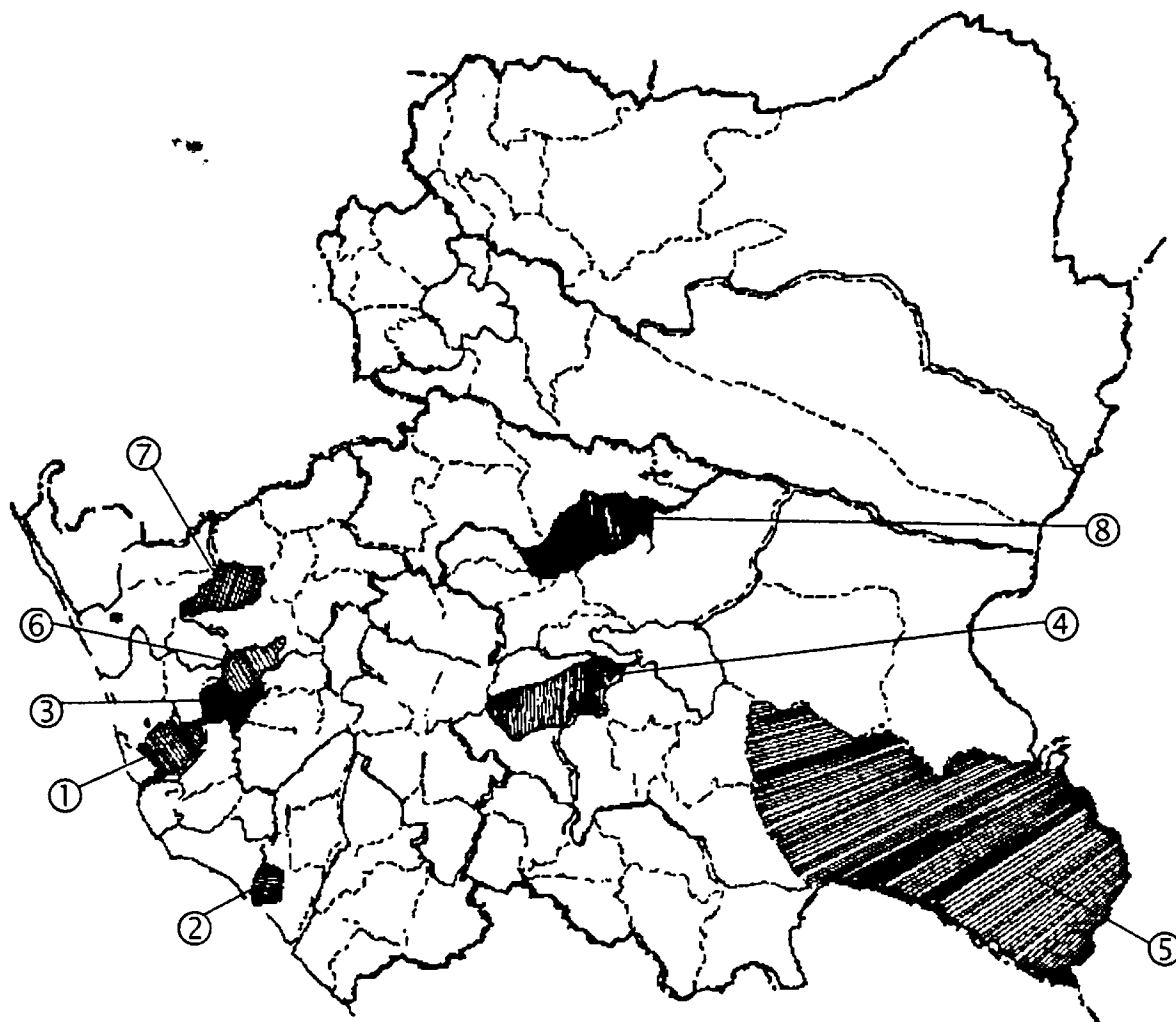
**ROOT WILT DISEASE - AREA SURVEYED**  
**THIRUVANANTHAPURAM**



Complete Enumeration in all  
84 Panchayats and 5 Municipal areas

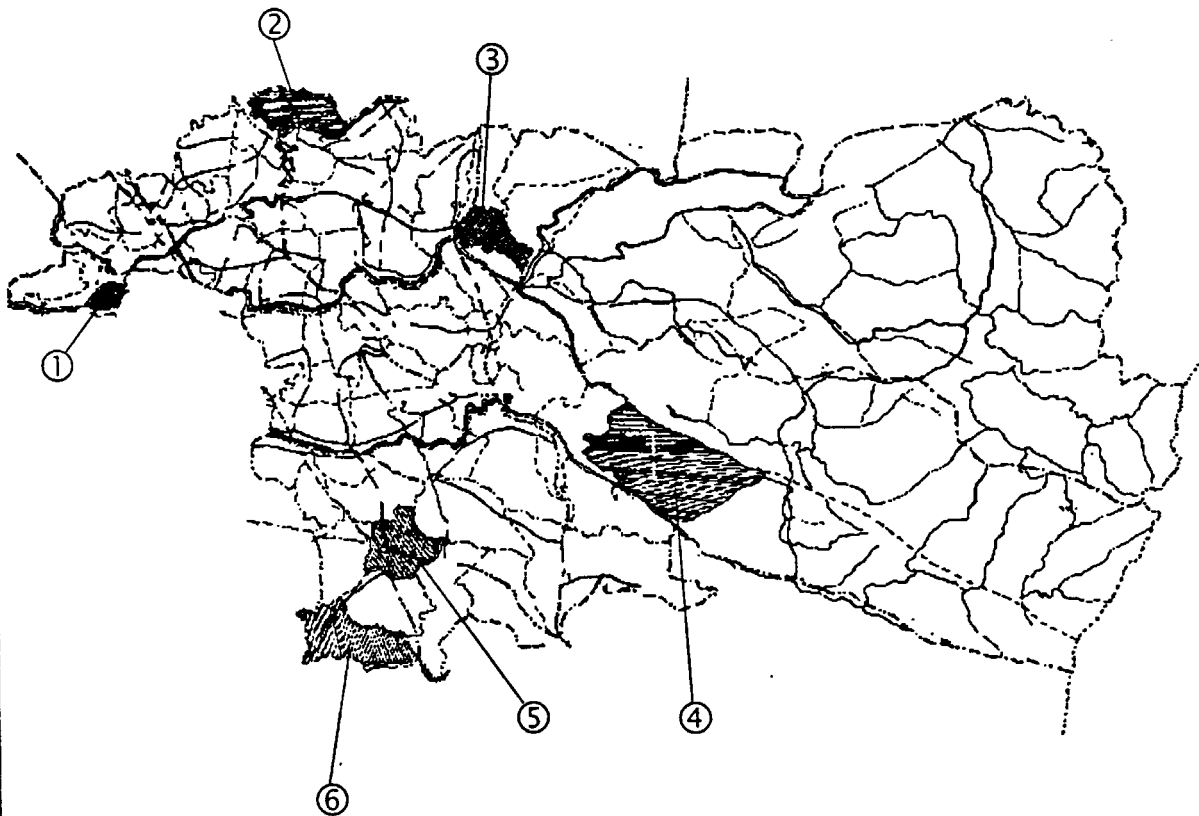
## ROOT WILT DISEASE - AREA SURVEYED

## KOLLAM



- ① Thekkumbhagam
- ② Eravipuram
- ③ Mandro island
- ④ Vattikavala
- ⑤ Kulathupuzha
- ⑥ W. Kallada
- ⑦ Sooranadu South
- ⑧ Pathanapuram

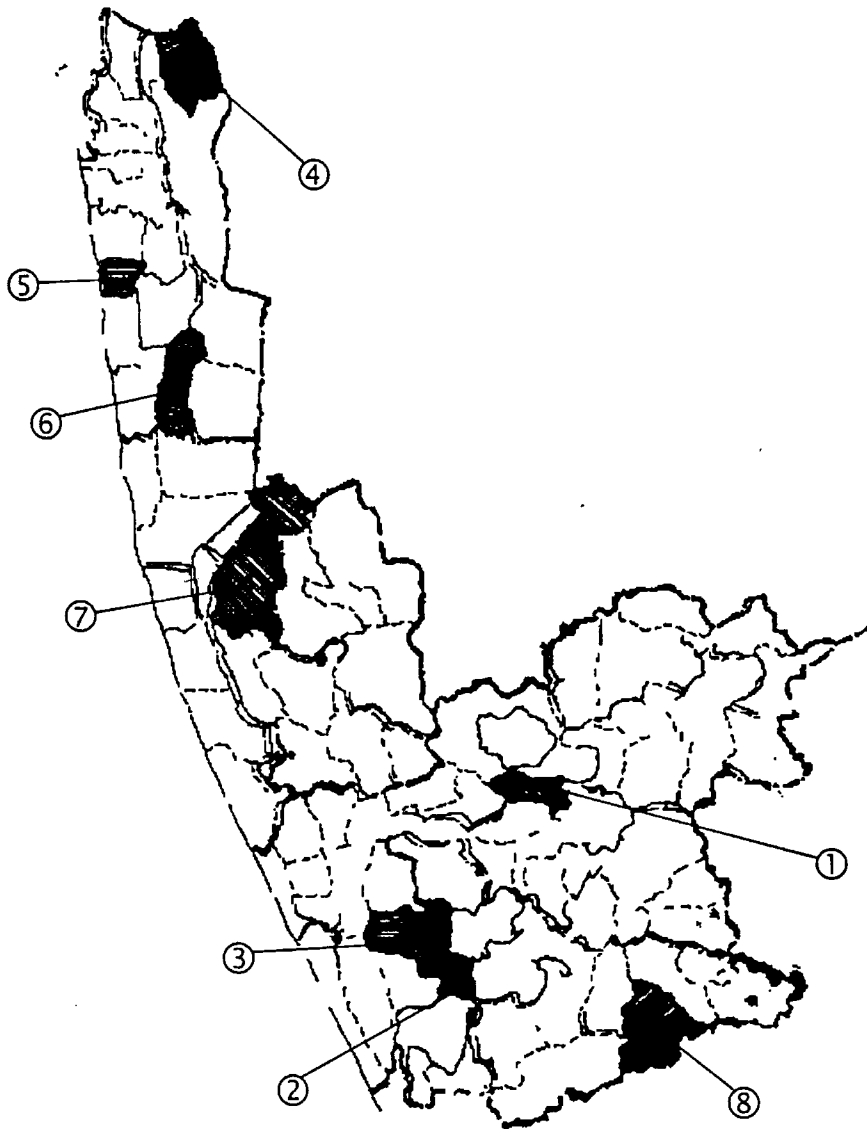
## ROOT WILT DISEASE - AREA SURVEYED PATHANAMTHITTA



- ① Kadapra
- ② Anicadu
- ③ Pazhayangadi
- ④ Kozhencherry
- ⑤ Adoor
- ⑥ Kadampanadu

## ROOT WILT DISEASE - AREA SURVEYED

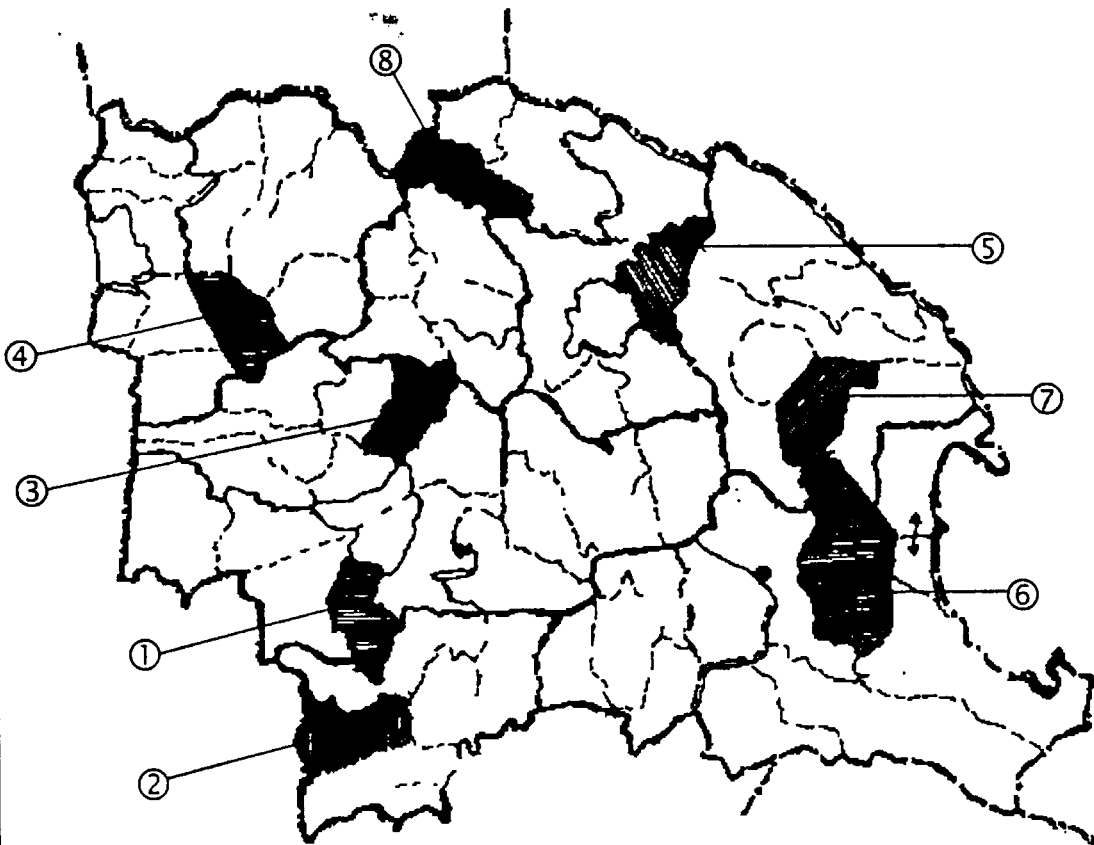
### ALAPPUZHA



- ① Thiruvandapur
- ② Chettikulangara
- ③ Cheppad
- ④ Perumbalam
- ⑤ Kadakarappally
- ⑥ Kanjikuzhi
- ⑦ Kainakery
- ⑧ Palamel

## ROOT WILT DISEASE - AREA SURVEYED

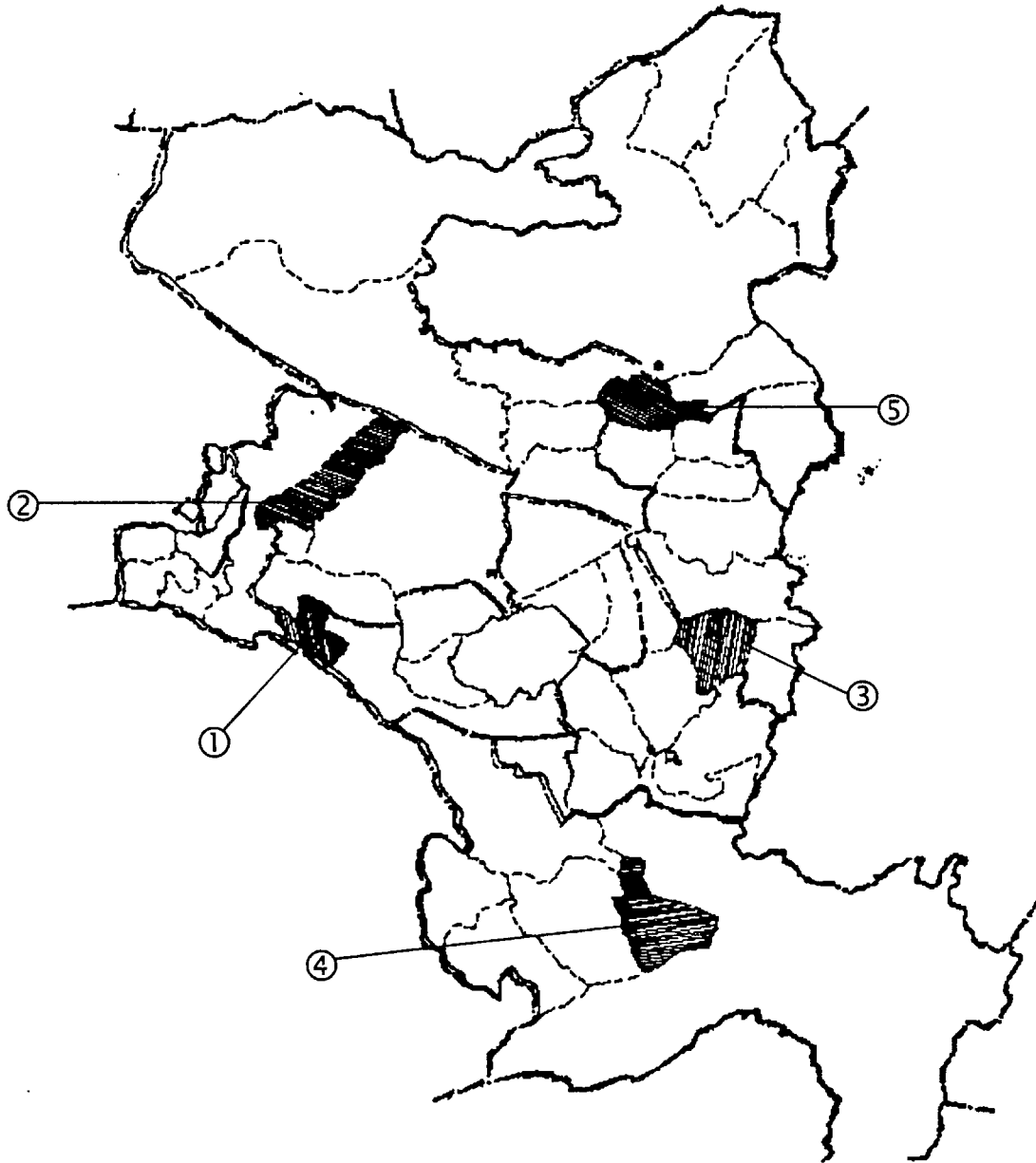
### KOTTAYAM



- ① Panachikadu
- ② Vazhappally
- ③ Ettumanoor
- ④ Kallara
- ⑤ Bharananganam
- ⑥ Parathode
- ⑦ Poonjar
- ⑧ Uzhavoor

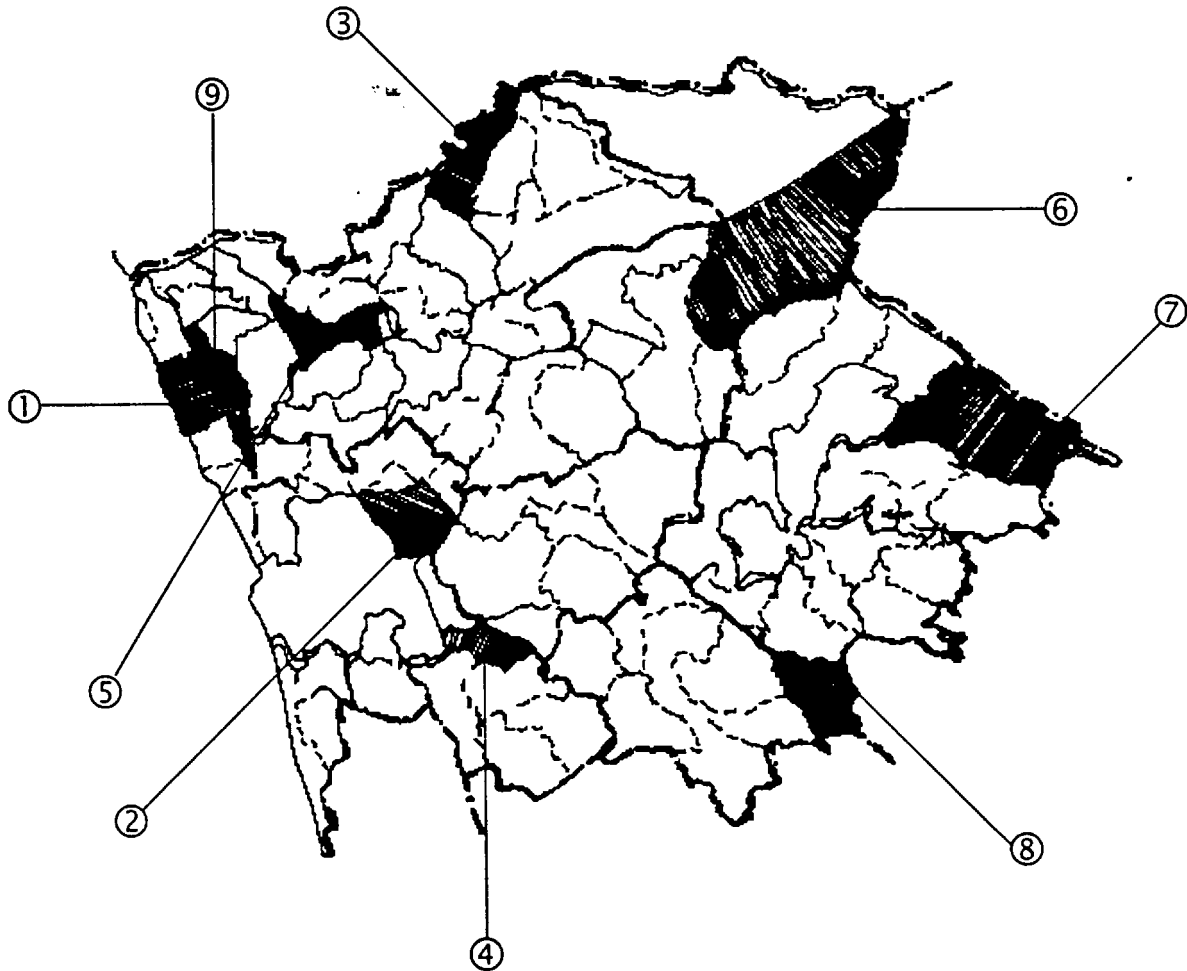
## ROOT WILT DISEASE - AREA SURVEYED

### IDUKKI



- ① Kudayathoor
- ② Karimannur
- ③ Pampadumpara
- ④ Vandiperiyar
- ⑤ Bison Valley

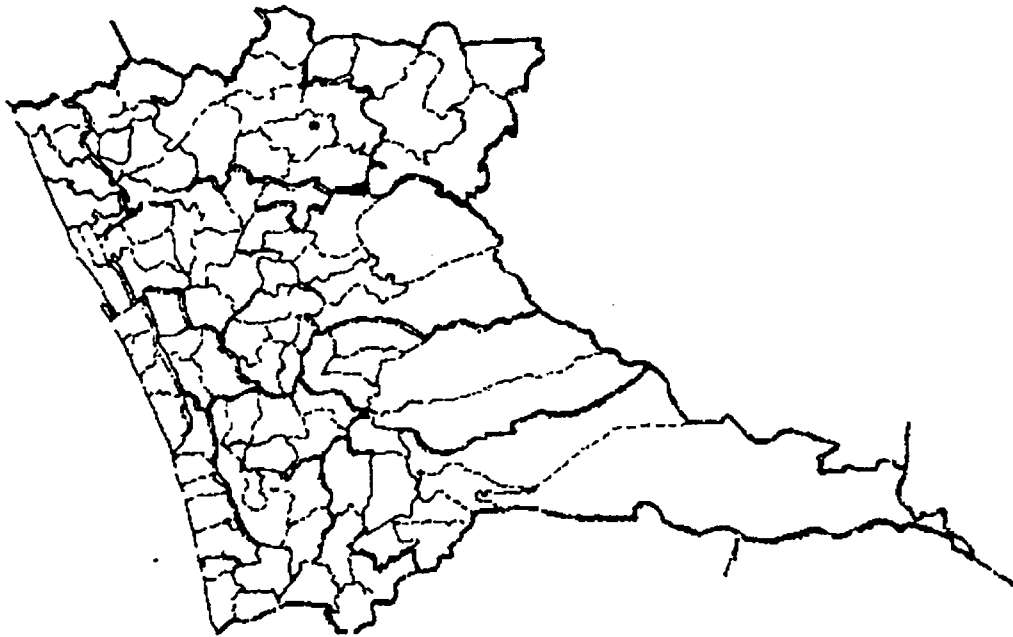
## ROOT WILT DISEASE - AREA SURVEYED ERNAKULAM



- ① Edavankkad
- ② Trikkakara
- ③ Karukutty
- ④ Thiruvankulam
- ⑤ Karumalloor
- ⑥ Vengoor
- ⑦ Kavalangad
- ⑧ Palakuzha
- ⑨ Parur

# ROOT WILT DISEASE - AREA SURVEYED

## THRISSUR



Complete Enumeration in all  
95 Panchayats and 7 Municipal areas