
MANAGEMENT OF COCONUT ROOT (WILT) DISEASE

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ABSTRACT

Coconut root (wilt) disease responds well to the management practices if the disease is in the early to middle stages. In the absence of a definite chemical control measure, a two-pronged approach was made namely to live with the disease in the heavily infested areas of southern Kerala and contain the disease in the mildly affected areas of northern Kerala and border districts of Tamil Nadu adjoining Kerala.

Integrated management increased nut yield from 28 to 51 nuts/palm/year within three years in mildly affected area and 23.4 nuts/palm/year on an average in disease affected area. Irrigation coupled with fertilizer application, plant protection measures and mixed cropping increased the yield of disease affected coconut garden from 17.6 to 46.0 nuts/palm/year.

In the mildly infected areas, the removal of disease affected palms irrespective of yield, continuous monitoring and removal helped to maintain almost disease free condition.

INTRODUCTION

Coconut root (wilt) disease reported over a century ago in Kerala is a slow debilitating disease but not lethal. Typical foliar symptoms of the disease are wilting and drooping of leaves, flaccidity, ribbing, yellowing and necrosis, coupled with shedding of buttons and immature nuts and reduction in the size and number of leaves. Often leaf rot caused by *Bipolaris halodes* is also associated with the disease which hastens the deterioration of the palms. Having established the mycoplasmal etiology, the possibility of sustaining the health and yield of the diseased palms is by adoption of integrated management practices.

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ORIGIN, DISTRIBUTION AND LOSS DUE TO ROOT (WILT) DISEASE

The root (wilt) disease of coconut has been known to be present in Southern Kerala and first reported from Erattupetta area of Meenachil Taluk in Kottayam District (Butler, 1908; Pillai, 1911). It is believed to have been significantly manifested since the great floods of 1882 (Menon and Pandalai, 1958). The disease which appeared more or less simultaneously in Thiruvalla and Kartikappally in Alleppey District began to spread to adjoining areas also (Varghese, 1934) and spread to about 24,000 ha of plantations in Meenachil, Thiruvalla, Kayangulam and Alleppey (Butler, 1908; Pillai, 1911). Varghese (1934) traced the occurrence of disease up to Cochin in the north and Kottarakara in the south. Pillai *et al.* (1973) reported contiguous distribution of disease in six districts, namely, Trivandrum, Quilon, Alleppey, Kottayam, Ernakulam and Trichur of Kerala State. A comprehensive survey was undertaken jointly by CPCRI, Agricultural Department and other agencies in 1984/85 to assess the extent and loss (Anonymous, 1985). This survey indicated prevalence of the disease in 4,10,000 ha in a contiguous manner in eight southern districts of Kerala. The intensity of the disease in both bearing and non-bearing categories of the palms was highest in Kottayam district (75.6 per cent) followed by Alleppey (70.7 per cent), Pathanamthitta (38.2 per cent), Ernakulam (34.5 per cent), Idukki (34.2 per cent) and Quilon (28.6 per cent). In the districts of Trichur and Thiruvananthapuram the percentage of disease incidence was 2.6 and 1.5, respectively (Fig. 74.1). It is also estimated that annual loss is about 968 million nuts. The loss in husk per nut of diseased palm was around 25.8 per cent and that of copra and oil per nut was 9 and 11.3 per cent respectively. The loss in revenue by sale of leaves is to the tune of 60 per cent.

The survey also revealed the sparse occurrence of the disease in some isolated pockets in the northern parts of Kerala, namely, Palghat, Malappuram, Kozhikode, Cannanore and Wynad far away from the contiguously diseased area bordered by Karuvannur river and Amballur-Varandarapalli road in Trichur district and adjoining districts of Tamil Nadu (Rethinam *et al.*, 1982; Radha *et al.*, 1981; Anonymous, 1986).

MANAGEMENT OF ROOT (WILT) DISEASE

Root (wilt) disease of coconut caused by Mycoplasma-like Organisms (MLO) has no definite control measures. However, the bearing palms which are in the initial to middle stages of disease intensity respond well to the management practices. Similarly, eradication in the mildly affected areas of Nadathara (Kerala) and Vallam (Senkottai) indicated that these areas are free from disease. Based on these evidences, the strategy developed to combat the disease is adoption of integrated management practices in the heavily affected contiguous tracts and removing the foci of infection in mildly affected areas by eradication of all diseased palms.

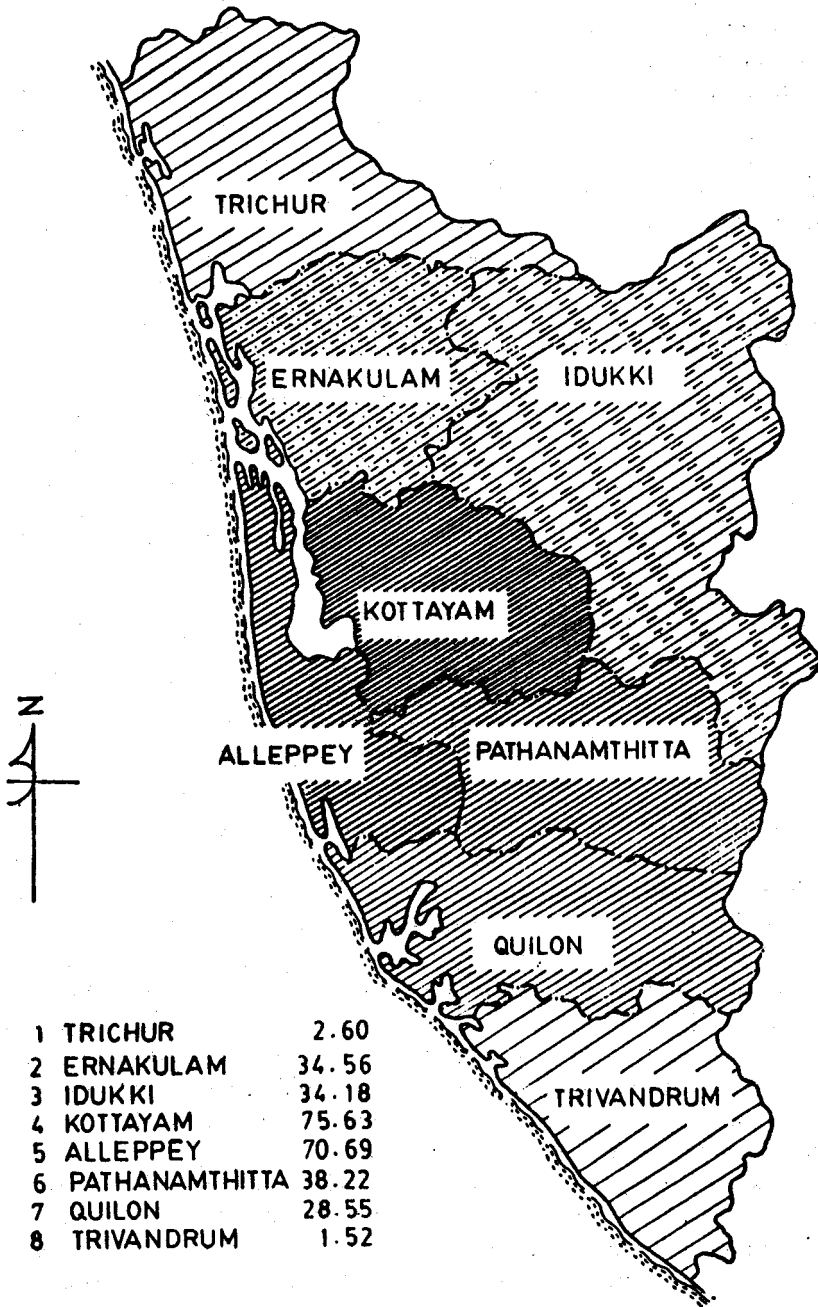


Fig. 74.1: Intensity of incidence of coconut root (wilt) disease in the contiguously affected districts of Kerala state.

Management Technologies

Managing the disease for sustained productivity of the palms has been well established (Sahasranaman *et al.*, 1964; Menon and Nayar, 1978; Sahasranaman *et al.*, 1983; Muralidharan *et al.*, 1986; Rajagopal *et al.*, 1987).

Mixed Farming: Cultivation of forage grasses in the interspaces of diseased coconut plantations and maintenance of milch cows enabled recycling of cattle manure and other organic wastes in the plantation. Adoption of these practices resulted in a decrease in foliar yellowing and increase in nut yield by 26.1 per cent (Table 74.1) over a period of five years (1976 to 1980) (Sahasranaman *et al.*, 1983). The response was higher in the disease early palms and lowest in disease advanced palms. In addition, there was increase in the soil organic carbon, exchangeable calcium, magnesium, potassium and soil microbial activity (Anonymous, 1986).

Table 74.1: Effect of mixed farming on nut yield of root (wilt) affected palms

Disease index	Pre-treatment yield		Post-treatment yield		Increase over pre-treatment (%)		Estimated net response due to mixed farming (%)
	Control	Treat.	Control	Treat.	Control	Treat.	
	0-10	58.3	50.3	62.4	68.4	7.0	
11-25	31.1	33.7	29.2	42.3	-6.1	25.5	31.6
26-50	20.9	22.5	18.1	24.5	13.4	8.9	22.3
> 51	19.5	19.0	21.4	23.7	9.8	24.7	14.9
Mean	30.5	31.4	29.9	39.6	-2.0	26.1	28.1

Intercropping and Mixed Cropping: Intercropping and mixed cropping in root (wilt) affected gardens exert some ameliorating effect on the disease affected palms and on increasing the yields. Intercropping with cassava, elephant foot yam and greater yam for five years in 16-year old coconut gardens gave an overall increase in the nut yield to the extent of 5, 15 and 8 per cent, respectively (Menon and Nayar, 1978). However, in a cassava plot the disease intensity was on the increase (indices increased from 32.1 to 37.3) whereas in others it was on the decrease (37.0 to 33.3). A similar study with cassava, elephant foot yam, colocasia, greater yam, ginger and turmeric did not reveal any adverse effect on disease index or yield of palms (Antony, 1983). Intercropping systems increased the mycorrhizal status of root (wilt) affected coconut palms (Thomas, 1988).

Mixed cropping with cocoa under single and double hedge systems increased the yield of coconut by 27.1 and 35 per cent, respectively without any deterioration in the disease intensity of palms under rainfed conditions (Nair *et al.*, 1975). In an experiment, conducted in the farmers' fields for a period of five years under irrigated conditions with the recommended doses of fertilisers to both the crops, the yield of coconut increased from an average of 17.6 to 46 nuts/palms/year. Similarly, Sahasranaman *et al.* (1983) reported that the nut yield of coconut in a root (wilt) affected garden increased by 27 to 35 per cent

as a result of coconut-cocoa mixed cropping. Mixed cropping with hybrid Napier enhanced the total bacteria, nitrogen fixing bacteria and phosphate solubilising bacteria (Potty *et al.*, 1977).

Basin Management with Green Manure: Eight species of leguminous green manure crops were raised in coconut basins in the farmers' fields to evaluate their efficiency in enriching soil organic matter and biological activity. The highest green manure yield of 43.4 kg/basin was obtained from *Pueraria phaseoloides*. On an average the three green manure crops, namely, *Pueraria phaseoloides*, *Mimosa invisa* and *Calapagonium mucunoides* yielded 19.45, 17.00 and 14.71 kg green manure respectively in a period of four months. There was a significant increase in microbial population as also in the activities of soil enzymes, namely, dehydrogenase, urease and phosphatase (Thomas, 1987).

Nutrient requirement for West Coast Tall (WCT) and West Coast Tall × Chowghat Orange Dwarf palms: In a freshly replanted plot of WCT and COD × WCT hybrid, the application of 500 g MgO per palm along with 500 : 300 : 1000 g N, P₂O₅ and K₂O/palm/year was optimum under rainfed conditions. Regular application of fertilisers since planting reduced the incidence of disease and increased yield (Cecil, 1981; Amma *et al.*, 1983). Cecil and Amma (1991) while reviewing the nutrition of coconut in the root (wilt) affected area had indicated that the foliar yellowing is not due to any major nutrient deficiency but can be corrected with the foliar application of magnesium sulphate as 2 per cent solution. No other nutrient deficiency was associated with the disease. The nutrient management practices adopted in the cultivators' fields during 1982 to 1984 gave encouraging results (Table 74.2). The yield increase was more in diseased early palms and was much less in diseased advanced palms.

Table 74.2: Response due to management practices on the yield of coconut in cultivators' fields (rainfed)

Disease index	No. of palms observed		Yield at start of expt. (nuts per palm) 1982	Estimated yield for 1984 (nuts per palm)	Response % increase
	1982	1984			
Apparently healthy (< 10%)	114	90	29.1	49.3	69.4
Disease early (11-50%)	66	82	18.9	30.2	59.8
Disease advanced (> 50%)	9	12	8.5	9.4	10.6
Total	188	184	4643.6	7028.8	51.4
General mean			24.7	38.2	

Varietal difference: A comparative evaluation of WCT and COD × WCT in the root (wilt) affected areas under unirrigated conditions indicated that the hybrid, COD × WCT came to the bearing stage early and the disease intensity was less (Table 74.3). The performance of COD × WCT up to the eleventh year gave clear indications that this hybrid with adequate management from

field planting can perform better than the local tall (Cecil, 1981; Amma *et al.*, 1983).

Table 74.3: Comparative performance of COD × WCT and WCT in root (wilt) affected area with respect to yield and disease incidence

Year after planting	Disease incidence %		Nut yield/palm	
	COD × WCT	WCT	COD × WCT	WCT
Fourth	1.8	2.2	—	—
Fifth	3.6	4.3	55.9	—
Sixth	5.0	8.8	100.9	—
Seventh	5.0	22.5	75.9	16.8
Eighth	8.9	29.3	91.1	39.6
Ninth	22.1	35.5	105.0	49.4
Tenth	22.8	42.6	61.9	44.8
Eleventh	40.9	50.7	103.4	62.9
Twelfth	41.1	62.2	26.6*	52.1
Cumulative yield/palm up to the twelfth year			620.7	265.6

* Mean yield in 1984 after the unprecedented drought in 1982–83.

Water Management: Studies conducted at the farmers' fields have indicated that irrigation of the palms with 250 l of water/palm/week during January to May with normal application of fertilisers and plant protection chemicals resulted in an overall improvement of the conditions of the palms with increased nut yield ranging from 64 to 200 per cent. There was reduction in the flaccidity, yellowing, leaf rot and necrosis to the tune of 51, 60, 40 and 45 per cent, respectively and an increase in the overall photosynthetic activity by 53.3 per cent (Rajagopal *et al.*, 1987).

Leaf rot control: Sequential application of Bordeaux mixture 1 per cent, Dithane M. 45, 0.3 per cent and Fytolon 0.5 per cent gave an effective control (87.8 per cent) of leaf rot which is normally superimposed on root (wilt) affected palms (Thomas Joseph and Rawther, 1991).

Integrated Management: An integrated management practice consisting of eradication of diseased advance and unproductive palms as also young palms that have taken up the disease prior to flowering, application of balanced fertilisers, farmyard manure, control of leaf rot and growing intercrops and mixed crops were tried in the farmers' fields both under irrigated and rainfed conditions in the diseased tract and the results are presented in Tables 74.4 and 74.5. Average increases of 23.4 nuts/palm under rainfed and 17.2 nuts under irrigated conditions were obtained (Muralidharan *et al.*, 1991). A large scale demonstration in mildly affected areas of Trichur district revealed an increase of yield from 20.2 nuts during 1981–82 to 49.2 nuts/palm/year during 1984 due to the adoption of integrated management practices (Anonymous, 1986).

Table 74.4: Effect of integrated management practices on yield of root (wilt) affected palms (rainfed)

Disease index	Yield (nuts/palm/year)				Increase in nut yield over control	
	Pre-expt.		Post-expt.		Number	%
	Control	Treat.	Control	Treat.		
0-10	40.8	43.5	51.3	30.9	29.6	57.7
11-25	29.9	26.4	35.5	64.3	28.8	81.1
26-50	18.7	17.7	21.2	29.6	8.4	39.6
> 51	9.7	8.0	9.4	11.4	2.0	17.5
Mean	33.4	32.6	41.0	65.3	24.3	59.3

Table 74.5: Effect of integrated management practices on yield of root (wilt) affected palms (irrigated)

Disease index	Yield (nuts/palm/year)				Increase in nut yield over control	
	Pre-expt.		Post-expt.		Number	%
	Control	Treat.	Control	Treat.		
0-10	52.4	54.4	58.2	72.1	14.0	24.1
11-25	27.5	32.6	35.5	61.5	26.0	73.0
26-50	13.3	18.6	21.5	25.1	3.0	17.0
> 51	9.8	10.2	10.4	7.8	-2.6	25.0
Mean	35.8	43.6	45.1	62.3	17.2	36.0

Containing the Disease by Eradication in Mildly Affected Areas

Eradiation of disease affected palms to contain the disease within the contiguously infected geographic limit has been successful (Anonymous, 1986). Uprooting and burning of diseased trees in Vallam village of Senkottai, Tamil Nadu in 1971 prevented the recurrence of disease (Anonymous, 1986) and this was confirmed again in 1991. Based on this encouraging result an attempt was made to create a buffer zone in the sparsely affected areas between Chalakudi river and Karuvannur river in Trichur district by eradicating 28,000 diseased palms and also to contain the disease within the geographical zone. An attempt was also made in 10 villages north of Karuvannur river and Amballur—Varandarappalli road at the border of buffer zone (Fig. 74.2). A total of 730 palms in 341 gardens were confirmed to be diseased and were eradicated after spraying carbaryl (0.05 per cent) to suppress *Stephanitis typica*, the insect vector, before cutting the palms. The leaves, boles and root were burnt *in situ*. Replanting was done with elite seedlings after applying 10 g Temik G to the pit. Continuous monitoring was done by survey and eradication in this area. Subsequently areas beyond the buffer zone were also surveyed and eradicated. The results indicated that where continuous monitoring was done the recurrence was almost nil (Radha et al., 1981; Rethinam et al., 1982) (Table 74.6).

Table 74.6: Effect of eradication of diseased palms on recurrence of disease

State, district and village	Year of eradication	Number of		Recurrence in 1984	
		Gardens	Palms	Gardens	Palms
Tamil Nadu					
Sencottai	1971	1	3	Nil	Nil
Kerala					
Trichur Distt.					
1. Nadathara	1973	1	1	Nil	Nil
2. Varandarappalli	1979	78	175	5	8
3. Amballur	1979	43	66	Nil	Nil
4. Kallur	1979	5	9	Nil	Nil
5. Arattupuzha	1979	2	9	Nil	Nil
6. Inchemudi	1979	2	3	Nil	Nil
7. Kurumbilavu	1979	5	8	Nil	Nil
8. Keezhupallikare	1979	17	24	Nil	Nil
9. Urakam	1979	4	9	Nil	Nil
10. Nemmenikkare	1981	13	37	Nil	Nil
11. Vellachira	1981	2	2	Nil	Nil
Palghat Distt.	1980-82	11	27	Nil	Nil
Malappuram Distt.	1980-82	3	3	Nil	Nil
Kozhikode Distt.	1980-82	30	48	Nil	Nil

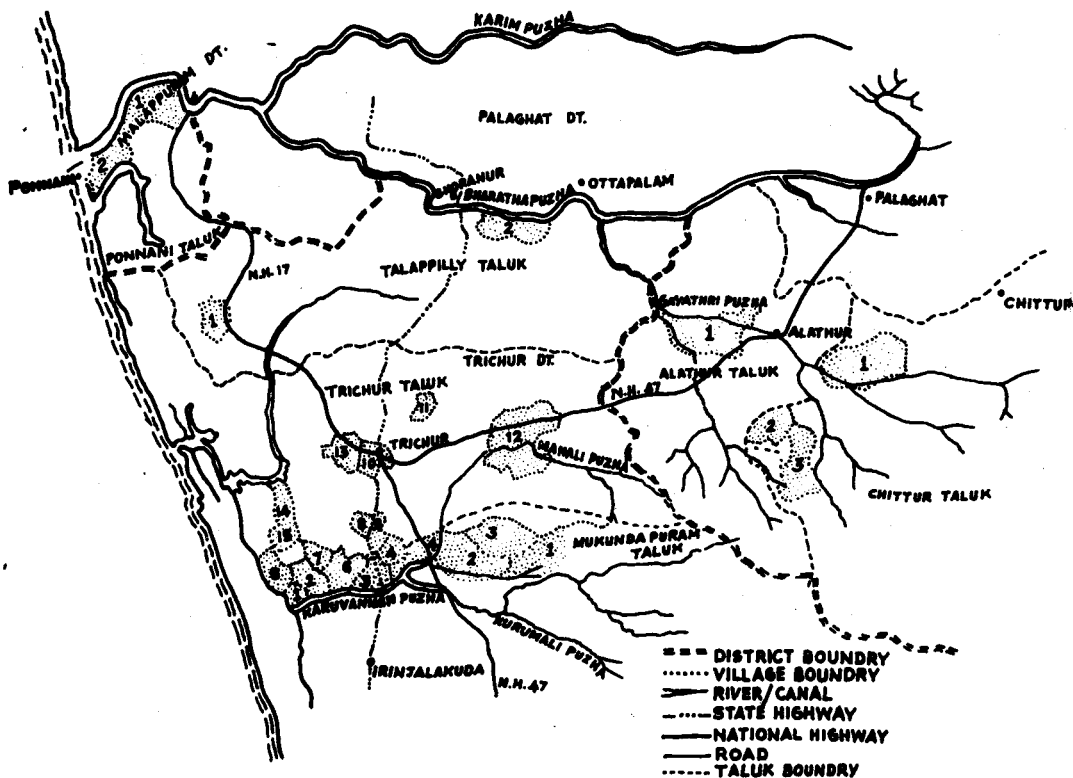


Fig. 74.2: Distribution of root (wilt) disease affected villages in parts of Trichur, Malappuram and Palghat districts — 1982.

Similarly, in 24 villages away from the belt area where 100 diseased palms were removed from 40 gardens, there has been no recurrence so far. This attempt had helped to keep the northern Kerala nearly free from the disease except in pockets of Cannanore district where eradication could not be completed and a few cases of recurrence and new incidence had occurred. A resurvey made in June 1991 after a lapse of five years has indicated that 3,202 diseased palms are still to be removed in the belt area. This indicates the need to constantly monitor the mildly affected area to keep it free from disease.

CONCLUSIONS

Integrated management practices, consisting of removal of diseased advanced old and diseased juvenile palms; adoption of packages like application of fertiliser 500, 300, 1000 g N, P₂O₅, K₂O and 500 g MgO coupled with 50 kg farmyard manure/palm/year in two splits; irrigation during dry months (January to May); proper drainage; leaf-rot control with sequential spraying; raising intercrop and mixed crop; and restructuring the canopy of the existing trees to provide adequate light to the coconut, are recommended to increase the productivity of palms in severely affected eight southern districts. Eradication of diseased palms irrespective of yield and continuous monitoring coupled with adoption of the above-said management practices are suggested for the mildly affected areas for containing the disease and increasing the productivity. A permanent solution can be possible if a resistant/tolerant variety is available. These management strategies will definitely go a long way in increasing the production and productivity of coconut in Kerala though the only permanent solution will be evolving disease tolerant coconut varieties.

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