

CURRENT TRENDS ON COCONUT ROOT (WILT) DISEASE

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It is only logical that the coconut palm is considered with reverence particularly by the people of Kerala State (India) as every part of the palm is profitably utilised and over 60% of coconut cultivation in the country is confined to the State. But ironically the crop is badly neglected. Though historically the palm has been under cultivation in Kerala State during the past several hundreds of years, ecologically the land is not ideal for optimal productivity due to continuous cultivation and statistically there is an over-all reduction in productivity. And to add to this predicament is the coconut root (wilt) malady which is largely confined to the State. It is believed that the disease became prevalent after the great floods of 1882 at Erattupetta (Meenachil) Taluk, Kottayam District) in the erstwhile Travancore State. Within a decade, the disease was independently reported from Kaviyoor and Kalloo-

ppara (Tiruvalla Taluk, Alleppey District) and Karunagapally Taluk (Quilon District).

Retrospect

Eventually the situation demanded scientific investigations, but organised research programmes were initiated only as late as in 1966 consequent on the reorganisation of the Indian Council of Agricultural Research. Appropriate research projects were drawn out which have been implemented from 1970 with the establishment of the Central Plantation Crops Research Institute. In brief, the salient research findings include characterisation of the disease symptoms as flaccidity of the leaflets being the most consistent feature of the disease, with yellowing of the outer whorls of the leaflets and marginal necrosis, which together contribute, to an indexing method based on grade points separately assigned. The higher

percentage of root rotting with vascular discolouration as possible symptoms have been brought out but vascular discolouration has not been observed in the presence of an antioxidant and so is the observation on the extent of rotting of the root system as a factor independent of the root (wilt) diseased condition of the coconut palm.

Histological observations indicate the presence of fungal hyphae and tyloses in xylem vessels, phloem necrosis and burrowing nematode lesions in the cortex of disease affected palms with lower content of polyphenol tannins. The serodiagnostic test and the characteristic differences noticed on the metabolism of phenol compounds offer scope for diagnosis of the disease before the onset of visual symptoms.

The epidemiology is not consistent with nutritional disorders.

Occurrence is sporadic and the spread either contiguous or sporadic. Palms of all ages are susceptible to the disease; disease-free gardens occur in the midst of disease affected areas and apparently healthy palms in heavily infected gardens. Intensity of the disease can be higher in sandy, sandy loam and clayey soils compared to laterite soils.

The spreading nature of the coconut root (wilt) disease suggests the involvement of a pathogen that has been supported by the reported observations on the manifestation of the symptoms in the field and controlled conditions. Different biotic agents have been implicated but the etiology is still uncertain. The reported findings on the transmissibility of the disease suggest a viral etiology but virus and virus-like particles are yet to be located consistently in electron micrographs. Submicroscopic observation with thin and ultra thin sections are under way in renewed efforts in this direction.

The probable involvement of a toxin has been brought out with root sap obtained from diseased palms in contrast to healthy. Consequent on disease development an altered permeability, an imbalance in the water mechanism, an impaired water translocation, an increase rate of respiration and transpiration, an altered carbohydrate and protein metabolism and an accelerated phenol metabolism have been noticed. The direct involvement of the major nutrients has been ruled out in the disease and micronutrient status has indicated lower concentrations of exchangeable iron, zinc, manganese and molybdenum.

Perspective

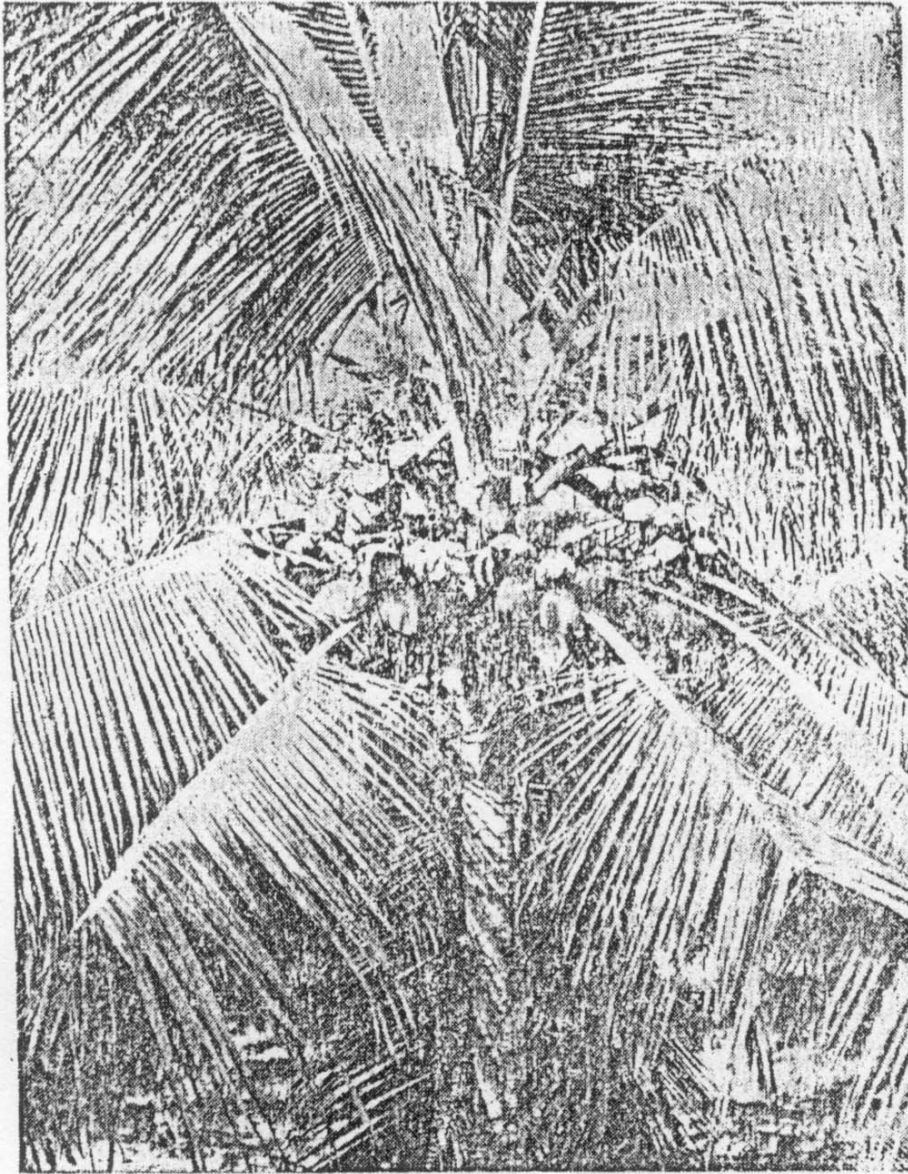
Viewing the century old coconut root (wilt) disease against this background, people at large in the State of Kerala are concerned that the disease has assumed a sociological impact, the scientists engaged in the elucidation of its cause and control sustain persistent optimism and the authorities are determined to unravel the baffling situation. Those who can assimilate the results of the scientific investigations carried out on the management of the disease at the Regional Station, Kayangulam along with certain other relevant observations have no reasons for dismay or panic. Unlike the other major maladies of the coconut, root (wilt) disease has several positive attributes to reckon with barring its elusive complexity that has been overemphasised with sadistic inclination.

The disease prevalent in a contiguous area of 250,000 ha is contained in the 7 southern districts of Kerala viz., Trivandrum, Quilon, Alleppey, Kottayam, Idukki, Ernakulam and Trichur wherein it is estimated that 10 per cent of the total palm population are disease affected. Admittedly sporadic occurrence of the disease has also been reported recently from Malappuram, Palghat and Calicut districts which may not be in a severe extent. Nevertheless statistics reveal that the average per palm productivity and per hectare productivity of coconut palms in the root (wilt) affected districts are higher than the root (wilt)-free districts in the State of Kerala (Table 1). Comparatively the less distribution of rainfall and ground water availability could be the regulating factors in such

a situation. Irrigation and management practices have therefore a positive influence on the disease which is debilitating and non-lethal and at the same time responding to care and management.

Trials laid out at the Central Plantation Crops Research Institute, Regional Station, Kayangulam with WCT palms (648 numbers planted in 1970) and DxT hybrids (324 numbers planted in 1972) with a view to studying the effect of varying doses of phosphorus, potassium, calcium and magnesium have indicated among other observations that within a heavily infected area in sandy soil under rainfed conditions the palms give comparatively high yields under good management in spite of the disease (Table II). It is also brought out that the D x T hybrids are superior to the WCT palms both in terms of productivity and susceptibility to root (wilt) disease.

The canopy of the coconut permitting around 50 per cent of the light percolation and the restricted land utilisation by the crop to less than 25 per cent are ideal for inter and mixed cropping and a compatible crop combination can enhance productivity in a sustained manner. The preliminary experiments carried out on inter cropping with the commonly cultivated tuber crops undertaken at the CPCRI Regional Station, Kayangulam have revealed that there was no reduction in yield on coconut palms due to intercropping (Table III). Variation in yield response has been noticed in coconut palms in different stages of the disease. In general, increase in



D x T Hybrid

yield of root (wilt) affected palms has been noticed under intercropping with an increase in the overall mean yield in plots where elephant foot yam was cultivated followed by the plots with yam under intercropping. The profitable impact on disease intensity has been noticed in coconut palms under intercropping with elephant foot yam and yam.

The mixed farming experiments in coconut gardens with fodder grass and legumes with milch

cows, concluded in 1975 after a lapse of 5 years under rain fed conditions at Kayangulam have indicated that regular recycling of farmyard manure has increased the mean yield of palms by 26 per cent irrespective of the diseased conditions (Table IV). Increase in the production of inflorescence as well as female flowers has also been reported (Table V). Mixed farming has not indicated any ameliorative effect on the disease syndrome. It has resulted in a significant

increase in the organic carbon, available phosphorus, exchangeable calcium and magnesium contents in soils drawn at the depths of 0-50, and 50-100 cms.

There was also a beneficial influence on the microbial activity in the root region of the coconut palms. In a similar manner, in an observational trial of mixed cropping experiment in the root (wilt) affected tract at Krishnapuram (Quilon district), crop mixing cacao with coconut has doubled the yield over a period of 4 years irrespective of the diseased condition of the palms. The mean yield per palm of the 90 palm plot has increased from 17.6 nuts in 1976 to 46.0 nuts in 1980. Among the several attempts made in the past and present to combat the root (wilt) malady with chemicals, a few have shown positive indications. The application of Oxytetracycline (Terramycin Tree Injection Formula - a research product of M/s. Pfizer Ltd., Bombay) has promising affect on the coconut root (wilt) disease. Disease affected palms treated with the chemical (1970 to 1976) have responded favourably without further deterioration while the untreated control palms have shown deterioration in the diseased condition. The treated palms have also yielded increased number of nuts (Table VI). Root (wilt) disease is not amenable to normal plant protection measures; however, periodic spraying with fungicides has been reported to have significantly reduced the incidence of leaf rot normally superimposed on the root (wilt) diseased palms (Table VII).

Needless to emphasize the necessity to intensify the efforts on the development of appropriate management practices for root

(wilt) affected coconut plantations for which the essential requisites have been initiated by the Central Plantation Crops Research Institute. Besides strengthening the research efforts on the elucidation of the causal agent, large scale varietal screening for disease tolerant types form part of the other component of the strategy for combating coconut root (wilt) disease. Referring back to the etiological agent the research station at Kayangulam which deals this aspect on a priority basis is optimistic of a successful closing in.

Summing up

In summation, the coconut root (wilt) malady need not be a nightmare because it does not kill the disease affected palms outright but only brings about decline in yield in the course of several years. It responds favourably to management practices and irrigation. The diseased gardens sustain yield with intercropping with suitable crop combination and mixed farming and a clear understanding of the cause of the problem will emanate in the immediate future. The general decline in terms of productivity observed in the State of Kerala

can be attributed to the unsuitability of its soils due to continuous cultivation of the crop since the early post-vedic period without adequate agronomic practices. It is also necessary that at least a sizeable number of coconut cultivators who bother about the situation may refrain from stamping all disorders of coconut as root (wilt) disease and earnestly resort to the recommended plant protection measures and other management practices like fertilizer application, irrigation and planting genetically superior quality seedlings.

Table - I
Comparison of Yield Pattern in Kerala

Name of district	Per palm productivity* (1977-78)	Per hectare Productivity** (1980)
Trivandrum	38	4767
Quilon	30	3936
Alleppey	32	5168
Ernakulam	32	4995
Kottayam	26	3809
Idukki	30	3222
Trichur	43	6094
Malappuram	37	4895
Calicut	33	4800
Cannanore	25	3623
Palghat	30	3419

*Source : Thampan P. K. *Indian Coconut Journal* 9 : No. 8 p 1-7 (1980)

**Source : *Indian Coconut Journal* 13 : No. 4 (1982)

Table II
Performance of DxT and WCT Under Good Management*

Year after planting	Disease incidence %		Average yield of nuts/palm / year	
	WCT	DxT	WCT	DxT
4	2.2	1.8	Nil	Nil
5	4.3	3.6	Nil	75
6	8.8	5.0	Nil	129
7	22.5	5.9	17	90
8	29.3	8.9	40	118
9	35.5	22.1	50	112

*Source - *Technical Bulletin* No. 8 CPCRI, Kasaragod (1982)

Table III
Effect of Intercropping in Root (Wilt) Affected Coconut Gardens - Yield of Coconut Palms

Treatment	Disease index	Number of nuts/tree (overall mean)		% increase over Pre-experimental period (overall mean)
		Pre-experimental period	Experimental period	
Control	0-10	45.40	48.00	+5.72
	11-25	52.11	46.25	-11.24
	26-51	36.00	34.00	- 5.55
	Above 51	30.33	26.25	-13.45
	Overall mean	40.96	38.62	- 5.76
Tapioca	0-10	61.40	65.11	+ 6.04
	11-25	52.83	50.80	- 3.84
	26-51	48.47	44.09	- 9.03
	Above 51	36.29	35.40	- 0.02
	Overall mean	49.75	48.85	- 1.80
Elephant foot yam	0-10	55.00	76.94	+39.89
	11-25	54.66	73.60	+34.65
	26-51	52.00	45.20	-13.07
	Above 51	48.33	39.00	-19.30
	Overall mean	52.49	58.69	+11.81
Yam	0-10	82.33	88.50	+ 7.49
	11-25	69.09	63.94	+ 8.20
	26-51	41.09	48.40	+17.79
	Above 51	45.52	32.39	-28.86
	Overall mean	57.01	58.31	+ 2.28

Source: Sethumadhava Menon, K and Ramakrishnan Nair T. V. *Proceedings of the First Annual Symposium on Plantation Crops* p. 416-424. (1978).

Table - IV
Effect of Mixed Farming on the Yield of Coconut

Disease index	Yield of nuts per palm per year		Percentage increase
	Pre-treatment	Post-treatment	
0-10	50.3	68.4	36.0
11-25	33.7	2.3	25.5
26-50	22.5	24.5	8.9
Above 51	19.0	23.7	24.7
General Average	31.4	39.6	26.1

Source : *Technical Bulletin No. 8 CPCRI Kasaragod (1982)*

Table V
Production of Female Flowers - Mixed Farming

Disease status	Number of female flowers per palm				
	1969-70	1970-71	1971-72	1972-73	1973-74
Healthy	110	122	190	160	147
Disease early	103	90	132	112	115
Disease middle	72	69	81	79	60
Disease advanced	59	60	90	68	72

Source : Mixed farming in coconut garden. Final report of Agrostology Project, CPCRI Regional Station, Kayangulam (1970-75).

Table VI
Response to Oxytetracycline (Terramycin Tree Formulation)*

Period	Treated palms	Untreated palms
	Mean % incidence of disease	
1/77	24.04	23.70
1/78	23.68	30.72
1/79	20.86	31.09
12/79	22.57	2.68
7/80	21.92	33.43

*Source : *Research Highlights CPCRI, Kasaragod, (1980)*

Table VII
Mean Percentage of Leaf Rot Affected Palms

Year	% of leaf rot affected palms
1976	40.17
1977	32.00
1980	20.90
1981	7.80

Source : *Technical Bulletin No. 8 CPCRI Kasaragod (1982)*