

INVESTIGATIONS ON THE INTEGRATED CONTROL OF ROOT (WILT) DISEASE OF COCONUT

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ABSTRACT

Results of investigations conducted on the integrated control of root (wilt) disease of coconut employing a fungicide, bactericide, nematocide and different plant nutrients indicated that the disease is incited by an organism or entity which is unaffected by a nematocide, bactericide or a fungicide. It is also indicated that the deficiency of Ca, Mg or Zn pre-disposes the palms to infection by root (wilt) pathogen. The various treatments further failed to show any effect on the incidence of leaf rot disease, the ratings of which were higher in palms with high root (wilt) disease index.

INTRODUCTION

Studies so far conducted on the cause of root (wilt) disease of coconut, present a complex situation, wherein more than one biological agents are involved. As such no specific measures for the control of the disease have been evolved. The disease symptoms were reproduced under field conditions and controlled conditions by sap transmission from diseased palms as well as by incorporation of roots of diseased palms in the soil substrata. Soil fungi like *Rhizoctonia* sp. are found to be associated with the root damage. A strain of TMV was isolated from diseased coconut tissue and also from healthy material. A bacterium iden-

tified as *Pseudomonas* sp. was found to be associated with the rotted roots. Plant parasitic nematodes belonging to 23 genera occur in the root zone of the coconut palm. Investigations on soil and nutritional factors suggested the possible role of Ca and Mg deficiency in soils in pre-disposing the palm to root (wilt) disease. The present study aims to have an integrated approach, accounting for all these factors controlling the disease.

MATERIALS AND METHODS

The investigations on the integrated control of root (wilt) disease were conducted at the regional Agricultural Research Station, Kumarakom, Kerala during the period from 1976 to 1984 in a randomised replicated field trial with 11 treatments. The following were the treatment combinations: (1) Control; (2) NPK + Ca + Mg + Zn; (3) NPK + Ca + Mg; (4) Tr. 2 + Dasanit; (5) Tr. 3 + Dasanit; (6) Tr. 2 + Agrimycin-100, (7) Tr. 3 + Agrimycin-100; (8) Tr. 2 + Benlate, (9) Tr. 3 + Benlate; (10) Tr. 2 + Dasanit + Agrimycin-400 + Benlate; and (11) Tr. 3 + Dasanit + Agrimycin-100 + Benlate. All the treatments including control were given the following common pre-treatments: (1) each planting pit was burned with trash; and (2) the coconut seedlings of variety WCT were dipped for 15 minutes in 1000 ppm nemagon solution before they were planted. The application of treatment was started three months after planting and continued for five years. NPK was applied at the recommended dosage for ordinary WCT palms. Ca was applied as slaked lime at the rate of 12 kg/tree and Mg as Magnesium sulphate (commercial) at the following rates: (1) first year of planting 1 kg/palm; (2) second year 2 kg/palm; and (3) from the third year onwards 3 kg/palm. Zn was given as zinc sulphate (0.2 per cent) foliar spray. Dasanit was treated after opening the basin when the soil was moist, and used at 100 g for seedlings up to three years and afterwards at the rate of 300 g/palm. Treatment of Agrimycin-100 was carried out as foliar spray (500 ppm) once in a month for six months per annum. Benlate was applied at the basin twice a year at the rate of 40 litres of 0.1 per cent solution up to three years and 70 litres/palm afterwards. Benlate was made to dissolve in acetone and 3 per cent Hcl before it was diluted with water and warmed for six hours. Observations on

the intensity of root (wilt) disease were recorded from 1979 at half-yearly intervals based on standard methods of indexing, evolved by George and Radha (1973). The number of leaves showing leaf rot was also recorded for the above period.

RESULTS AND DISCUSSION

Results of statistical analysis of the data on intensity of root (wilt) disease (Table 1) and the number of leaves affected by leaf rot (Table 2) are presented.

Root (wilt) disease

The treatment effects are not statistically significant when the observations on individual years are analysed except that of 1979 and 1981. Root (wilt) disease intensity was lowest in plots treated with NPK + Ca + Mg + Zn both for 1979 and 1981. But pooled analysis of the data for six years from 1979 indicated that combined application of NPK + Ca + Mg + Zn have significant effect in reducing root (wilt) disease syndrome. However, the treatment effects of NPK + Ca + Mg with Agrimycin or with Benlate or with a combination of Dasanit. Agrimycin and Benlate were on par. The investigations lead us to the conclusion that treatment with a nematicide bactericide or fungicide was not effective to check the occurrence of root (wilt) disease in coconut. It may therefore be presumed that neither a nematode, bacterium nor a fungi is involved in the development of the disease. Perhaps it leads us to infer that root (wilt) disease is incited by an organism or entity which is unaffected by a nematicide, bactericide or fungicide. On the other hand, the results reveal that there is a reduction in the intensity of the root (wilt) disease due to the application of Ca, Mg or Zn. It may also be indicated here, that deficiency of Ca, Mg or Zn plays a vital role in pre-disposing the palms to infection by the root (wilt) pathogen. Investigations carried out by earlier workers suggested the possible role of Ca and Mg deficiency in soils in pre-disposing the palms to root (wilt) disease. According to Robert Cecil (1975) the Ca and Mg contents of root (wilt) diseased palms are lower than that of healthy palms. Ramadasan (1964) attributed foliar yellowing which is part of root (wilt) disease syndrome due to Mg deficiency. Mathai and Vasudevan Nair (1978) observed

Table 1. Mean root (wilt) disease index

Tr. No.	1979	1980	1981	1982	1983	1984	Mean of pooled data
1	26.77	25.57	27.99	43.98	41.35	41.66	34.55
2	9.46	9.05	6.84	30.43	31.51	21.05	18.05
3	25.99	26.98	16.79	41.62	35.22	28.85	25.56
4	29.12	23.70	28.07	49.12	36.18	34.49	33.45
5	26.20	25.07	20.45	43.78	46.65	36.49	28.04
6	17.76	16.33	17.49	29.57	45.67	35.28	27.02
7	20.94	19.72	21.53	21.95	28.99	26.63	23.79
8	21.77	20.35	15.27	33.59	38.77	37.22	27.83
9	17.14	14.04	10.59	38.56	33.07	31.80	22.23
10	14.10	12.05	28.20	27.57	37.68	29.37	24.82
11	8.88	10.16	17.45	19.80	33.62	22.44	18.18
CD (P = 0.05)	12.75	N.S	12.38	N.S	N.S	N.S	

CD (P = 0.05) for comparison between treatments: 7.32.
(Pooled Mean).

Table 2. Mean number of leaves affected by leaf rot

Tr. No.	1979	1980	1981	1983	1984	Pooled Mean
1	0.33	0.58	0.08	2.00	1.90	0.98
2	0.58	0.42	0.50	0.83	0.80	0.63
3	0.80	0.50	0.33	1.63	0.50	0.63
4	0.50	0.42	0.00	0.66	2.30	0.78
5	0.80	0.64	0.92	1.77	1.00	0.93
6	0.08	0.17	0.42	2.33	2.20	1.05
7	0.50	0.50	0.00	0.42	0.50	0.38
8	1.16	0.83	0.75	1.39	1.90	1.13
9	0.75	0.42	0.67	1.43	2.40	0.98
10	0.41	0.25	0.22	1.00	1.50	0.69
11	0.08	0.17	0.67	1.58	0.90	0.69
CD (P = 0.05)	N.S.	N.S.	N.S.	N.S.	N.S.	

significant beneficial effect on the yield with the application of Zn. Thus the results obtained in the present study substantiate the observations made by the earlier workers.

Leaf rot disease

Statistical analysis of the pooled data as well as the observations for individual years on the number of leaves affected by leaf rot disease for the period from 1979 to 1984 (Table 2) does not reveal any significance between treatments. There was no significant effect for the different treatments in reducing the number of leaves affected by leaf rot disease. However the trend was that its incidence was higher in palms with high root (wilt) disease index and *vice versa* as observed by Mathai (1980). The widespread occurrence of leaf rot disease in the root (wilt) affected tract and its limited incidence in healthy areas as reported by Radha and Lal (1968) confirm the relationship obtained in the present study.

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DISCUSSION

Q : What was the basis for fixing the dose of lime? Did you take lime requirement into consideration?

Ans: The dose of lime was fixed based on general lime requirement of the area.

Q : What was the organic matter status of the soil?

Ans: Not tested.

Q : Under waterlogged conditions, the Al and Mn level play a significant role. Have you estimated them?

Ans: No. Estimation of these nutrients is not envisaged in this trial.

Q : Incidence of disease is much lower in plots under treatment T₂. But the same treatment with insecticides did not show such a trend. Please comment?

Ans: The effect observed in treatment T₂ was found to be satisfactory on par with T₇, T₉, T₁₀ and T₁₁. The values under these treatments are only numerically higher.

Q : What is the level of Mg in root wilt affected palms?

Ans: The level of Mg varies with intensity of yellowing.

Q : It is stated that the etiology of the disease is not known. But as early as 1983, MLO has been observed to be associated with root wilt disease. Please comment?

Ans: The etiology of the disease is not proved beyond doubt by employing Koch postulates.

Q : Have you worked out the cost involved in integrated control of root wilt disease?

Ans: No.