

EFFECT OF MAJOR NUTRIENTS ON THE INCIDENCE OF ROOT (WILT) DISEASE IN COCONUT

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ABSTRACT

Studies on the effect of application of N,P,K, Ca and Mg, from the time of planting in the main field at Kayangulam, on the incidence and severity of root (wilt) disease in West Coast Tall palms indicated that, young palms are more susceptible to the disease at the onset of bearing. When young palms under good management contracted the disease before flowering, the onset of bearing was delayed by about 12 months. The frond production rate and the number of functioning leaves on the crown are considerably reduced in diseased palms. Among the nutrients, Mg significantly increased the expression of both these characters thereby preventing the reduction in growth due to the disease. The disease caused about 60 per cent reduction in yield in the early bearing period. The mean yields of healthy and diseased palms at the 10th year of planting were 58.8 and 23.8 nuts/palm respectively. The disease caused about 12 per cent reduction in copra weight per nut while the reduction in oil content was not significant.

INTRODUCTION

In the etiology of coconut root (wilt) disease, the involvement of biotic factors such as fungus (Thomas Joseph, 1978), virus (Solomon and Sasikala, 1980) and bacterium (Mathew George *et al.*, 1976) have been implicated but the precise cause of the disease needs to be established.

Studies on soil and tissue samples of palms in diseased area indicated a lower status of Ca and Mg and a higher N, P and K contents in the tissue. (Verghese *et al.*, 1959; Cecil, 1975; Pillai *et al.*, 1975). The possibilities of nutritional imbalance with regard to

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major nutrients was indicated by Verghese *et al.* (1959), Pandalai (1959), Cecil (1975) and Pillai *et al.* (1975). The application of Ca and Mg salts along with N.P.K. fertilizers showed improvement in the condition of root (wilt) affected palms and their yields (Nair and Radha, 1959; Davis, 1964).

With a view to studying the effect of Ca and Mg in combination with N, P and K from the time of planting of coconut in the main field, an experiment was started in 1970 at CPCRI Regional Station, Kayangulam and the results obtained are reported in this paper.

MATERIAL AND METHODS

Split plot design with main plot treatments as combinations of 3 levels of N, P and K in a 3^3 confounded factorial arrangement confounding $N P^2 K^2$, and sub-plot treatments as factorial combinations of 2 levels of Ca and Mg with a single replication, was adopted for the study. The main plot size was 24 palms and the sub-plot 6 palms.

Nutrient levels (Adult dose/palm/year)

N ₁ —500 g N	P ₁ —300g P ₂ O ₅	K ₁ —1000g K ₂ O
N ₂ —750 „	P ₂ —450 „	K ₂ —1500 „
N ₃ —1000 „	P ₃ —600 „	K ₃ —1200 „

Ca₀—No calcium

Ca₁—Lime requirement to raise the soil pH to 6.5

Mg₀—No magnesium

Mg₁—500 g MgO

50 kg cattle manure (from 1973 onwards)

One-year-old WCT seedlings were planted in October, 1970 at a spacing of 7.5m in the square system of planting.

Nutrients were given in the form of ammophos (16:20)+urea for N and P, muriate of potash for K, slaked lime for Ca and magnesium sulphate (hydrated) for Mg. The young palms were fertilized at the rate of 1/3 adult palm dose in the first year after planting, 2/3 in the second year, and the full dose from third year

onwards. The fertilizers were applied by broadcasting in circular basins of the palms in two splits, 1/3 in April-May, and 2/3 in August-September every year.

The dose of Ca was fixed as the lime requirement (Shoemaker *et al.*, 1961) for raising the pH of the 0-50 cm layer soil to 6.5. The quantity required for a sub-plot of 6 palms, (75 kg slaked lime) was broadcast uniformly over the entire sub-plot area including the palm basins during June every year and ploughed in.

RESULTS AND DISCUSSION

The total number of palms under the experiment was 648. The progressive incidence of disease upto December, 1981 (Table 1) showed that the maximum number of palms contracted the disease at the 7th year.

Table 1. The progressive incidence of root (wilt) disease in the experimental palms

Progression from year of planting (1970)	No. of palms affected	Cumulative percentage
1973	2	0.3
1974	16	2.8
1975	10	4.3
1976	29	8.8
1977	89	22.5
1978	44	29.3
1979	40	35.5
1980	47	42.7
1981	51	50.6

The distribution of disease under different treatments from 1977 to 1981 was analysed separately. From 1980-81, the data (Table 3), also indicates that none of the main effects had any significant influence on the incidence of disease which suggests that the disease incidence is not related to the major element nutrition of the palm.

The effect of root (wilt) disease on the onset of bearing was studied on 43 such palms in different treatments that exhibited visible symptoms before the emergence of the first inflorescence.

Irrespective of the treatments, the mean pre-bearing age of these affected palms was 84.8 months and that of all other healthy palms was 73.1 months. Eventhough the time lapse between the appearance of visible symptoms and the onset of bearing varied in different palms, an overall assessment based on the above consideration showed that, under good management, the onset of bearing in WCT palms was delayed by about 12 months when the young palms contracted the disease before flowering.

The total number of palms affected by the disease till Dec. 1979 was 230 and the number of palms that contracted the disease during 1980 was 47. Observations recorded in 1980 relating to the 230 palms that had already contracted the disease before 1980, and those relating to the palms remaining healthy upto December, 1980 were separately considered for studying the influence of disease on frond production rate, functioning leaves on the crown, nut yield and yield attributes. Since the number of healthy and diseased palms under different treatments was small and their distribution uneven, the effects of nutrients on the various parameters under healthy and diseased conditions might not be very realistic. Further, the disease had occurred at irregular intervals since its first appearance in 1973 and the intensity of disease had also been different in different palms. Nevertheless, an overall assessment on the differences between healthy and root (wilt) affected palms for the various characters observed was found to be very useful for estimating the damage caused by the disease in the early bearing period.

The effects of nutrients on the number of functioning leaves on the crown and frond production rate are given in Table 2. The beneficial influence of Mg was more and of Ca less on disease. The frond production rate was reduced by 3.4 per cent and the number of functioning leaves by 15.1 per cent.

Higher levels of N, P and K had no significant influence on yield and yield attributes of healthy as well as diseased palms (Table 3). In contrast to healthy palms, the yield and yield attributes of root (wilt) affected palms were slightly depressed at the third level of N P and K application. Sahasranaman *et al.* (1964) also opined that heavier doses of NPK fertilizers aggravated the disease condition and reduced the yield of root (wilt) affected palms, whereas lower

Table 2. Effect of nutrients on functioning leaves, frond production, copra and oil contents of healthy and root (wilt) affected WCT palms, and on disease incidence

Main effects	No. of functioning leaves in Dec. 1980		No. of fronds produced from Jan. to Dec. 1980		Weight of copra per nut (g)		Oil content (%)		% palms affected by disease (1981)	
	H	D	H	D	H	D	H	D	H	D
N ₁	28.8	24.4	14.4	14.1	195.7	171.7	68.5	67.3	46.7	
N ₂	29.6	24.4	14.6	14.0	195.7	165.3	68.1	66.1	51.9	
N ₃	28.8	25.3	14.7	14.3	186.2	170.5	68.5	68.7	53.3	
P ₁	28.9	25.8	14.5	14.3	193.0	167.5	69.0	68.3	52.3	
P ₂	29.6	24.1	14.9	14.1	193.8	167.3	66.8*	65.7	48.6	
P ₃	28.7	24.2	14.3	14.0	190.8	172.8	69.3	68.2	50.9	
K ₁	28.5	25.2	14.3	14.3	193.4	168.8	68.3	68.0	51.5	
K ₂	29.9	24.8	14.7	14.2	196.9	169.3	68.7	66.1	51.4	
K ₃	28.8	24.1	14.8	13.9	187.3	169.5	68.1	68.1	49.1	
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	2.0	NS	NS	NS
Ca ₀	27.8	24.1	14.4	14.0	191.1	171.2	69.2	67.6	50.7	
Ca ₁	30.3**	25.3	14.4*	14.3	193.9	167.2	67.5*	67.2	50.6	
Mg ₀	27.5	23.0	14.3	13.5	194.6	169.4	69.0	68.1	48.2	
Mg ₁	30.6**	24.4**	14.9**	14.8**	190.4	169.0	67.8	66.7	53.1	
C.D. (P=0.05)	1.1	2.1	0.4	0.7	NS	NS	1.6	NS	NS	NS
General mean	29.1	24.1	14.6	14.1	192.5	169.2	68.4	67.4	50.7	

*Significant at 5% level

**Significant at 1% level

NS—Not significant

H—Healthy palms

D—Diseased palms

Table 3. Effects of nutrients on yield and yield attributes of healthy and root (wilt) affected WCT palms at the 10th year of planting (1980)

Main effects	No. of bunches/palm		No. of female flowers/bunch		No. of nuts/bunch		Nut set (%)		No. of nuts/palm	
	H	D	H	D	H	D	H	D	H	D
N ₁	10.2	6.5	20.8	22.2	5.3	3.2	27.3	14.7	56.5	24.3
N ₂	10.7	6.3	23.2	18.5	5.6	3.0	26.7	15.3	62.2	23.0
N ₃	10.5	7.1	21.9	17.7	5.3	3.1	27.2	16.8	57.6	24.0
P ₁	10.6	6.4	20.8	18.5	5.3	3.2	27.0	16.5	57.8	23.9
P ₂	10.8	6.9	21.9	21.7	5.5	3.4	27.4	16.4	62.1	25.3
P ₃	10.1	6.6	23.2	18.1	5.4	2.6	26.7	13.8	56.4	22.1
K ₁	10.2	6.7	19.3	20.2	5.4	3.5	29.3	16.8	56.5	24.2
K ₂	11.1	6.9	23.8	20.9	5.2	3.2	24.9	15.8	59.0	24.6
K ₃	10.2	6.3	22.7	17.4	5.7	2.6	26.9	14.2	60.8	22.5
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Ca ₀	9.9	6.4	20.8	18.2	5.0	3.1	26.2	16.2	52.1	22.8
Ca ₁	11.1**	6.9	23.1	20.8	5.8*	3.1	27.9	15.1	65.5**	24.8
Mg ₀	9.5	5.5	20.5	18.3	5.0	2.8	27.5	14.4	49.6	18.3
Mg ₁	11.6**	7.8**	23.4	20.7	5.8	3.4	26.6	16.9	67.9**	29.2**
C.D. (P=0.05)	1.0	1.4	NS	NS	0.6	NS	NS	NS	9.5	7.9
General mean	10.5	6.6	21.9	19.5	5.4	3.1	27.0	15.6	58.8	23.8

*Significant at 5% level

**Significant at 1% level

NS—Not significant

levels helped to maintain an economic yield. The beneficial effects of Ca on yield and yield attributes were more in healthy palms, and of Mg in diseased palms. When the increase in yield of nuts by Mg treatment in healthy palms was 37 per cent the corresponding increase in diseased palms was 60 per cent. Similar responses of Mg on healthy and diseased palms were reported by Varkey *et al.* (1979) and Davis (1964).

The mean yield of nuts per palm at the 10th year was 58.8 in healthy and 23.8 in diseased palms, and the reduction in yield of nuts over healthy ones was about 60 per cent. Radha *et al.* (1962) reported that palms affected by leaf-rot disease yielded, on an average, 70 per cent less whereas root (wilt) affected palms yielded 43 to 82 per cent less than healthy palms depending on the stage of the disease. The reduction in yield observed in the present study was mainly due to the production of lesser number of bunches (10.6 and 6.6) and a very low percentage nut set (27.0 and 15.6) in healthy and diseased palms respectively.

The copra and oil contents of healthy and diseased palms are given in Table 1. It is interesting that while the addition of Mg had been very effective in promoting growth and increasing yield and yield attributes, it had no effect on the weight of copra per nut. This is in agreement with the observation made by Manciot *et al.* (1979). The mean weights of copra per nut of healthy and diseased palms were 192.5 g and 169.2 g respectively, and the reduction in copra weight due to disease was 12.1 per cent. Based on the mean values of nut yield and copra content, the copra yield of healthy and diseased palms at the 10th year of planting was 11.3 and 4.0 kg/palm respectively, and the loss in yield of copra due to the disease was 64.4 per cent. The reduction in oil content (68.4 per cent in healthy and 67.4 per cent in diseased) due to the disease was not considerable in the initial periods.

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