19*. Manuring-cum-spraying for the control of coconut palm diseases

U. K. NAIR AND K. RADHA,
Central Coconut Research Station, Kayangulam.

INTRODUCTION

THE nutritional requirements of the coconut palm was investigated by several workers, (Pillai, 1919, Jacob and Coyle, 1926; Copeland, 1927; Georgi and Teik, 1932; Eckstein *et. al.*, 1937; Patel, 1938; Carvalho, 1947 and Cooke, 1950). Although their data vary considerably it emphasises the steady drain of nutrients from the soil resulting from the perennial habit and the continual fruiting nature of the palm. Anandan, *et. al.*, (1950) point out that soil fertility is intimately tied up and associated with the proper growth of coconut even in a locality climatically and otherwise suited for good coconut growth. When viewed with this background the results of the investigations on the soil conditions in relation to disease incidence in coconuts, that soils from diseased areas are deficient in the essential plant nutrients, viz, N. P. & K. (Menon, *et.* a*l.*, 1950) gain great importance. The results of a manuring-cum-spraying experiment conducted at this Research Station during 1951-56 are presented in this communication.

MATERIALS AND METHODS

The experiment was conducted in Block 1 of the Central Coconut Research Station, Kayangulam. The manurial treatments comprised of:

I N. P. K;
II N. P. K. + lime;
III N. P. K. + Farmyard manure;
IV N. P. K. + lime + Farmyard manure; and
V Untreated control.

The experimental palms were not given any basal dose of manures.

* Papers 17 & 18 were not read at the Conference.

The treatments were laid out in single plots with 15 palms in each. Majority of the palms (50 out of 75) were diseased and exhibited symptoms of both leaf rot and roof (wilt) disease. All the palms excepting those under treatment V received the following foliar spray.

Spraying schedule

December-January	- 1% Bordeaux mixture + 0.5% Fe S04 + 0.5% Zn S04.
February-March	- 0.5% Boron, 0.01% Molybdenum, 0.75% Manganese and 0.75% Magnesium.
April-May	- 1% Bordeaux mixture.
June-August	- 1% Bordeaux mixture during non-rainy days.
October-November	- 1% Bordeaux mixture.

Approximately ½ gal. of the spray fluid was used per tree.

Application of lime

Lime at 4 cwt / acre was broadcast before the South-west monsoon and the land was ploughed.

Green manuring

Crotalaria juncea was raised *in situ*. At the time of flowering, during August-September the crop was lopped and about 75 lb. was applied in ring trenches dug around the palms.

Other manures

Nitrogen at 0.5 lb, P_2O_5 at 0.5 lb. and K_2O at 2.0 lb. per tree were applied along with the green manure as groundnut cake, bone meal and muriate of potash respectively. Farmyard manure at the rate of 100 lb. per tree was applied in July around the base of the palms.

Cultural operation

The usual cultural operation adopted in the West Coast, namely piling of mounds in September-October and levelling of the same in January-February was carried out in all the experimental plots.

Observations

(1) The general foliar condition of the palms was recorded six times a year. The intensity of disease was graded as mild or in the early stage (d +), moderate or middle stage (d ++) and severe or advanced stage (d +++). Different stages of disease may be defined as follows:

1. Early stage - when the apex of the central shoot alone is affected,

2. Middle stage - when about $\frac{1}{2}$ the number of the apically growing leaves and with about $\frac{1}{4}$ of the total leaflets of each leaf are affected,

3. Advanced stage - when all the leaves are with more than $\frac{1}{2}$ the number of the total number leaflets of each leaf are affected - Evident from a degenerated crown, stumps of leaflets only attached to the mid-rib.

(2) There were eight harvests per year and the total yield per year per palm was recorded.

Results

Intensity of disease

The data collected on the foliar condition of the palms from 1951 to 1956 has been summarised and presented in Table 1. The figures indicate a gradual improvement in the condition of the palms under treatments I to IV and a similar deterioration of the palms in V, i.e., the untreated control. After the experimental period of five years the number of healthy palms in the treated series were 10, 11, 9 and 13 as compared to two in the control. The improvement noticed was more in the case of palms which were in the early stage of disease than in the severely diseased ones. Treatment IV was found to be more beneficial than the treatments I to III.

Yield

The average annual yield of the experimental palms is presented in Table 2. Since the experimental palms were selected based on visual observation emphasis was not given on their yield at the time of starting the experiment. An attempt has been made to statistically interpret the available data while fully aware of the fact that the lack of uniformity of tree condition at the commencement of the experiment has inflated the experimental error considerably.

The main points considered were:

i) year x yield,

ii) treatment x yield, and

iii) year x treatment, with 10 palms under each treatment taken as effective palms for analysis.

The statistical analysis indicates that:

i) the annual variation in yield is not significant,

ii) the treatment differences are significant. The treatments may be expressed as I, II, III, IV and V. In other words, the manurial treatments I to IV are generally efficacious, although the variation between the treatments is not significant,

iii) the year x treatment component is significant, thereby showing that the response of the treatment was not uniform throughout the experimental period. Table 3.

Discussion

The data presented above indicate the favourable response of the palms to the balanced manurial applications exhibited by the improvement in their general condition while the untreated control palms steadily deteriorate. The improvement noted in the foliar condition of the palms may also be due to the direct effect of the fungicidal spray as earlier trials have shown the efficacy of fungicides in controlling leaf infections. The beneficial nature of the micronutrients included in the foliar spray cannot be ascertained from the present experiment. Further evidence on the efficacy of N.P.K. application in improving the vigour and productivity of coconut palms is forthcoming from the extensive Coconut Fertilizer Demonstration Trials conducted by Potascheme (N. P. K. Pamphlet No. 1, 1956), although the improvement noted was partly masked in the diseased belt of Travancore-Cochin. This discrepancy is perhaps due to the impoverished soil conditions in the diseased areas. As already stated by Menon *et. al.* (1950) the soils in the diseased tract are highly deficient in N. P. & K, the deficiency being more pronounced in the case of potash. Instead of the nutrient dosage 1: 1: 2 adopted by Potascheme, we supplied there in the ratio 1: 1: 4, whether the dosage suffices to correct the soil deficiency is not known. The aetiology of the baffling coconut disease is still under investigation and the role of plant nutrients in the incidence of the disease is not yet correctly understood, nevertheless our experimental data stress the beneficial role of soil amelioration in combating the disease. Potascheme has also stated that the response of the palms in the diseased area to manurial application is boosted with regular fungicidal spray. Further manurial trials which are in progress with higher dose of nutrients particularly that of potash with and without the fungicidal spray is expected to throw more light on this intricate problem.

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APPENDIX

TABLE 1

Indicates the general condition of the palms during 1951-56

Treatments	Condition	1951	1952	1953	1954	1955	1956
I	d +++	4	4	2	0	0	0
	d ++	4	4	5	3	3	1
	d +	3	3	3	6	4	4
	Healthy	4	4	5	6	8	10
II	d +++	2	2	1	1	1	1
	d ++	5	5	3	1	1	0
	d +	4	4	6	5	1	3
	Healthy	4	4	5	7	12	11
III	d +++	5	5	5	3	2	2
	d ++	2	2	2	2	2	1
	d +	3	3	3	3	3	3
	Healthy	5	5	5	7	8	9
IV	d +++	1	1	1	0	0	0
	d ++	4	4	2	1	0	0
	d +	6	6	8	7	3	2
	Healthy	4	4	4	7	12	13
Control	d +++	5	4	4	4	3	4
	d ++	0	0	1	1	3	3
	d +	4	4	4	4	4	6
	Healthy	6	6	6	6	5	2

d +++ — diseased advanced stage
d ++ ,, middle ,,
d + ,, early ,,

TABLE 2

Average yield - Number of nuts per palm per year

Treatments	1951	1952	1953	1954	1955	1956
I	25	32	34	41	36	31
II	31	30	36	37	42	34
III	25	28	30	36	30	30
IV	37	36	38	47	36	36
Control	17	14	17	28	17	17

TABLE 3

Analysis of variance

Source	Sum of squares	Degrees of freedom	Mean standard error	F	Critical difference
Total	274517	449	—	—	760
Year	6636	5	1327	2.75	
Treatments	28273	4	7068	14.66	
Year and treatment	37293	20	1865	3.87	
Error	202315	420	482	—	

Test of significance

Treatment	*Total yield*	*Critical difference*
I	2983	760
II	2650	
III	2650	I, II, III, IV, V
IV	3398	
V Control	1349	I = II = III = IV > V