Effect of manuring and intercultivation on the yield of coconut in relation to leaf rot and root (wilt) diseases

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INTRODUCTION

ALTHOUGH considerable information on the effect of manuring and intercultivation of coconut gardens has been reported from almost all the coconut growing countries (Sampson, 1923; Patel, 1938; Fremond and Gros, 1956; Potascheme, 1956; Pandalai and Menon, 1957; Fenwick, 1961; Eden et al, 1963; Spencer, 1963) no information appears to be available with regard to the responses of coconut palms affected by any serious disease. Hence it was thought justifiable to examine the data available at the Central Coconut Research Station, Kayangulam on the response of the palms affected by two important diseases, *viz.*, the leaf rot [*Bipolaris halodes* (Drechs) Shoemaker, *Gloeosporium* sp. and *Gliocladium roseum* (Baines)] and the root (wilt) disease to regular and systematic agronomic practices. An attempt has thus been made to compare the effect of manuring and intercultivation with no manuring and no intercultivation as well as with higher doses of manuring plus intercultivation in disease affected coconut gardens. The data collected on the yield and general condition of palms during the period 1950 to 1962 are presented and discussed in this paper.

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MATERIALS AND METHODS

All the experimental palms are adult trees aged about 50 years and above standing in Blocks I and VIII of the Research Station. The majority of the palms are affected by root (wilt) disease and a few by leaf rot also. The soil is a loose sandy loam rather poor in plant nutrient contents and with a fairly high water-table.

SERIES 1. Palms under this group were given the following treatments :-

Manuring: With NPK fertilizers at the rate of 0.55 lb. N, 0.56 lb. P_2O_5 and 1.0 lb. K_2O as groundnut cake, bone meal and muriate of potash respectively plus green manure *(Crotalaria juncea)* grown *in situ* at the rate of 75 lb. per tree per year applied in ring trenches.

Intercultivation: Two ploughings with iron mould board plough annually during May-June and piling of mounds in September-October and levelling of the same in December-January.

Block VIII of this Research Station consisting of about 171 trees is under this treatment from 1948 onwards.

SERIES 2. 150 palms in plots 1 to 9 of Block I formed the experimental trees in this series. These palms received the same treatments as in Series 1 from 1948 to 1952. From 1955 to 1956, a manurial-cum-spraying experiment was carried out, the results of which have already been published (Nair and Radha, 1959). The experimental details were as follows :-

Treatments – I) NPK,
II) NPK + Lime (4 cwt. per tree),
III) NPK + Farm yard manure (100 lb. per tree),
IV) NPK + Lime + Farm yard manure (as in II & III),
V) Untreated control.

NPK at the rate of 0.5 lb. N, 0.5 lb. P_2O_5 and 2.0 lb. K_2O per tree were supplied as groundnut cake, bone meal and muriate of potash respectively plus 75 lb. of green manure. Palms under treatment I to IV were given four sprayings with 1.0 per cent Bordeaux mixture during December-January, April-May, June-August and October-November and a single spray with 0.5 per cent iron, 0.01 per cent molybdenum and 0.75 per cent each manganese and magnesium during February-March.

From 1956 onwards the same palms were under an intensive manurial-cum-spraying trial, the treatments being N and P_2O_5 at the rate of 1.5 lb. and 3.0 lb. per tree per year and K_2O at the rate of 3.0 lb., 4.5 lb. and 6.0 lb. per tree per year in different combinations. Green manure and lime were applied as in the previous years. Spraying with 1.0 per cent Bordeaux mixture four times a year was also being carried out.

SERIES 3. 20 palms in Block I which received manuring and intercultivation till 1952 are maintained as untreated controls from 1952 onwards.

SERIES 4. Block IX of the Station where manuring and intercultivation as in Series 1 has been practised from 1959 onward. Prior to this the garden remained almost in a neglected condition having received no cultural or manurial treatments.

CONDITION OF THE PALMS

Series 1. The earliest record available on the general condition of the palms is in 1958. The population of this Block dwindled from 171 trees to 148 by 1958, of which only two palms were healthy (1.35 per cent), 77 trees were affected by leaf rot and root (wilt) diseases and 52 by root (wilt) disease alone. By 1962 the total number of palms came down to 130 due to advance of diseases and senility. Healthy palms remained in the same condition.

Series 2. Of the 150 experimental palms 77 were apparently healthy in 1952, and this includes four senile trees. Twenty-seven palms were affected by root (wilt) disease and 45 with root (wilt) disease and leaf rot. The percentage increase in disease was to the extent of 33.3 during the period 1952 to 1962. Mortality was to the extent of 7.3 per cent.

Series 3. Among the untreated controls 8 palms out of 20 were diseased in 1952. The disease incidence progressively increased upto 75.0 per cent by 1962, i. e. an increase of 35.0 per cent of the initial number of palms during the period 1952 to 1963. Three of the palms died due to advance of disease.

Series 4. Block IX comes under the land recently acquired for the Station. Hence no information prior to 1959 is available regarding this garden. Of the 237 palms only 35 are healthy.

YIELD

Yield data of the palms have been considered for the nine years from 1954 to 1962, since the manurial trials were laid out in 1952, and any response due to the treatment is expected to be evident only from 1954 onwards at the earliest. However, the data collected from 1950 onwards for the palms in series I to III have also been tabulated to indicate the response of the neglected gardens to regular manuring and intercultivation as in the case of palms under series 4.

A study of the yield data is presented in Table 1. The number of yielding trees, the average yield per tree per year in the different treatments and the response over the pretreatment yield are given in Tables 2, 3a and 3b respectively. The results clearly indicate the positive response of the coconut palms to proper agronomic practices.

TABLE 1

Showing the average yield of nuts per tree per year

R. w. d. = Root wilt disease L. r. = Leaf rot

Year	Series 1		Series 2			Series 3		Series 4	
			Condition of trees						
	Root (wilt) disease	R.w.d. and leaf rot	Healthy	R.w.d.	R.w.d. and L. r.	Healthy	R.w.d. and L. r.	Healthy	R.w.d. and L. r.
1950	26.0	21.8	35.6	26.2	21.6	37.2	21.0		
1951	29.6	20.6	34.2	30.3	23.2	42.6	19.8		
1952	24.3	18.6	39.1	28.8	19.9	41.8	24.7		
1953	31.7	23.5	43.8	30.8	29.6	45.4	33.1		
1954	36.5	24.8	50.0	27.7	28.5	67.6	29.5		
1955	28.6	16.6	43.3	25.6	24.1	39.5	25.5		
1956	33.3	20.6	42.6	26.1	24.4	41.4	13.1		
1957	30.5	17.0	44.7	34.4	26.7	43.5	15.2		
1958	30.3	19.1	47.2	35.5	20.8	31.1	10.5		
1959	44.6	19.9	48.9	33.4	33.1	43.8	16.2		
1960	36.2	18.4	39.4	24.4	24.3	35.5	10.2	38.1	25.2
1961	32.1	18.5	38.5	26.9	19.5	41.1	6.3	56.6	32.9
1962	33.5	16.5	42.3	27.9	24.9	38.6	8.0	62.0	32.7

A steady increase in yield of nuts is evident during 1951-'54 in all the plots supplied with fertilizers and where intercultivation was also carried out till 1954. In view of the heterogeniety in the disease conditions of the trees it is not possible to offer any rigid comment on the precise interaction of the disease and the manurial treatments in affecting the yield of the palms. Nevertheless, the data given are of some indicative value.

The positive respose of palms to normal agronomic practices is evident in palms of series 1, 2 & 3 till 1954. Thereafter the effect of special manurial treatments like application of farm yard manure and higher doses of potash (2.0 lb.) is reflected in the yield of palms in Series 2. An improvement in the yield of palms was again noticed during the period 1957 to 1959. Probably this is due to the seasonal influence, a factor which cannot however be ruled out.

Palms under series 3 which received normal manuring and intercultivation till 1952 show a declining trend in yield of diseased palms from 1954 after these treatments were withdrawn. As compared to the treated palms of series 1 and 2 the reduction in yield is very conspicuous thereby indicating the importance of regular manuring and intercultivation in a diseased tract. In the case of healthy palms the difference was not so marked perhaps because the root system of those palms are capable of drawing upon the available nutrients from a wider area than the diseased palms with a crippled root system.

DISCUSSION

Our observations on the beneficial effect of manuring and intercultivation is, in general, comparable to the results of the large scale experiments conducted under the coconut fertilizer demonstration scheme (John and Jacob, 1959). However, the effects of the additional dose of NPK described by them is contrary to our record. The reason is not far to seek. It can quite possibly be due to the diseased conditions of the palms considered in these experiments. Moreover, the dosage of NPK supplied to these palms is higher than what was applied under the C.F.D. Scheme. Ziller and Fremond (1961) have reported that 1.5 kg. of K_2O per tree per year increased the yield by about 40 per cent over the control after six years treatment. These observations were also made on healthy palms. While recognising the importance of manuring in maintaining the productivity of the palm, a fact clearly established by the results of the C.F.D. Scheme, the fact that the response of the palms is determined to a great extent by its general condition of health is also to be taken into account. No foliar diagnosis in the experimental palms were attempted by us yet the observations recorded by Ziller and Fremond on the magnesium antagonism consequent on the heavy application of potash could, apart from the influence of disease, have caused some imbalanced conditions of nutrition which might have been an additional factor leading to reduction in yield of the palms.

Although the additional dose of fertilizers failed to increase the productivity of the palms, the data presented here emphasize the imperative necessity of proper plantation management in a diseased tract. The reduction in annual

yield in a well maintained plot (Series 1) is 8.3 nuts per tree in the course of 8 years (1954-1962) whereas it is to the extent of 21 nuts in the untreated control plot (Series 3) over the same period. In contrast to this yield of the diseased palms in series 2 which received special manurial treatments showed slight decrease (Table 1). The data presented in Table 2 indicate an increase in the number of yielding trees, both healthy and diseased, in the treated plots. Similarly the increase in disease intensity is estimated to be 12 per cent in the manured while it is 25 per cent in the unmanured during the period 1958 to 1962. The response of the healthy and diseased palms to the different manurial treatments as shown in Tables 3-a and b reveal that normal manuring given to all the palms till 1952 and continued in series 1 till 1964 yield the best results. Increase in the yield of healthy palms during a period of five years of treatment is to the extent of 8.2 nuts per tree while the same effect is produced in palms affected by root (wilt) disease during a period of 14 years. In the case of palms affected by both root and leaf diseases the response is highly variable depending on the intensity of disease. Palms in the advanced stages of disease fail to respond even to continuous manurial application. Special manurial treatment also appears to have no beneficial effect in these cases.

On working out the economics of manuring it is found that the cost of manuring one acre of coconut garden with 70 palms is approximately Rs. 218 and the increased yield of healthy palms at a cost of Rs. 350 per 1000 nuts is Rs. 200.9. Although there is no profit during the early years (5 years) in the long run it will prove fruitful as indicated by the data on diseased palms in 14 years. This is clearly an important result particularly since it is derived from an experimental material with a record of long neglect and a rather heterogeneous physiological condition due to the different and diverse pathological influences which had affected the palms. Moreover, the picture is complete only when the untreated control palms are considered — the reduction in yield in both the healthy and diseased palms in this series ranges from 500 to 1500. These data should be taken as a pointer to the extensive loss that might accrue consequent on the neglect of coconut gardens in a disease affected area.

Menon and Nair (1952) reported deterioration in the quality of the copra obtained from palms affected by root (wilt) disease. John and Jacob (1959) recorded increase in the copra content of the palms due to regular manuring. Whether there is any improvement in the quality of the copra of the experimental palms reported here is under study. Results of these and further observations on the residual effects of the practices adopted on the health and yield of the palms will be reported separately.

SUMMARY

The effect of (1) manuring with standard dose of NPK fertilizers at the rate of 0.55 lb. N, 0.56 lb. P_2O_5 and 1.0 lb. K_2O plus intercultivation, (2) heavy dose of NPK fertilizers 1.5 and 3.0 lb. of N and P_2O_5, and 3.0, 4.5 and 6.0 lb. of K_2O plus intercultivation and (3) no manuring and no cultivation, on the

yield and foliar disease symptoms of four groups of palms affected by root (wilt) disease as well as leaf rot have been recorded.

Manuring with standard dose of fertilizers plus intercultivation was found to be beneficial in maintaining an economic yield and the general health of the palms, although it has not been able to check the progress of the disease to any appreciable extent in the case of trees in an advanced stage of either of the diseases. A higher dose than the standard dose of manures is not advocated as it seemed, under the conditions of the experiment, to aggravate disease conditions and reduce yield. This probably arises due to the antagonists action of increased potassium on the magnesium.

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