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EFFECT OF CONTINUOUS CULTIVATION AND MANURING ON THE LEAF NUTRIENT COMPOSITION AND SOIL NUTRIENT STATUS OF COCONUT PALMS

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ABSTRACT

Three permanent observational plots, first with no cultivation and no manuring, second with regular cultivation but no manuring, and the third with regular cultivation and manuring have been maintained at the Institute since 1919. Analysis of leaf samples collected from these plots during summer (March) and rainy (July) seasons showed that during both the seasons, leaves of palms receiving regular cultivation and manuring contained significantly higher amounts of nitrogen (1·90% dry matter in summer and 1·92% in rainy seasons) and potassium (0·40 and 1·00% respectively). The average annual yield of nuts from this plot (67 nuts/palm) was also significantly higher than those from the other two treatments (39 nuts/palm for the 'cultivation and no manuring' plot and 12 nuts/palm for the 'no cultivation and no manuring' plot). Soil analytical data showed that available potassium in 0–30 cm and 30–60 cm depths of soil increased significantly in the 'cultivation and manuring' plot over that of 'no cultivation and no manuring' plot.

INTRODUCTION

THE coconut as a perennial crop remains on land for 60 or more years and so our primary interest in the management practices should be not only for the immediate response of palms, but also on its long term effect. Patel (1938) reported the results of trials carried out, on a red sandy loam soil of the Institute with different manure mixtures. He reported that the mean difference in the yield between the control and the plot receiving 9·07 kg (20 lb) of ash/tree/annum was 34 nuts for the yield group 30–50 nuts. John and Jacob (1959) observed that the application of balanced NPK fertilizer, combined with green manure, gave 35% increased yield of nuts and 44% of copra. Muliyar and Nelliat (1971) reported 17% increased yield of nuts due to N, 6% due to P, and 9% due to K over a ten year period.

Three permanent observational plots are being maintained at the Institute from 1919 to study the effect of cultural operations and manuring on coconut palms. These palms were studied to find out the differences in the nutrient contents of the leaf tissues due to these treatments as well as the great difference in yield. Besides, soil samples were also analysed to know the nutrient variations in them over this period and these are reported here. So far, no work of this type has been done in coconut. The soil of these plots is deep sandy loam with water table going 6–7 m below ground level during summer. The plots are within 1 km of the sea and the ordinary west coast tall coconut palms are growing under entirely rainfed conditions. The plots are receiving the following treatments : Plot I —uncultivated and unmanured ; Plot II—cultivated, but not manured (two ploughings/year, one in August-September and the other in October-November with iron plough. In case weed growth is observed, Junior hoe will be worked during December-January) ; and Plot III—cultivated and manured ($N = 0·50$ kg ; $P_2O_5 = 0·32$ kg, and $K_2O = 1·20$ kg/tree/year).

MATERIALS AND METHODS

Two middle leaflets from either sides of the 14th leaf were collected from 6 palms of the central parts of the three plots during summer and rainy seasons. The middle 10 cm of the leaflets was taken for analysis discarding the midribs. The samples were analysed for N, P, K, Ca, and Mg according to Piper (1950). Composite soil samples (from the base of the palms from which leaf samples were taken) were collected from the plots at three depths, 0–30 cm, 30–60 cm, and 60–90 cm during summer and rainy seasons and analysed for the N, P, K, Ca and Mg to

ascertain the variations, if any, in the nutrient status of the soil due to different treatments and seasons. The leaf analytical data were statistically analysed and the results are presented in Table I.

Plot I). In the rainy season, P did not show any significant difference in the three plots. The Ca content of leaves did not show any significant differences between the three plots in both the seasons.

TABLE I

Analytical data of leaf samples from the permanent observational plots during summer and rainy seasons

Treatments	N%		P%		K%		Ca%		Mg%	
	Summer season	Rainy season	Summer season	Rainy season	Summer season	Rainy season	Summer season	Rainy season	Summer season	Rainy season
t_1: uncultivated and unmanured	1·514	1·467	0·1072	0·1110	0·2762	0·5388	0·3164	0·3447	0·0991	0·1223
t_2: cultivated, but not manured	1·704	1·761	0·0901	0·1372	0·3172	0·7037	0·3997	0·2696	0·1305	0·0922
t_3: cultivated and manured	1·899	1·920	0·0677	0·1074	0·4030	1·0040	0·3169	0·2974	0·0801	0·0451
Mean	1·705	1·716	0·0883	0·1185	0·3322	0·7487	0·3443	0·3039	0·1032	0·0865
Gen. mean	1·711		0·1034		0·5405		0·3241		0·0948	
S.E. per plot	0·138		0·0329		0·0907		0·0633		0·0413	
Significant effects	t†		s†		t†, s‡, and $t\times s$*		$t\times s$*		t*	
Critical difference (5% level)	0·1153 (t)		0·0224 (s)		0·0907 (t) 0·0740 (s) 0·1282 ($t\times s$)		0·0747 ($t\times s$)		0·0326 (t)	

t—treatments, s—seasons. * Significant at P=0·05, † Significant at P=0·01, ‡ Significant at P=0·001.

RESULTS AND DISCUSSION

The nitrogen (1·899% in summer and 1·920% in rainy season) and potassium (0·403% in summer and 1·004% in the rainy season) contents of the leaves of the cultivated and manured plot were significantly higher than those of the other two plots in both the seasons (Table I). The lowest leaf nitrogen (1·467%) was recorded in the uncultivated and unmanured plot. Thus the effect of manuring was quite evident in the nitrogen and potassium contents of the palms getting NPK fertilizers. Cultivation alone has increased the N (by 12·55% in summer and by 20·04% in rainy season) and K (by 14·84% in summer and by 30·60% in rainy season) contents in the leaf in both the seasons. Cultivation increases the microbial activity in the soil, thereby enriching the soil (Rangaswamy, Oblisami, and Swaminathan, 1967). During summer, the leaf P content (0·0677%) in the third plot was significantly less than that in the other two plots (0·0901% in plot II and 0·1072% in

Among the three plots, the third plot gave the highest yield of coconuts (67 nuts), followed by the second (39 nuts), and first (12 nuts). Marar and Pandalai (1959) had reported from these very observational plots that regular cultivation (Plot II) by itself was highly effective in increasing yields even in the absence of manuring. According to them, regular cultivation induces the production of inflorescences in leaf axils, while in the palms of the uncultivated and unmanured plot, abortion of the inflorescences occurs to a large extent. Thus, the increased NK status in the leaves was reflected in the increased yield. The leaf K content (1·00%) during the rainy season was more than that of the summer (0·40%), which is in conformity with the results reported by Ziller and Prevot (1962) in Dahomey. Further, the results of IRHO also confirm the above finding (private communication, 1971).

The higher concentration of nutrients in leaf during the rainy season is due to the presence of sufficient moisture in the soil due to which greater absorption is effected. In

TABLE II

Analytical data of soil samples (on dry wt. basis) from permanent observational plots during summer and rainy seasons

Particulars	N%	P%	K%	Ca%	Mg%
t_1: Uncultivated and unmanured	0·0513	0·00080	0·00280	0·02087	0·02612
t_2: Cultivated, but not manured	0·0462	0·00109	0·00241	0·01916	0·03572
t_3: Cultivated and manured	0·0451	0·00097	0·00443	0·03002	0·02214
s_1: Summer season	0·0349	0·00099	0·00378	0·02166	0·03584
s_2: Rainy season	0·0601	0·00092	0·00298	0·02502	0·02009
d_1: 0–30 cm depth	0·0593	0·00086	0·00332	0·02916	0·01357
d_2: 30–60 cm depth	0·0473	0·00124	0·00428	0·02087	0·03620
d_3: 60–90 cm depth	0·0360	0·00076	0·00254	0·02001	0·03421
Gen. mean	0·0475	0·00095	0·00338	0·02337	0·02799
SE per plot	0·0122	0·00016	0·00170	0·00558	0·01629
Significant effects	s† and d*	t* and d†	..	t* and d*	..
Critical difference (5% level)	0·0128 (s)	0·00020 (t)	..	0·00715 (t)	..
	0·0151 (d)	0·00020 (d)	..	0·00715 (d)	..

* Significant at P=0·05, † Significant at P=0·01.

addition, during the rainy season, new roots are produced and this also increases the absorbing capacity of the palms. Fremond and Conclaves (1967) have also reported that in coconut groves N uptake continued while the soil was damp but decreased rapidly during dry season. The soil data are given in Table II. There is no significant difference in the N content between the three plots in both the seasons. During both seasons cultivation alone had increased the available P (II plot). Potassium content was found to be more in the third plot. In the case of calcium there was a slight increase in the surface soil of the third plot due to cultivation and manuring in both the seasons. In the other two plots there was no significant difference. However, Mg content was less in the third plot because more of it has been absorbed by the palms. Thus, the results showed that regular cultivation and manuring are essential for the increased production of nuts. Further work to know the cause of the higher yield of nuts and higher uptake of nutrients by cultivation alone is in progress.

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