Evaluation of Micronutrient Status of Soils from Healthy and Yellow Leaf Disease Affected Arecanut Gardens

A. R. MOHAPATRA, N. T. BHAT AND C. DEVARAJU

Regional Station, Central Plantation Crops Research Institute, Vittal, Karnataka

Abstract : *The major and micronutrients status of soils of healthy and disease affected areas were examined to find out whether nutrient imbalance is the probable cause of the yellow leaf disease of arecanut. The available forms of micronutrients such as boron, zinc, copper and manganese were low in soils both from healthy and yellow leaf disease affected gardens. Exchangeable iron was adequate in the soils. The KCl extractable aluminium contents of soils of diseased tracts were higher than those of disease free areas.* (Key words : Yellow leaf disease of arecanut ; available micronutrients ; aluminium).

The yellow leaf disease of arecanut is a serious problem in southern districts of Kerala and Chickmangalore district of Karnataka and has affected five per cent of plantations in these areas (Anonymous 1969). Generally, palms of prebearing age are more susceptible to the disease. The oldest leaves first turn yellow and then yellowing spreads upwards to younger leaves. Leaf size is gradually reduced and the affected palms lose vigour (Anonymous 1969). In bearing palms, yellowing of leaves is sometimes accompanied by tender nut-fall and kernal discolouration. Yellowing of leaves is more clearly seen in August after the onset of monsoon (Anonymous 1970). Since the aetiology of the disease is not correctly known, the present study was undertaken to find out whether micronutrient status of soils has any relationship with the incidence of this disease.

EXPERIMENTAL

A soil fertility survey was undertaken in the disease affected district of Trivandrum (Kerala) and the disease free districts of Kanniyakumari (Tamil Nadu) and South Kanara (Karnataka). The location and general fertility status of soils of the gardens are given in table 1. Broadly, the soils of these gardens are sandy loam in texture, acidic in reaction, low to medium in avail. P, K and well supplied with N (Muhr *et al.* 1965). The soils of the farms of research stations where manuring and fertilization are regularly done, contained more avail. P and K than those of private plantations.

Soil samples used in the estimations of micronutrients were passed through 2 mm stainless steel sieve. Mechanical analysis of pooled soil samples representing each category of garden was carried out by International pipette method (Piper 1966). Org. C and avail. P were estimated by Walkley and Black and Bray and Kurtz methods, respectively. Exchangeable K was determined flame photometrically after equilibrating the soils with

TABLE 1

General fertility status of soils from yellow leaf disease affected and healthy arecanut gardens

Location	Description of palm	Number of gardens covered	Sample size (0-50 cm)	Texture	pH	Org. C (%)	Avail. P_2O_5 (ppm)	Avail. K_2O (ppm)
Palode, Trivandrum	Apparently healthy palms in diseased ryots garden	Ten	20	Sandy loam	3.9-5.8	0.7-2.6 (1.41)*	Trace-8.2 (3.4)	12-93 (37.3)
Palode, Trivandrum	Diseased palms in diseased ryots garden	Ten	20	Sandy loam	4.3-6.1	0.4-2.7 (1.37)	Trace-10.3 (3.3)	9-83 (33.45)
Palode, Trivandrum	Healthy palms in healthy ryots garden	Ten	20	Sandy loam	4.4-5.7	0.1-4.7 (1.70)	Trace-8.2 (2.4)	21-80 (43.0)
Palode, Trivandrum	Diseased palms from CPCRI sub-station farm	Five	10	Sandy loam	5.0-5.9	1.0-3.2 (1.74)	0.9-34.3 (18.2)	39-164 (94.9)
Palode, Trivandrum	Healthy palms from CPCRI sub-station farm	Five	10	Sandy loam	5.0-6.2	1.1-3.7 (1.96)	5.5-56.1 (20.9)	55-166 (122.1)
Nagercoil, Kanniyakumari	Healthy palms from ryots garden	Five	15	Sandy loam	5.4-8.3	0.3-1.9 (0.75)	Trace-43.2 (4.1)	25-500 (83.8)
Vittal, South Kanara	Healthy palms from CPCRI regional station farm	Five	22	Sandy loam	4.8-6.1	0.4-2.8 (1.16)	Trace-64.8 (20.2)	35-160 (95.2)

*Figures in parenthesis represent the mean values

TABLE 2

Micronutrient status of soils from yellow leaf disease affected and healthy arecanut gardens

Location	Description of palm	Number of gardens covered	Sample size (0-50 cm)	Hot water soluble B (ppm)	Dithizone extractable Zn (ppm)	*N* NH_4-OAc extractable Cu (ppm)	KCl extractable Al (ppm)	Fe^{2+} + Fe^{3+} (ppm)	Avail. Mn (ppm)	Quinol reducible Mn (ppm)
Palode, Trivandrum	Apparently healthy palms in diseased ryots garden	Ten	20	Trace-0.20 (0.096)*	Trace-5.52 (0.388)	Trace-0.44 (0.221)	36-230 (90.0)	1.6-21.9 (7.8)	Trace-3.5 (0.60)	Trace-6.25 (0.31)
Palode, Trivandrum	Diseased palms in diseased ryots garden	Ten	20	Trace-0.20 (0.095)	Trace-6.25 (0.655)	Trace-0.64 (0.305)	20-254 (98.4)	2.4-12.0 (7.2)	Trace-17.5 (1.77)	Trace (Trace)
Palode, Trivandrum	Healthy palms in healthy ryots garden	Ten	20	Trace-0.30 (0.047)	Trace-7.72 (0.423)	Trace-0.32 (0.075)	19-213 (104.2)	3.1-11.6 (6.8)	Trace-12.5 (1.35)	Trace-7.25 (1.04)
Palode, Trivandrum	Diseased palms from CPCRI sub-station farm	Five	10	0.13-0.46 (0.266)	Trace-1.76 (0.176)	Trace-0.74 (0.118)	42-270 (99.2)	2.3-9.0 (4.5)	Trace (Trace)	Trace (Trace)
Palode, Trivandrum	Healthy palms from CPCRI sub-station farm	Five	10	0.06-0.30 (0.191)	Trace (Trace)	Trace-0.64 (0.254)	30-138 (73.4)	1.9-14.0 (6.4)	Trace-80 (9.45)	Trace (Trace)
Nagercoil, Kanniyakumari	Healthy palms from ryots garden	Five	15	Trace-0.11 (0.044)	Trace-6.25 (1.15)	Trace-0.64 (0.072)	9-39 (13.7)	Trace-16.8 (4.4)	Trace-43.7 (10.9)	Trace-160.00 (41.45)
Vittal, South Kanara	Healthy palms from CPCRI regional station farm	Five	22	Trace-0.17 (0.058)	Trace-6.75 (0.396)	Trace-0.38 (0.083)	9-119 (28.8)	Trace-6.2 (2.3)	3.0-80.0 (24.6)	0.75-35.50 (9.13)

*Figures in parenthesis represent the mean values

1*N* NH_4OAc (Muhr *et al.* 1965). Hot water soluble boron in soil was estimated by curcumin method (Jackson 1967). Dithizone extractable zinc, neutral *N* NH_4OAc extractable copper, combined exchangeable $Fe^{2+} + Fe^{3+}$, available and quinol reducible manganese were also estimated according to Jackson (1967). Aluminium from soil was extracted by 1*N* KCl and determined by aluminon method (Chapman & Pratt 1961).

RESULTS AND DISCUSSION

The aluminium and micronutrient contents of soils representing healthy and diseased tracts are given in table 2. The data show that irrespective of the prevalence or absence of disease, the soils are low in avail. Zn, Cu, Mn and B as judged by 0.5 ppm of dithizone extractable zinc (Brown *et al.* 1962), 0.5 ppm of neutral *N* NH_4OAc extractable Cu (Wood 1945), 3 ppm of exchangeable and 100 ppm of reducible Mn (Sherman & Harmer 1943) and 0.1 ppm of hot water extractable boron (Eaton & Wilcox 1939). The contents of ferrous and ferric iron did not show much difference between the soils of healthy and diseased belts and were above the threshold value of 2 ppm of available iron which is considered as the level of sufficiency (Olson & Carlson 1950).

The KCl extractable Al contents of disease affected soils were higher than those of completely disease free tracts of Vittal and Nagarcoil and are likely to be toxic to plants (Vlamis 1953). Aluminium toxicity is often encountered in acid soils and responses to crops have been obtained as a result of liming (Hyot & Nyborg 1971). On the other hand, certain plants like tea and cacao grown in tropical acid soils exhibit considerable degree of tolerance to the higher levels of soil-aluminium (Childers 1966). It is, therefore, not known whether the exchangeable Al contents of soils of Palode are really toxic to arecanut. However, the role of aluminium as a probable factor in the incidence of yellow leaf disease of arecanut could be ascertained by carrying out suitable liming trials in the disease affected areas. In an earlier study, application of different major and micronutrients reduced the intensity of yellowing and increased the yield and vigour of palms to certain extent (Anonymous 1970). The results suggest that in addition to liming of the acid soils to neutrality, some of these essential micronutrients should also be added along with NPK fertilizers to arecanut to reduce the severity of this disease.

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