

## CALCIUM AND MAGNESIUM STATUS OF SOILS AND LEAVES IN RELATION TO THE ROOT (WILT) DISEASE OF COCONUT

A. S. MATHEW AND THOMAS VARKEY

Central Plantation Crops Research Institute, Regional Station,  
Krishnapuram-690 533, Kerala State, India

### ABSTRACT

The healthy and diseased tracts in the northern border of root (wilt) affected area in Kerala State were studied to find out how far calcium and magnesium contents of soil and leaf were involved in the development of the disease. Soil and leaf samples from healthy and diseased tracts were collected from sandy, loamy, and laterite soils covering the coastal, midland, and hilly regions, respectively. Results indicated that the status of calcium and magnesium of soil and leaf could not be considered as a factor for the incidence of root (wilt) disease of coconut.

### INTRODUCTION

The root (wilt) disease of coconut occurs in all soil types of Kerala, but the intensity and rate of spread are higher in sandy, loamy, and reclaimed clayey soils as compared to laterite soils. (Pillai *et al.*, 1975). Investigations on the nutrient status of soil and leaf of coconut palms in relation to the root (wilt) disease were carried out by several workers (Menon *et al.*, 1950; Sankarasubramoney *et al.*, 1954, 1955, 1956; Pandalai *et al.*, 1958). Menon and Nair (1949) observed a state of unbalanced nutrition in the root (wilt) affected palms while Sankarasubramoney *et al.* (1952) reported the accumulation of nutrients in the leaves of diseased palms. Menon and Pandalai (1960) found significant differences between the soils of diseased and healthy tracts for total exchangeable bases, percentage base saturation, pH, total calcium, and available potassium. They observed that the values for these factors were always lower in soils collected from the diseased tracts as compared to

those from healthy tracts. However, they were doubtful whether the disease could be attributed to a deficiency of calcium as a nutrient in the soil. Based on his studies on the nutritional aspects of coconut palms under health and disease, Cecil (1969) reported that deficiency of calcium and magnesium was associated with the disease. This study was undertaken to determine if calcium and magnesium contents of the soil and leaf have any relationship with the incidence of the disease.

### MATERIALS AND METHODS

The intensity of root (wilt) disease is highest in the districts of Quilon, Alleppey, and Ernakulam and it is spreading gradually to the north in Trichur District. The northern border region of the diseased tract, which stretches through the coastal sand, loamy soil of the midland region, and the laterite soil of the hilly tract in Trichur district, was selected for this study. For collection of samples, eight plots each were selected in

sandy, loamy, and laterite soils, 8-16 km away from the border on either side in healthy and diseased tracts except in the laterite soil of diseased tract where. Only three plots were obtained in laterite soil of diseased tract. Thus, a total of 43 plots, consisting of 24 in healthy and 19 in diseased tracts, were selected. These plots were situated at Edathuruthy, Oorakam, Trichur, and Ollur in the healthy tract, and Parur, Irinjalakuda, Chalakudy, and Pariyaram in the diseased tract.

The leaf samples were collected by the technique described by Fremond (1966).

Soil samples were collected from the basins of palms 150 cm away from the bole. The exchangeable calcium and magnesium in soil and total calcium and magnesium in leaf were determined by the versene method. (Jackson, 1967).

#### RESULTS AND DISCUSSION

Analytical data of soils and leaves are given in Table I. In general, the exchangeable calcium content of soils from the diseased tract was significantly higher than that of soils from healthy tract. When individual types were considered, both loamy and sandy

TABLE I  
*Calcium and magnesium status of soil and leaf*

Item	Soil types						Overall analysis	
	Laterite		Loamy		Sandy		H	D
	H	D	H	D	H	D	H	D
<b>Ex. Calcium (m.e./100 g)</b>								
Mean and range of two depths	1.48 (1.0-2.2)	1.52 (0.9-3.0)	2.23 (0.9-4.6)	2.78 (0.9-6.0)	0.85 (0.4-1.8)	1.35 (0.8-5.5)	1.55	2.04
Significance	—		*		**		**	
<b>Ex. Magnesium (m.e./100 g)</b>								
Mean and range of two depths	0.77 (0.3-2.9)	0.58 (0.2-1.1)	1.11 (0.3-4.1)	1.35 (0.2-2.8)	0.37 (0.1-0.6)	0.79 (0.2-1.7)	0.74	1.05
Significance	—		—		**		**	
<b>Calcium content of leaf (%)</b>								
Mean and range	0.33 (0.20-0.46)	0.28 (0.22-0.36)	0.31 (0.14-0.49)	0.29 (0.20-0.48)	0.36 (0.22-0.50)	0.38 (0.14-0.58)		
Significance	—		—		—			
<b>Magnesium content of leaf (%)</b>								
Mean and range	0.34 (0.19-0.56)	0.25 (0.17-0.33)	0.35 (0.23-0.49)	0.24 (0.11-0.35)	0.32 (0.13-0.44)	0.28 (0.18-0.54)		
Significance	*		**		—			

H Healthy

D Diseased

\*Significant at 5% level.

\*\*Significant at 1% level.

Figures in bracket indicate the range of values.

soils of diseased tract contained more exchangeable calcium than those from healthy tract. Laterite soils of healthy and diseased tracts did not vary significantly in their exchangeable calcium content. Analytical data of leaves showed that calcium content did not vary between healthy and diseased palms irrespective of soil types. These observations indicated that calcium status of soil or leaf did not serve as a causative factor for the development of disease. As regards exchangeable magnesium content of soils, in general, soils from diseased tract showed higher values than those from healthy tract. However, when individual soil types were examined, this difference was significant only in sandy soil. As for leaves, the total magnesium content was higher in healthy leaves in the case of laterite and loamy soils while samples from sandy soil did not vary significantly. Though the soils of diseased tract were having higher amounts of exchangeable magnesium, a corresponding increase in total magnesium of leaves was not observed. Pillai (1959) also obtained similar results. The low content of total magnesium in the diseased leaves may probably be due to the imbalance in the ionic ratios usually observed in disease affected palms (Cecil, 1975). It appears from the data that the nutrient concentration of diseased leaf need not reflect the soil content once the palm is affected by the disease. As in the case of calcium, the results of the present study did not give any indication to suspect the deficiency of magnesium as a causative factor for the incidence of the disease since the exchangeable magnesium content of soils of the diseased tract was comparatively higher than that of healthy tract. These observations do not agree with the findings of Cecil (1969) and Menon and Pandalai (1960). After a detailed study of the nutrient status of soils and leaves, covering all the major coconut growing soil groups of Kerala State, Pillai *et al.* (1975) observed that no regular pattern

was apparent in the content of calcium and magnesium when the diseased and healthy plants were compared. The results of the present study tends to conclude that the status of calcium and magnesium of the soil and leaf cannot be considered to have a relationship with the incidence of root (wilt) disease.

#### ACKNOWLEDGEMENT

The authors are grateful to Dr KV Ahamed Bavappa, Director, and Dr (Mrs) K Radha, Plant Pathologist in-charge, for their encouragement and Dr AI Jose, formerly Asst. Soil Chemist, for help rendered in the preparation of this paper.

#### REFERENCES

- CECIL, S. R. 1969. Nutritional Aspects of the Coconut Palm in Health and Disease. pp. 249. MSc Thesis. University of Kerala, Trivandrum.
- CECIL S. R. 1975. Mineral composition of coconut leaves in relation to root (wilt) disease. *J. Plant. Crops* 3: 34-37.
- FREMOND, Y. 1966. Contribution of IRHO to the study of mineral nutrition of coconut palm. pp. 97-107. in II Meeting of the FAO Tech. Work. Party on Coconut Production, Protection, and Processing. FAO Regional Station, Bangkok, Thailand.
- GOPINATHAN PILLAI, N., LAL, S. B., AND SHANTA, P. 1973. Distribution and intensity of root (wilt) disease of coconut in Kerala. *J. Plant Crops* 1 (Suppl.): 107-112.
- JACKSON, M. L. 1967. Soil Chemical Analysis. 485. pp. Prentice Hall, New Delhi.
- MENON, K.P.V. AND NAIR, U.K. 1949. The wilt (root) disease of coconut in Travancore and Cochin. *Indian Coconut J.* 3: 5-10.
- MENON, K.P.V., SANKARASUBRAMONEY, H., AND PANDALAI, K. M. 1950. Investigations on the diseases of coconut palm in Travancore-Cochin State. Studies on soil conditions in relation to disease incidence. *Indian Coconut J.* 3: 81-87.
- MENON, K.P.V. AND PANDALAI, K. M. 1960. The Coconut Palm—A Monograph. 384. pp. Indian Central Coconut Committee, Ernakulam.

- PANDALAI, K. M., SANKARASUBRAMONEY, H., AND MENON, K.P.V. 1958. Studies on soil conditions in relation to the 'Root' and 'Leaf' diseases of the coconut palm in Travancore-Cochin. Part IV. Total and exchangeable calcium and magnesium content of coconut soils. *Indian Coconut J.* **11**: 49-66.
- PILLAI, N. G. 1959. *Physiological Aspects of Nutrition in the Coconut Palm*. 241. pp. MSc Thesis. University of Kerala, Trivandrum.
- PILLAI, N. G., WAHID, P. A., KAMALA DEVI, C. B., RAMANANDAN, P. L., CECIL ROBERT, KAMALAKSHI AMMA, P. G., MATHEW, A.S., AND BALAKRISHNAN NAMBIAR, C. K. 1975. Mineral nutrition of root (wilt) affected coconut palm. Paper presented at the Fourth Session of the FAO Tech. Work. Party on Coconut Production, Protection and Processing, Kingston, Jamaica.
- SANKARASUBRAMONEY, H., PANDALAI, K. M., AND MENON, K.P.V. 1952. On the nutritive contents of the leaf tissues of the coconut palm in health and disease. *Indian Coconut J.* **6**: 7-18.
- SANKARASUBRAMONEY, H., PANDALAI, K. M., AND MENON, K.P.V. 1954. Studies on soil conditions in relation to the 'Root' and 'Leaf' diseases of coconuts in Travancore-Cochin. Part I. Nitrogen, organic matter content and C/N ratio of coconut soils. *Indian Coconut J.* **8**: 5-25.
- SANKARASUBRAMONEY, H., PANDALAI, K. M., AND MENON, K.P.V. 1955. Studies on soil conditions in relation to 'root' and 'Leaf' diseases of coconuts in Travancore-Cochin. Part II. Total phosphoric acid, available phosphoric acid, and iron content of coconut soils. *Indian Coconut J.* **9**: 20-29.
- SANKARASUBRAMONEY, H., PANDALAI, K. M., AND MENON, K.P.V. 1956. Studies on soil conditions in relation to 'root' and 'leaf' diseases of coconuts in Travancore-Cochin. Part III. Total, available, and exchangeable potassium content of coconut soils. *Indian Coconut J.* **9**: 90-100.