

## FOLIAR YELLOWING OF COCONUT PALMS IN HEALTHY AND ROOT (WILT) AFFECTED AREAS

THOMAS VARKEY, P. G. KAMALAKSHI AMMA, P. L. RAMANANDAN\* AND P.T.N. NAMBIAR

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

### ABSTRACT

An attempt had been made to check the foliar yellowing by applying different nutrients and also its effect on growth and yield of affected palms. Foliar sprays with 2% MgSO<sub>4</sub> and 1% FeSO<sub>4</sub>, and basal application of MgSO<sub>4</sub> reduced foliar yellowing by 26% in diseased palms and 87% in healthy palms. In diseased palms the application increased yield by 106% while in healthy palms, the increase was 95%.

### INTRODUCTION

Foliar yellowing occurs commonly in coconut palms growing in the coastal districts of Kerala, India. Pandalai, Sankara Subramony and Menon (1957) found this to be seasonal and reversible. This was confirmed by Davis (1966) who found also that basal application as well as foliar sprays with Mg cured yellowing. A comparison of Ca/K and K/Ca+Mg ratios in yellow and green leaves indicated that Ca/K ratio was lower and K/Ca+Mg ratio higher in yellowed leaves (Pandalai, 1959; Ramanandan and Pandalai, 1959). This indicated that Mg deficiency is a factor in foliar yellowing.

The yellowing of leaves of middle and outer whorls is associated with root (wilt) disease of coconut palm, but similar yellowing is seen also in palms growing in healthy areas. In the present study, an attempt was made to control foliar yellowing by applying different nutrients and study their effects on growth and yield of affected palms.

### MATERIAL AND METHODS

The experiments were conducted at various locations in root (wilt) disease-affected areas and disease-free areas. In Palode (Trivandrum District, a diseased area), nine farmers' plots were selected. Each plot had 5 healthy palms and 5 palms with foliar yellowing. In four plots, MgSO<sub>4</sub> (2 per cent), MnSO<sub>4</sub> (1 per cent) and FeSO<sub>4</sub> (1 per cent) were sprayed at quarterly intervals separately and in combinations @ 21/palm/spray. In the remaining four plots, MgSO<sub>4</sub>, MnSO<sub>4</sub>, and FeSO<sub>4</sub> were applied basally in two split doses, both singly and in combinations at 500g/palm/year. One plot was left as control and no manuring or cultural practices were followed in it. Soil and leaf samples were analysed for major nutrients and chlorophyll.

In Trikkaripur, (Cannanore District, a root (wilt) free area), one plot containing 60 palms was selected in which 54 palms showed foliar yellowing and 6 palms looked normal. The affected palms were divided

\*Now at, Central Plantation Crops Research Institute, Kasaragod-670 124, Kerala.

**Table I.** *Yellow leaf/green leaf ratio and yield before and after treatment at Palode, a diseased area*

Treatment	Before treatment (January, 1975)		After treatment (January, 1978)	
	Yellow leaf	Yield of nuts/palm/ year	Yellow leaf	Yield of nuts/palm/ year
	Green leaf		Green leaf	
Control	0.41	19	0.52	13
MgSO <sub>4</sub> Spray	0.55	4	0.44	12
FeSO <sub>4</sub> "	0.57	2	0.40	11
MnSO <sub>4</sub> "	0.65	5	0.53	10
MgSO <sub>4</sub> +MnSO <sub>4</sub> +FeSO <sub>4</sub> "	0.55	7	0.46	17
MgSO <sub>4</sub> (basal application)	0.48	17	0.38	26
FeSO <sub>4</sub>	0.53	10	0.38	19
MnSO <sub>4</sub> "	0.61	4	0.49	9
MgSO <sub>4</sub> +MnSO <sub>4</sub> +FeSO <sub>4</sub> (basal application)	0.46	5	0.39	15

into two lots, one lot was used for carrying out spraying trials with MgSO<sub>4</sub>, MnSO<sub>4</sub>, and FeSO<sub>4</sub> separately and in combination. The other lot was used for carrying out trials with basal application of MgSO<sub>4</sub>, MnSO<sub>4</sub>, and FeSO<sub>4</sub>, in combination and separately. Soil samples were collected from basins of each palm at 0-50 cm and 50-100 cm depth from four locations and

composited. Leaf samples were collected from  $\left(\frac{n}{2} + 1\right)$ th leaf (where n=total number of leaves) from each palm.

Pretreatment observations were recorded on green leaf/yellow leaf ratio and annual yield of palms. After 2 years' treatment, the same observations were taken again (Tables I and II).

**Table II.** *Yellow leaf/green leaf ratio and yield before and after treatment at Trikkaripur, a disease-free area*

Treatment	Before treatment (January, 1976)		After treatment (January, 1978)	
	Yellow leaf	Yield of nuts/palm/ year	Yellow leaf	Yield of nuts/palm/ year
	green leaf		green leaf	
Control	0.00	17	0.00	28
MgSO <sub>4</sub> Spray	0.43	22	0.05	29
FeSO <sub>4</sub> "	0.55	17	0.12	27
MnSO <sub>4</sub> "	0.44	17	0.04	39
MgSO <sub>4</sub> +MnSO <sub>4</sub> +FeSO <sub>4</sub> "	0.47	13	0.05	34
MgSO <sub>4</sub> (basal application)	0.40	20	0.02	36
FeSO <sub>4</sub>	0.45	5	0.3	15
MnSO <sub>4</sub>	0.49	11	0.10	22
MgSO <sub>4</sub> +MnSO <sub>4</sub> +FeSO <sub>4</sub> (basal application)	0.44	9	0.03	20

## RESULTS AND DISCUSSION

Taking the critical levels as 1.8-2.0 per cent for N and 0.5 per cent for Ca (Fremont, Ziller, and de Lamothe, 1966), both healthy and diseased palms contained low levels of N and Ca. The variation in the major nutrients of the leaves was studied from June to December. The ranges of N,P,K,Ca and Mg in the healthy and diseased tracts were 1.23-1.71, 0.22-0.58, 0.72-1.44, 0.17-0.27, 0.12-0.35 and 1.21-1.44, 0.22-0.50, 0.88-1.10, 0.12-0.35, 0.13-0.34, respectively.

In Palode, a diseased area, monovalent and divalent cation ratios were worked out on multiequivalent basis to find out the disturbances in the nutrient ratios, if any. K/Mg, K/Ca+Mg, and K/Ca ratios were higher in palms with yellowing (1.29, 0.80, 3.29, 1.83 for yellow leaves and 0.85, 0.62, 2.46, 1.61 for green leaves). These observations are significant in the light of the recent findings on nutrient imbalance, especially monovalent and cation ratios in root (wilt) affected palms showing foliar yellowing (Pillai et al., 1975). This agrees also with the previous findings of Ramanadan and Pandalai (1959). Pandalai (1958) had discussed the association of high K/Mg ratio with foliar yellowing and had suggested K-induced Mg deficiency as a probable reason for yellowing in such cases.

The data on soil and leaf analysis of healthy and diseased palms indicate significantly higher content of P (0.23 per cent in the diseased and 0.18 per cent in the green leaves) in the leaves of diseased palms at Trikkaripur root (wilt) disease free area. At the same time the healthy and diseased soils did not show any significant difference in soil nutrient levels, even though both the soils were poor with respect to available K, P, Ca, and Mg according to accepted standards. (Sankaram, 1966).

In Trikkaripur (healthy tract), no significant difference between healthy and diseased

palms was observed regarding monovalent and divalent cation ratios.

Total chlorophyll and chlorophyll fractions (chlorophyll a/b ratio) in the leaves of palms with and without foliar yellowing was determined in the root (wilt) affected area (Palode) and in the healthy area (Trikkaripur). Total chlorophyll content and chlorophyll fractions (a/b) varied between months: the range is 2.01-2.09 and 1.07-1.25 diseased tract and 1.85-2.73 and 1.25-1.57 for the healthy tract.

Foliar sprays with 2 per cent  $MgSO_4$  and 1 per cent  $FeSO_4$ , and basal application of  $MgSO_4$  separately resulted in 26 per cent reduction in foliar yellowing in the diseased area, and as much as 87 per cent reduction in the healthy area. Combination of nutrients did not supersede the single treatment.

These results indicate that foliar yellowing both in healthy and diseased area is due to nutrient deficiency and that the same could be corrected by either foliar sprays of 2 per cent  $MgSO_4$ , 1 per cent  $FeSO_4$ , or by the basal application of  $MgSO_4$ . The spraying may be done quarterly avoiding rainy days.

## REFERENCES

1. DAVIS, T. A. (1966). Coconut withering disease of Ceylon and Indian root (wilt). A comparison of symptoms. II Meeting of the F.A.O. Technical Working Party on Coconut Production, Protection and Processing, F. A. O. Bangkok. Thailand pp. 289-298.
2. FREMONT, Y., ZILLER, R., AND DE NUCE DE LAMOTHE, (1966). The Coconut Palm, International, Potash Institute, Berne, Switzerland. pp. 227.
3. PANDALAI, K. M., SANKARA SUBRAMONEY, H. AND MENON K. P. V. (1975). Problem of foliar yellowing in coconut palm. *Indian Coconut J.* 11: 19-25.
4. PANDALAI, K. M., (1959). Some aspects of nutritional disturbances in relation to certain disorders in the coconut palm. Proc. First Confer. Coconut Res. Workers in India. pp. 118-131. C.P.C.R.I., Kasaragod.

5. PILLAI, N. G., WAHID, P. A., KAMALA DEVI C. B., RAMANANDAN, P. L., ROBERT CECIL, S., KAMALAKSHI AMMA, P. G., MATHEW, A. S., AND NAMBIAR, C. K. B. (1975). Mineral nutrition of root (wilt) affected coconut palm. Proc. Fourth. Sess. F.A.O. Tech. Wkg. Pty. Cocon. Production, Protection and Processing, Kingston, Jamaica, 14-25 September, 1975. F.A.O., Rome.
6. RAMANANDAN, P. L. AND PANDALAI K. M. (1959). Nutritional aspects of foliar yellowing in the coconut palm. Proc. 1st Conf. of coconut Research Workers in India. pp. 371-375.
7. SANKARAM A. (1966). Laboratory Manual for Agricultural Chemistry. Asia Publishing house, Bombay-1.