*Journal of Plantation Crops* 5(2): 84-88. *December* 1977.

# CHANGES IN CARBOHYDRATE CONTENT OF COCONUT PALM AFFECTED BY ROOT (WILT) DISEASE

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ABSTRACT

Changes in the carbohydrate content were studied in root (wilt) infected coconut palms. Total, reducing, and non-reducing sugars were significantly higher in the leaves of infected palms. But a depletion of these sugars was observed in the roots of diseased palms, indicating thereby a possible block in the translocation process. Starch and total carbohydrates were at a reduced level in the leaves and roots of infected palms.

## INTRODUCTION

The etiology of root (wilt) disease is still unknown. It is suspected to be the combined effect of pathogen, nutrient imbalance, and water stress. Physiological derangement caused by the root (wilt) disease has been studied in the past by a few workers. These consist of changes in the water economy of the diseased palm, as indicated by increased moisture content in the leaves, higher rate of transpiration, and lower uptake of water (Ramadasan, 1970), accumulation of non-protein nitrogen, inorganic phosphorus, and reduction in protein nitrogen in the leaf tissue of diseased palms (Varkey et al., 1970), accumulation of certain amino acids, especially arginine, in the leaves of diseased palm (Pillai and Shanta, 1965), and loss of permeability of root cells and increased respiratory activity in the leaves and roots of diseased palms (CPCRI Annual Report, 1975). The present paper deals with changes in the carbohydrate content of diseased palms.

## MATERIALS AND METHODS

Leaf and root samples for analysis were drawn from 20-25 year old healthy and root (wilt) diseased coconut palms growing in the farms of CPCRI, Kasaragod and Kayangulam, respectively. Ten palms were sampled in each category. Sampling was done at 6 AM, 10 AM, 2 PM, and 6 PM. Leaf samples were prepared from leaflets collected from both sides of the mid rib in the mid-region of the most recently matured (1st fully opened) leaf. Root samples were prepared from roots collected from 1/8th sector of the bole region at different depths. The samples, immediately after collection, were dried in the oven at 80°C, powdered, and taken up for analysis.

The various carbohydrate constitutents were extracted from the powdered and dried material by boiling the sample in 80% alcohol. The extract was clarified according to Hig-kin and Frenkel (1962) and reducing sugars were estimated by Somogyi's method (1952). Total sugars were estimated on the acid hydrolysed extract by the same method. Non-reducing sugar content was obtained by substracting the value of reducing sugar from total acid hydrolysable sugars and multiplying the same by 0.93. Starch content was estimated on the basis of the acid hydrolysed extract of the residue by the above method

and multiplying the value by 0.9 For the estimation of total carbohydrates, the material was first hydrolysed with 2.5*N* HCl and then neutralised with 5*N* $Na_2CO_3$. The extract was filtered and clarified with $CaSO_4$ mixture. Total carbohydrates were determined as mentioned above (Somogyi's), using glucose as standard.

## Results and Discussion

Results presented in Fig. I showed that there was a significant increase in the level of total, reducing, and non-reducing sugars in the leaves of diseased palms. The increase was more pronounced in the case of reducing and total sugars. Increase of sugar content in the leaves due to pathogenic infection has been reported in barely yellow dwarf virus (Orlob and Arny, 1961), sterility mosaic disease of pigeon pea (Narayanaswamy and Ramakrishnan, 1965), rosette mosaic virus of groundnut (Mandahar and Garge, 1973), helminthosporium disease of sorghum (Arjunan, Vidyasekharan, and Kandaswamy, 1976), among others. Association of several pathogens with root (wilt) disease has been observed (Shanta and Radha, 1975). The quantitative increase of sugars in the leaves of infected palms may be attributed to impaired translocation. Higher concentration of reducing sugars in the leaves especially at the early hours of the day indicate a possible block in the translocation of photosynthates. This becomes clear by the decreased sugar content in the roots. Misra and Jha (1971) have observed a similar increase in sugar content in the leaves of virus infected chilly plants, with a concomitant decrease in the roots. Inhibition of tranlocation of sugars has also been reported by Holmes (1931) in TMV infected tobacco and Sreenivasaya and Sastri (1928) in sandal spike disease. Damage to the phloem tissue, which is concerned in the tranlocation of photosynthates, could derange the flow of carbohydrates and cause its accumulation in the leaves and depletion in the roots. In root (wilt) affected coconut palms, several roots reveal degenerate phloem (Govindankutty and Vellaichamy, 1976).

In spite of the higher sugar content in the leaves, total carbohydrates and starch content were lower in both leaves and roots of diseased palms (Fig. II). Similar observation has been made in virus infected tapioca (Alinganinglingam and Ramakrishnan, 1970), cowpea mosaic virus (Khatri and Chenulu, 1969), pigeon pea mosaic virus (Narayana Swamy and Ramakrishnan, 1965), and barley stripe mosaic disease (Gordon, 1960). Decrease in total carbohydrates and starch content may be due to the combined effect of retarded rate of net photosynthesis and increased rate of respiration. Increased rate of respiration has been noticed in the case of root (wilt) affected palms (Michael, unpublished).

## Acknowledgement

The author thanks Mr. K. Vijayakumar for statistical analysis of the data.

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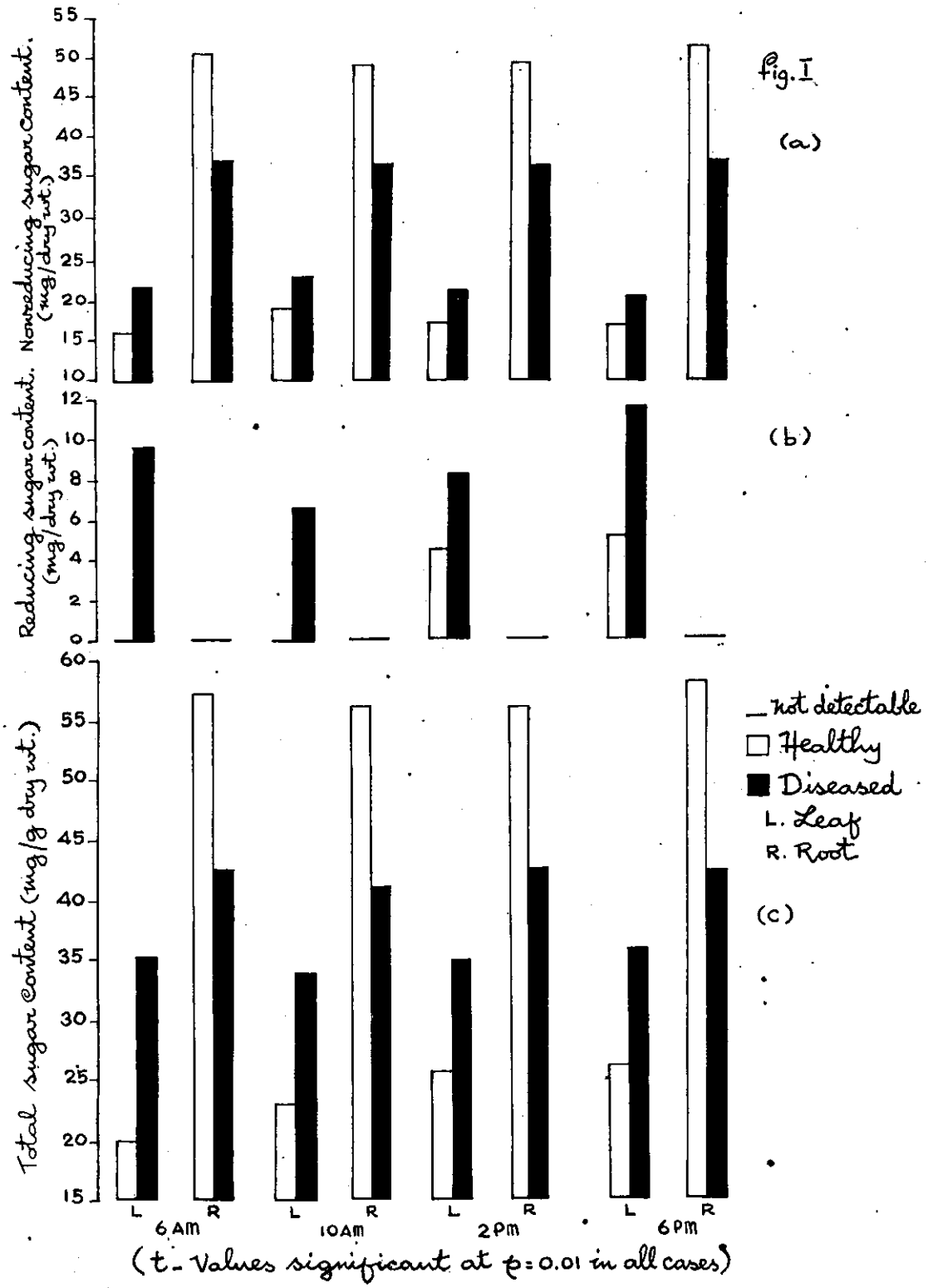
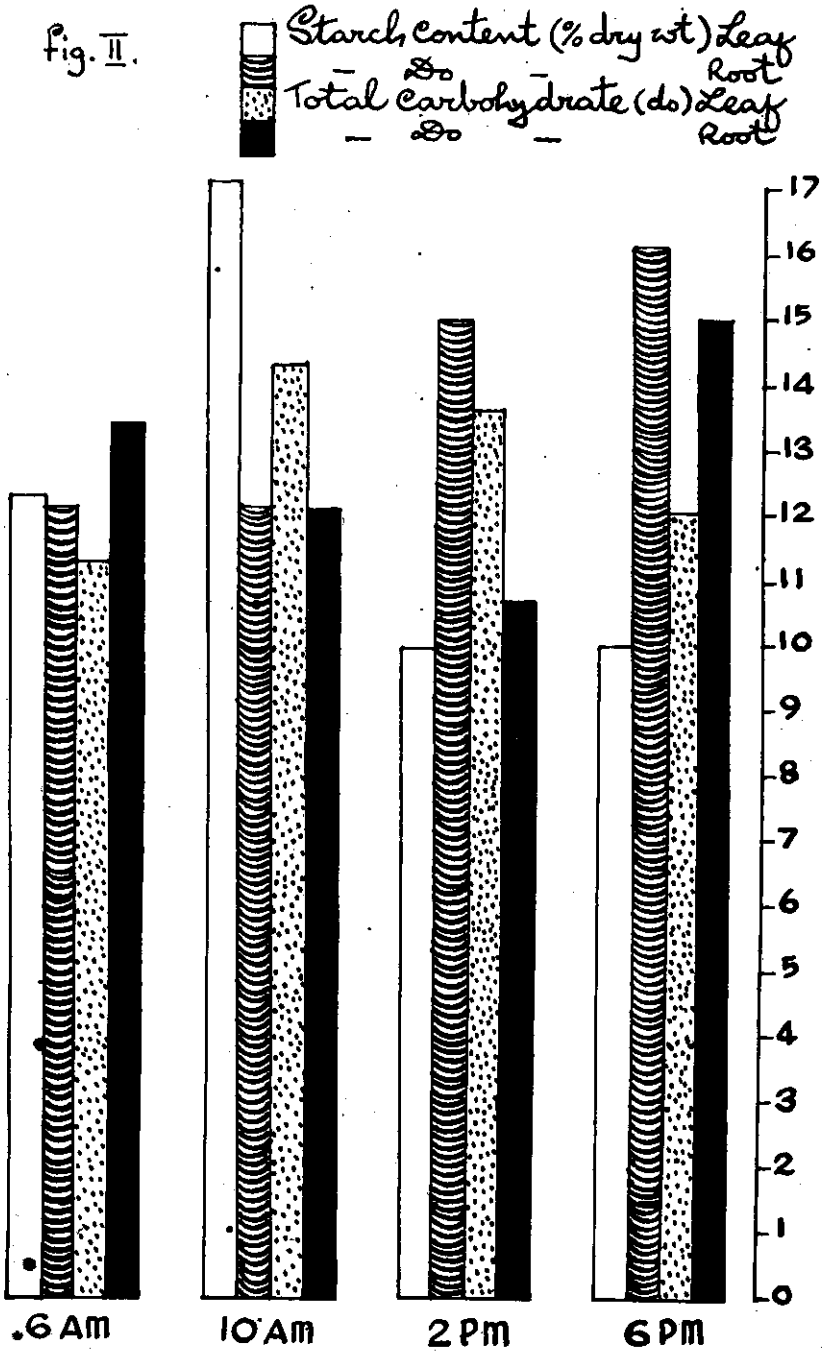



Fig. I. Effect of root (wilt) disease on sugar content of leaves in coconut palm

Percentage decrease of Starch content and Total carbohydrates in diseased palms as compared to healthy.

Fig. II.




(t. Values significant at $p = 0.01$ in all cases)

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