

NOTE ON THE INVESTIGATIONS ON THE NITROGEN AND PHOSPHORUS METABOLISM OF COCONUT PALM AFFECTED BY ROOT (WILT) DISEASE

THOMAS VARKEY, K. J. MICHAEL and A. RAMADASAN

Central Coconut Research Station, Kayangulam

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Previous studies on the nutrient status of healthy coconut palms and those affected by root (wilt) disease showed that major and minor nutrients accumulate in the leaf tissue of diseased palms (Sankarasubramony *et al.*, 1952; Pillai, 1960). However, the metabolism of palms involving the nutrients, with special reference to the disease, has not been studied so far. In the present studies an attempt has been made to investigate the nitrogen and phosphorus metabolism of palms in relation to the severity of the disease.

MATERIAL AND METHODS

Leaf samples for analysis were drawn from 25–30-year-old healthy and root (wilt)-diseased coconut palms growing in the farm of the Central Coconut Research Station, Kayangulam. The diseased palms were categorized into early, middle and advanced stages according to the severity of symptoms. All the experimental palms received 340g N, 227g P₂ O₅ and 567g K₂ O per palm per year during the previous years.

Leaf samples were prepared from the leaflets collected from both sides of the mid-rib in the mid-region of the 14th leaf. The total phosphorus content was analysed as per the method of Piper (1944), water-soluble nitrogen, non-protein nitrogen and protein nitrogen as per the method of Ganapathy *et al.* (1958), inorganic phosphates as per the method of Lowry and Lopez (1946) and the total carbohydrate content as per the method of Hagedorn and Jensen (1933). The contents of organic phosphorus were calculated as the difference between the value for the total phosphorus and that for inorganic phosphorus.

RESULTS AND DISCUSSION

Table 1 shows that there was a considerable increase in the non-protein nitrogen content in the middle stages of the disease. This is concomitant with a sharp decrease in the water-soluble and protein-nitrogen fractions. A similar trend, although slight in effect, was noted in the early stages of the disease also. The extent of derangement in the metabolism of nitrogen in the diseased leaf tissue is further supported by the sharp decrease in the total carbohydrate content of diseased leaf tissue, especially in the middle and advanced stages of disease, since it is known that active accumulation of nitrogen does not occur in tissues depleted with carbohydrates.

Accumulation of free amino acids, especially aspartic acid, threonine, glutamine and asparagine, in the diseased leaf tissue of root (wilt)-diseased palms was reported by Pillai and Shanta (1965). The reported increase in arginine content toward the

TABLE 1. TOTAL N, P AND CARBOHYDRATE CONTENTS IN THE LEAF TISSUE OF ROOT (WILT)-DISEASED PALMS IN RELATION TO SEVERITY OF SYMPTOMS
(Expressed as percentage of dry weight)

	Healthy	Diseased (early stage)	Difference over healthy (%)	Diseased (middle stage)	Difference over healthy (%)	Diseased (advance stage)	Difference over healthy (%)
Total N	1.93	2.08	(+ 7.8)	2.22	(+15.0)	2.02	(+ 4.7)
Total water-soluble N	0.21	0.169	(-19.5)	0.133	(-36.7)	0.225	(- 7.1)
Total non-protein N	0.084	0.088	(+ 4.8)	0.118	(+40.5)	0.093	(-10.7)
Total protein N	0.663	0.062	(-62.0)	0.031	(-81.0)	0.071	(-56.4)
Total P ₂ O ₅	0.47	0.49	(+ 4.3)	0.46	(- 2.2)	0.54	(+14.9)
Inorganic P	0.33	0.26	(-21.2)	0.29	(-12.1)	0.41	(+24.2)
Organic P by difference	0.14	0.23	(+64.3)	0.17	(+21.4)	0.13	(- 7.1)
Total carbohydrate	6.64	6.04	(- 9.0)	4.56	(-31.3)	4.20	(-36.7)
C:N ratio	7 : 2	3 : 1		2 : 1		2 : 1	

middle and advanced stages of the disease is of interest to the results obtained from the present studies. In a preliminary study conducted here, the vascular sap of diseased palms was found to contain increased quantities of arginine. In higher plants protein synthesis mostly depends on the secondary metabolism of amino acids rather than on the primary assimilation of inorganic nitrogen, and arginine is one of the chief compounds involved in the mobilization and translocation of nitrogen (Yemm and Folkes, 1958). Thus the pronounced changes observed in the nitrogen fractions in the diseased leaves indicate the importance of studying in detail the nitrogen nutrition of root (wilt)-diseased palms.

A sharp increase in the organic phosphorus contents in the early and middle stages of the disease (Table 1) indicates a rapid organic synthesis during these stages of disease, thereby deranging the normal metabolic pathways of phosphorus. Such derangements could well lead to non-utilization of phosphorus, as shown by the accumulation of inorganic phosphorus in the advanced stages of the disease.

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