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LEAF SAMPLING TECHNIQUES IN ARECANUT PALM FOR NUTRIENT ANALYSIS [1]

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INTRODUCTION

The primary consideration in deciding what part of the plant to sample is the degree to which nutrient concentrations in a given part reflects the nutrient status of the plant. In particular, it is important to use a plant part that gives a sharp transition from a concentration reflecting a deficiency of the nutrient in question to one that indicates an adequate supply of the nutrient. On the other hand, the main factor is the age of the leaf, and for comparisons to be valid, it is necessary to take leaves of the same physiological age. Regarding the selection of leaves for plant analysis, various foliar diagnostic techniques have been employed as a routine method of plant analysis (3,4,14). Further, in the case of coconut palm, the 14th or 15th leaf has been suggested (9), which had reached full maturity. Whereas, in the case of oil palm the 17th leaf has been recommended (10). But the distribution of elements vary from leaf to leaf as reported by Tyler et al (12) in potato plants and Southern and Dick (11) in coconut palm. However, no published information is available on arecanut about the selection of leaves for plant analysis. Therefore, the object of this paper is to develop the leaf sampling programme and to give some consideration for individual elements as well as composite plant analysis of the major nutrients.

MATERIALS AND METHODS

In order to obtain a clear idea of the range of nutrient contents, seventeen palms as a replicate were selected by random numbers in the bulk garden of the institute during 1969. All leaves from each crown except the oldest and the youngest were collected during the first three hours after sunrise. Samples were wrapped in plastic bags for transport to the laboratory. After cleaning and removal of the midribs the leaflets were dried in an oven at 80°C ± 1°C and then ground in an electrically operated grinder. The powdered material was stored in air tight glass containers until use.

Estimation of total nitrogen was carried out by micro-kjeldahl method (1), phosphorus by colorimetric (8), potassium by the cobaltinitrite method, calcium by oxalate method (7) and magnesium by Spectronic-20 (15).

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RESULTS AND DISCUSSION

The percentage of nitrogen content increased from 1st to 4th leaf then diminished in 5th and 6th leaves and again increased in 7th and 8th leaves (Table 1). Statistically the differences were highly significant. A Similar type of gradient was reported in tomato plants by Dove (5). In general, the 8th leaf is suitable for nitrogen determination because of its least coefficient variation, a method suggested by Zeiger and Konsler (16).

Phosphorus content also increased from leaf to leaf, though significant differences were noticed in 7th and 8th leaves only. The 2nd leaf appears to be the best suited for phosphorus determination because of its minimum variation. The selection of fully matured leaf lamina as the P index tissue of arecanut resembles the selection of Ulrich (13), who used the matured petiole of sugar-beets to establish the critical level of P for this crop. Similar results were also reported by Awada and Lang (2) in papaya tissue.

The maximum amount of potassium was recorded in the 6th leaf. Similar results were also recorded in the leaves of coconut with the advance in age (17). In general, the 2nd leaf may be selected for potassium estimation because, the K status of the arecanut palm was reflected best by this leaf. This type of findings were also noticed in potassium nutrition of potato plants (6).

The percentage of calcium content increased from leaf to leaf and maximum amount was recorded in 3rd and 4th leaves followed by a decrease in the subsequent leaves. Statistically, leaf to leaf variation is highly significant. It may be that under the growth conditions, calcium from the older tissues might not have moved faster enough to satisfy the needs of the young meristematic tissues and developing fruits. In general, 3rd leaf can be considered for its estimation. Magnesium content in arecanut leaves increased from 1st to 3rd and decreased in 4th leaf followed by subsequent increase. It might be due to formation of chlorophyll in the foliage affected by distribution of sun light. However, the differences are statistically significant. In general, magnesium content increased from older to younger leaves. Among the leaves, 5th leaf is identical for analysis.

The 2nd leaf is most suited for composite analysis of the major nutrients.

SUMMARY

A programme of selection of leaves of arecanutpalm for routine nutrient analysis is described and 8th leaf for nitrogen, 2nd for phosphorus and potassium, 3rd for calcium and 5th for magnesium analysis and for composite analysis of the major nutrients, the 2nd leaf have been suggested.

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LITERATURE CITED

1. A.O.A.C. 1960. *Official Methods of Analysis.* Association of Official Agricultural Chemists, Washington, p. 643.
2. Awada, M. and C. Lang, 1969. The selection of the phosphorus index in papaya tissue analysis. *J. Amer. Soc. Hort. Sci.* 94.501-504.
3. Chapman, G.W. 1941. Leaf analysis and plant nutrition. *Soil. Sci.* 52:63-81
4. ———, and H.M. Gray. 1949. Leaf analysis and the nutrition of the oil palm. *Ann. Bot.* 13:415.
5. Dove, L.D. 1968. Nitrogen distribution in tomato plants during drought. *Phyton* 25:49-52.
6. Fong, Kwok H. and A. Ulrich, 1969. Leaf analysis as a guide for potassium nutrition of potato. *J. Amer. Soc. Hort. Sci.* 94:341-344.
7. Johnson. C.M. and A. Ulrich, 1959. Analytical methods for use in plant analysis. *Calif. Agri. Exp. Stat. Bull.* 766:33-35,145-47.
8. Kitson, R.E. and M.G. Mellon, 1944. Colorimetric determination of phosphorus as molybdevando-phosphoric acid. *Ind. Eng. Chem. Amer.* Ed. 16:379-383.
9. Menon, K.P.V. and K.M. Pandalai, 1958. The *Coconut Palm*-A monograph. Indian Cen. Coconut Commtt, Ernakulam, India, p. 352,
10. Nifor, 1967. Third Annual Report, N.I.F.O.R., 1966-67, p. 92.
11. Southern, P.J. and K. Dick, 1967. The distribution of trace elements in the leaves of the coconut palm, and the effect of trace element injection. Papua New Guinea. *Agric. J.* 19:125-137.
12. Tyler, K.B., O.A. Lorenz and F.S. Fullmer, 1961. Plant and soil analysis as guides in potato nutrition. *Calif. Agri. Exp. Stat. Bull.* 781.
13. Ulrich, A. 1961. Plant analysis in sugar-beet nutrition. In *Plant Analysis and Fertilizer Problems.* Amer. Inst. Biol. Sci. Washington, D.C. p. 190-211.
14. ———., D. Ririe, F.J. Hills, A.G. George and M.D. Morse, 1959. I. Plant analysis: A guide for sugar-beet fertilization. *Calif. Agri. Exp. Sat. Bull.* 766:4-24.
15. Yadava, R.B.R, C K. Mathai and K. Vellaichamy, 1959. Modification in the colorimetric estimation of Magnesium. *Andhra agric J.* 16:166.
16. Zeiger, D.C. and T.R. Konsler, 1963. Comparison of sampling methods for determination of seasonal changes in the nutrient content of apple leaves. *J. Amer. Soc. Hort. Sci.* 94:73-77.
17. Ziller, R. and P. Prevot, 1962. Foliar diagnosis: A method of studying mineral nutrition. Its application to the coconut palm. *Ind. Coconut J.* 15:156-159.

TABLE 1 – Mean percentage of nutrients on dry weight basis, Standard Error (SE) and Co-efficient of Variation (CV) for individual leaves of arecanut palm.

Leaf No.	Nitrogen %	S.E.	C.V.	Phosphorus %	S.E.	C.V.	Potassium %	S.E.	C.V.	Calcium %	S.E.	C.V.	Magnesium %	S.E.	C.V.
1.	1.316	0.092	6.9	0.336	0.227	29.0	1.490	0.482	32.3	0.972	0 607	6 .4	0.628	0.272	43.3
2.	1.620	0.098	6.0	0.350	0.186	22.8	1.951	0.472	24.2	0.959	0.667	69.8	0.566	0.225	39.8
3.	1.666	0.111	6.7	0.359	0.324	38.8	1.919	0.506	26.3	1.007	0.292	29.0	0.623	0.436	69.4
4.	1.810	0.149	8.2	0.360	0.491	57.0	1.954	0.649	33 2	1.025	0.500	48.8	0.442	0.201	47.6
5.	1.469	0.126	8.6	0.400	0.436	46.8	1.912	0.867	45.3	0.797	0.424	53.2	0 487	0.120	24.6
6.	1.391	0.095	6.8	0.405	0.525	55.7	2.141	0.754	35.2	0.896	1.211	135.1	0.481	0.296	61.5
7.	1.543	0.119	7.7	0.434	0.288	28.5	1.629	1.220	74.9	0.578	0.283	49.0	0.724	0.301	41.6
8.	1.633	0.096	5.9	0.447	0.353	33.9	2.121	1.171	55.2	0.521	0.282	54.1	0 827	0.588	71.1
Mean	1 556			0.386			1.890			0.845			0.669		
S.E.	0.110			0.066			0.203			0.149			0.078		
C.V. (%)	7.100			7.300			10.700			17.600			11.700		
C.D. (5%)	0.073			0.044			0.135			0.099			0 052		
C.D. (1%)	0.096			0.058			0.178			0.131			0.068		