RP 742

DIURNAL AND SEASONAL FLUCTUATIONS OF NUTRIENTS IN FOLIAR TISSUES OF COCONUT

M. Jegamathan, P.A.D.C.Appuhamy,
B.J.A.J. Nandis & G.D. George

(Coconut Research Institute, Lunuwila)

On the assumption that internal nutrient concentration of the plant is related to growth and yield, plant analysis technique is being increasingly used as a diagnostic tool for crop nutrition. The theoretical basis being that what enters the plant is more important than what is available in the soil for effective performance of the plant.

Arising out of this, the concept of foliar diagnosis or leaf analysis as a tool for predicting fertiliser requirements originated. Data from foliar analysis could be used for two purposes, either for direct diagnostic use to decide which nutrient or nutrients are causing poor growth or for predictive use to decide how much response one could expect from application of fertilisers. It would seem logical therefore that depending on the nature of problem posed, the method of sampling had to be appropriately modified.

However, before using foliar analysis for interpretative purposes, rigid standardisation of sampling procedure is necessary; the physiological age of the leaflet analysed, the position along the length of the frond, the season and even the time of day at which sampling is carried out, have all been found to cause fluctuations of nutrients in the leaf. It is therefore necessary to minimise these interfering effects.

Therefore, as a first step in the application of foliar analysis; it was decided to determine the ideal time of leaf sampling (diurnal and seasonal) on the basis of minimal variability indications, before other sources of variation could be studied.

Materials and Methods

The study was conducted on 30 healthy typica palms that have reached the productive phase (selected on its vegetative character and bearing capacity of 71 to 90 nuts/per/palm/year) from the Botanists Progeny Trial at Palpita. The palms were selected from an area 16 hac. in

in extent, (40 acres) and confined to the sandy loam.

The experimental area was fertilised with the U.P.I. "C" mixture containing 10.3% of N, 5.5% of P_2O_5 and 18.0% of K_2O. The fertilizers were applied in two split doses of 2.25 kg each during May/June and October/November.

Three leaflets from either side of the mid region of the 14th leaf is taken from each palm, and the mid portion of the leaflets (10 cm in length) are chosen for the samples, rejecting the base and tip of leaflets, as recommended by IRHO (France).

For the study of durnal fluctuations in nutrients, sampling commenced at 0600 hours and was repeated at 3 hourly intervals upto 1800 hours (i.e. 5 sampling times per day).

The seasonal fluctuations were studied by sampling at monthly intervals, covering both the rainy and dry months. Altogether 12 samplings were done at monthly intervals covering a full one year period, from March 1972 to February 1973.

Samples from five (5) palms were bulked together at random dried at 85°c ground and analysed for the major nutrients N, P, K, Ca & Mg. Standard analytical procedures were adopted for the analyses of these elements.

Results.

The results of chemical analysis for the major elements expressed as a percentage of the dry weight, for both diurnal and seasonal variation together with an Analysis of Variance for each of the elements are tabulated in Tables I to V.

The results show that for all elements there was no significant diurnal fluctuations in nutrient concentrations but significant seasonal fluctuations at P = 0.01 for N, P and K, significant at P = 0.05 for Mg. Ca and just about significant at P = 0.05 for Mg.

Fig I shows the changing concentration with date of sampling (seasonal variation) for the five major elements. From the graph it is observed that N, P and K had the greatest seasonal fluctuations followed

Contd..3/.

by Ca and Mg which is not so marked.

The change in concentration of N with season is indicated by two increases in June-July 1972 and January - February 1973 with an intermediate period of minimal fluctuations during August - October 1972. The same trend is observed with K, except that in September 1972 it showed a rise. Ca and Mg showed a similar trend though not very discernible.

The significance of the difference between two points (corresponding to different dates) can be determined by calculating the

$$\text{Critical Difference (or L.S.D.)} = \sqrt{\frac{2\,MS}{N}} \times t\ 0.05\ (29)$$

If the observed difference between any two points (dates) is greater than the Critical Difference calculated, then we can say that the difference is statistically significant at the 95 level.

On this basis, it was found that for both N and K, the difference between the dates August - September 1972 and September - October 1972 was found to be statistically not significant.

The same was observedffor P, Ca & Mg.

Discussions

This study has shown that sampling of leaves could be done during any time of the day as fluctuations in the concentration of nutrients are negligible. However, the IRRI workers suggest that sampling be confined to the morning (7.00-11.00 a.m.), in order to avoid possible differences in contents between morning and evening.

Nutrient concentration in plant tissues varies considerably during a season and it is desirable therefore that sampling be done during a period when nutrient concentrations are stable. This has the practical advantage that comparison between different stands are still valid even though times of sampling may not be identical. Besides, it is during this period that hunger signs are more easily detectable.

Contd...4/.

In Sri Lanka, where there is a distinct seasonal pattern in rainfall (May/June; October/November) there are bound to be changes in nutrient concentrations of elements as a result of changes in nutrient availability. This causes considerable fluctuations in nutrients during the course of an year (Seasonal variation).

From Fig. I it is observed that the period of stability (Minimum fluctuations) is represented approximately by a period of three (3) months, August to October. The same trend is noted for Ca and Mg through on a very much smaller scale. K shows variable fluctuations. However, for all elements, leaf sampling would be confined to this period; as none of the elements during this period show fluctuations which are statistically significant.

It is also observed that for both N and K (Fig.I) there are two sharp increases in their concentrations during the period May to July 1972, and October 1972 to January 1973. It is considered that these sudden increases were probably due to increased availability of both nutrients as a result of rains during the preceding months April/May 1972 (23.8 cm and 37.0 cm respectively) and Sept/October (26.8 cm and 32.9 cm). The action of the rains has has increased the availability of these nutrients and also made it more mobile. Although Ca and Mg shows this tendency they are less mobile elements and so their effects are not dramatic.

****

ACKNOWLEDGMENTS

Our thanks are due to Mr.V.Abeywardene, Biometrician, for statistical guidance and to Mr.D.T.Mathes for the statistical analyses of the data.

References.

Van Den Driessche R. (1974) Prediction of mineral nutrient status of trees by foliar analysis. The Botanical Review 40 (3): 347-394

Yan Fremond Robert Ziller and M.de Nuce de Lamothe (1966) The Coconut Palm p 103-109.

— (1961) General directions for coconut leaf analysis. Communicated by IRHO (France). FAO Technical Working Party on Coconut Production, Protection and Processing p.234-242