Short Scientific Report

Journal of Plantation Crops, 2006, 34 (1) : 68-70

Critical levels of macro and micro-nutrients in coconut leaves in littoral sandy soil

(Manuscript Received : 1-09-2004; Revised : 16-01-2005; Accepted : 10-02-2006)

Key words: Critical level, nutrients, coconut, Sakhigopal Local

Differences in leaf nutrient concentration due to different factors underline the importance of strict adherence to guidelines for leaf sampling and the difficulties involved in the interpretation of the results of leaf analysis. Critical leaf nutrient concentrations, considered to have wide applicability should only be used with greatest caution. Critical level is defined as the concentration of the element in the leaf above which a yield response from the element in the fertilizer is unlikely to occur. Leaf analysis enables us to directly measure the nutritional status of the trees. The results then can be compared with known standards to determine whether the tissues contain excessively high or low concentrations of essential macro- and micro-nutrient elements. The nutrient supply can then be adjusted to bring the levels of the mineral nutrients in the tissues back to within acceptable limits. However, the critical values for individual nutrients can vary over a considerable range, depending upon factors such as the age of the palms, soil moisture regime, ratio to other nutrient concentrations, types of planting material and interpalm competition etc. (Fairhurst, 2003). Hence, critical leaf nutrient concentrations must be determined for each agro-ecological environment taking into consideration local soil and climate conditions.

Keeping the above facts in view, a study was conducted to determine the critical levels in the index leaf for different macro- and micro-elements for coconut in coastal tracts under littoral sandy soils of Orissa.

The investigation was conducted in the Coconut Research Station, Konark, Govt. of Orissa during 2003-2004. Twenty-five palms producing stable yield as proved by the earlier records were selected for the study. The soil of the experimental field is typical littoral sand with low nitrogen, medium phosphorus and high potassium content. The palms were receiving recommended dose i.e., 500 g N, 320 g P_2O_5 and 1200 g K_2O applied in two splits (two-third in May and one-third in September). For determination of critical limit the nutrient content of 14th leaf sampled in December during 0900-1100 hours were taken into consideration. Leaf nitrogen content was estimated by Kjeldahal methods (Singh *et al.,* 1999), P by colorimetric method (Jackson, 1973), K by diacid digestion method (Jackson, 1973), Ca and Mg by EDTA complexometric method (Jackson, 1973), S by following the procedure described by Chesnin and Yein (1950) and the micronutrients (Fe, Mn, Cu and Zn) were determined by the procedure described by Lindsay and Norvell (1978). The N, P, K, Ca, Mg and S content were expressed as percentage and the micronutrients content were detailed as ppm. The critical limit of different nutrients was fixed after developing the scatter diagram for each of the nutrients in relation to the yield using the procedure described by Cate and Nelson (1965). According to this procedure, two lines perpendicular to each other were drawn on scatter diagram in such a way that maximum number of observations were accommodated in lower left and upper right quadrants. Use of relative yield instead of absolute yield allows for more effective interpretation of the data. In this approach, relative yield is plotted against leaf test and the data were subdivided graphically into four quadrants visually by placing a horizontal line at optimum relative yield (93 per cent of the maximum) and a vertical line at the leaf test value that minimizes the number of points in the upper left and lower right quadrants. The point of intersection of axes was designated as critical limit.

As per the methods developed by Cate and Nelson (1965) the critical limit of nutrients was worked out by

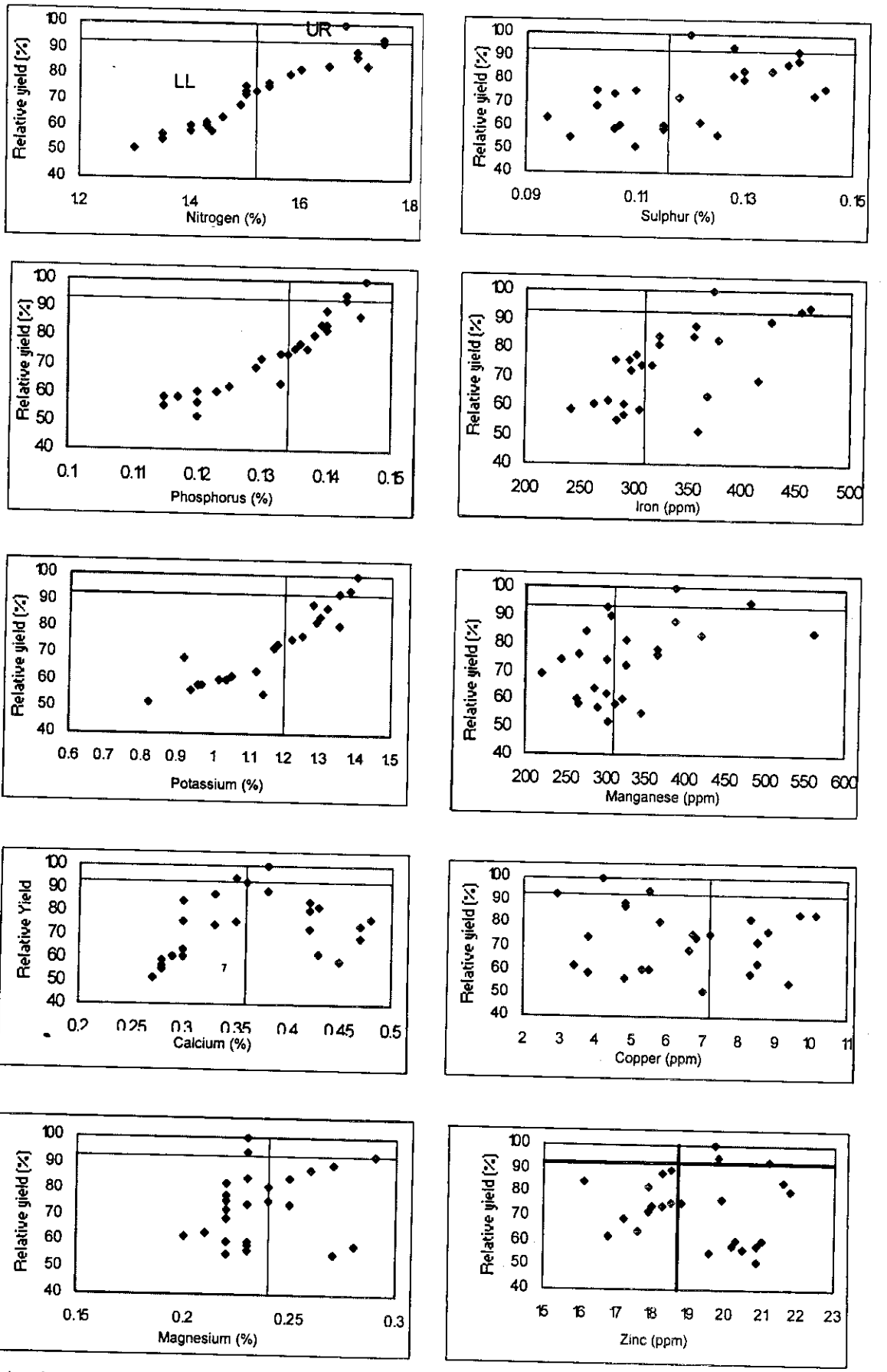

Fig.1 Determination of critical level of leaf nutrients (Cate and Nelson, 1965)

taking the 14th leaf sampled in December. The critical limit range for N, P, K, Ca, Mg and S was estimated as 1.52 to 1.54, 0.134 to 0.135, 1.20 to 1.23, 0.36, 0.24 to 0.25 and 0.116 to 0.118 per cent, respectively. Similarly, the critical limits for the micronutrients were 310 to 315, 310 to 315, 7.2 to 7.3 and 18.7 to 19.0 ppm for iron, manganese, copper and zinc, respectively. The critical nutrient levels worked out by the IRHO for the West African Tall palms using the 14th leaf were 1.8-2.0 per cent N, 0.12 per cent P, 0.8-1.0 per cent K, 0.50 per cent Ca, 0.30 per cent Mg, 50 ppm Fe and 60 ppm Mn (Thampan, 1982). The critical values for P and K obtained in this study were more or less similar to the critical levels (0.12 and 0.8-1.0 per cent, respectively) proposed by Thampan (1982). The critical level of N is 1.52 to 1.54 per cent, slightly lower than the critical level of 1.8 to 2.0 per cent reported by different workers. Such discrepancies are expected as the yield is modified by several other extraneous factors and critical levels established for one region may not hold good for another. Kamala Devi *et al.* (1983) in a fertilizer experiment also opined that the critical level of nitrogen under the coastal condition of India must be less than the value recommended by IRHO. The critical level obtained for calcium and magnesium (0.36 and 0.24-0.25 per cent, respectively) was in the range more or less similar to the concentration reported by Chew (1982), Ravi Savery *et al.* (1994). The critical level for sulphur was almost similar to the figure of 0.15 to 0.20 per cent suggested by Manciot *et al.* (1980). The critical level for Fe and Mn was unexpectedly high in this study. Manciot *et al.* (1980) working on the critical level of trace elements opined that it was not possible to define critical levels for Fe, Mn, Cu in coconut. The critical values of Cu-5-7 ppm, Zn-15 ppm, Fe-50 ppm and Mn-60 ppm in the 14th leaf suggested by Manciot *et al.* (1979 b) are only proposed values and critical levels have so far not been established experimentally (Manikandan *et al.*, 1986).

However, it is extremely difficult to define standard nutrient contents with wide application because of variations due to species, variety, age of plant, growth stages, climate, crop management and soil or other growth medium. It should only be defined to a particular cultivar under closely defined conditions.

References

Cate, R. B. and Nelson, L. A. 1965. *Intern. Soil Testing Series Tech. Bull. 1.* North Carolina State University, Agricultural Experiment Station, Releigh, USA, pp. 12.

Chesnin, L. and Yein, C. H. 1950. Turbidimetric determination of sulphur. *Proceedings of American Society of Soil Science.* **15**: 149-151.

Chew, P. S. 1982. Nutrition of coconuts a review for formulating guidelines on fertilizer recommendations in Malaysia. *Planter.* 54: 155-161.

Fairhurst, T. 2003. *The Oil Palm Leaf Sampling.* Review article published by Potash and Phosphate Institute, East and South East Asia Programs, 126 Watten Estate Road, Singapore - 287 599.

Jackson, M. L. 1973. *Soil Chemical Analysis.* Prentice-Hall of India Pvt. Ltd., New Delhi.

Kamala Devi, C. B., Velayutham, M. and Haridasan, M. 1983. Soil and leaf analysis in relation to the nutrition of high yielding coconut genotypes. *Coconut Research and Development [Proceedings of the International Symposium on Coconut Research and Development,* held at Central Plantation Crops Research Institute, Kasaragod, Kerala, December- 27-31] (Nayar, N. M., ed.), Wiley Eastern Publication, New Delhi, pp. 115-119.

Lindsay, W. L. and Norvell, W. A. 1978. Development of a DTPA test for Zinc, Iron, Manganese and Copper. *Soil Sci. Soc. Am. J.* **42:** 421-428.

Manciot, R., Ollagnier, M. and Ochs, R. 1980. Mineral nutrition and fertilization of the coconut around the world. Part III. Study of the different elements. *Oleagineux.* **35 (1)** : 13-27.

Manikandan, P., Joshi, O. P., Khan, H. H. and Biddappa, C. C. 1986. Available micro-nutrient status of the coconut- tract of Kasaragod district of Kerala. *Journal of Plantation Crops.* **14 (2)** : 134-146.

Ravi Savery, M. A. J., Madhiazhagan, K. and Rettinassababathy, C. 1994. Leaf sampling and critical nutrient levels in coconut. *Indian Coconut J.,* **25 (8)** : 6.

Singh, D., Chhonkar, D. K. and Pandey, R. N. 1999. *Soil-Plant-Water Analysis: A Methods Manual.* IARI, New Delhi.

Thampan, P. K. 1982. *Handbook on Coconut Palm.* Oxford and IBH Publishing Co. Kolkatta, pp. 81-157.

CPCRI Research Centre, Mohitnagar, Jalpaiguri, West Bengal-735 101.

G. C. Acharya
D. K. Dash*

** Associate Professor, AICRP on Palms, OUAT, Bhubaneswar, Orissa-751 003.*