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PRELIMINARY N, P AND K FOLIAR DRIS NORMS FOR COCONUT

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The efficiency of predicting nutrient imbalances and deficiencies in coconut was tested using Diagnosis and Recommendation Integrated System (DRIS) developed by Beaufils which utilizes the ratio of tissue nutrient concentration rather than the concentration *per se*. DRIS consistently produces more accurate diagnosis and imbalances than critical concentration studies. Plant samples were collected from 14th leaf (diagnostic leaf) from a population of 183 palms and palms yielding less than 35 nuts/annum/palm were considered low yielding and those producing more than 35 nuts/palm/annum were considered high yielding or desirable population. Cocouut leaf norms were formulated for different forms of expression for nitrogen, phosphorus and potassium and the variance ratios for K. NK, PK, K/P, K/N were found to be highest and significant. Indexes for N, P, and K were obtained integrating values of nutrient ratio of a test sample, mean value of the ratio for high yielding population and CV of high yielding population for that form of expression. Nutrient indexes were calculated from the leaf analysis values obtained from individual treatments from a factorial experiment. The indexes indicated marked deficiency for nitrogen, which was confirmed by experimantal data. The foliar levels of K which were below the suggested critical levels did not give any negative index DRIS method of diagnosis suggested the order of importance of limiting nutrient for a given situation. Hence based on the norms developed, nutrient application can be suggested for a targetted production. There is ample scope for refinement of DRIS norms by sampling a larger population, and utilizing it as an effective tool for fertilizer recommendation for coconut.

Conventionally, diagnosis of nutrient deficiencies using plant analysis and prediction of yield response to fertilizer application are based upon comparing the tissue nutrient concentration with 'critical levels' in coconut. Often this has not given desirable results in coconut probably due to nutrient imbalances in the system even as a result of fertilizer application and failure to determine the order of importance of a particular nutrient in case of multiple deficiencies Diagnosis and Recommendation Integrated System (DRIS) developed by Beaufils (1973), which takes into consideration the ratios of tissue nutrient concentration rather than cocentration *per se* consistently produces more accurate diagnosis of imbalances than the critical concentration studies. The usefulness of this approach has been tested for potatoes (Meldal-Johnson, 1975), sugarcane (Beaufils and Sumner 1976), wheat (Sumner, 1977) pineapple (Langenegger and Smith, 1978 and grapes (Chithiraiselvan, *et al.*, 1984). In this study the DRIS leaf norms for N, P and K were developed and its efficiency in predicn ting the imbalance and order of nutrient requirement was tested with a view to use it as a diagnostic tool for fertilizer recommendation for coconut.

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MATERIALS AND METHODS

Data base for this study was derived from a NPK factorial experiment with three levels each of N (0, 325, 750g/palm/year) P_2O_5 (0, 225, 450g/palm/year) and K_2O (0, 450, 900g/palm/year). The age of the palms, when sampled was 25 years and the palms were growing on fine sandy soil (Quartzipsamments). Palms yielding less than 35 nuts/palm/year were considered as low yielding population and those yielding more than 35 nuts /palm/year were considered high yielding or desirable population. Irrespective of fertilizer treatments 183 palms were sampled for the study of which 63 accounted for the low yielding population.

Leaf samples were collected from 14th leaf (diagnostic leaf) (Prevot and Bachy, 1962) during the month of May 1983, washed with detergent solution, rinsed with distilled water, oven dried at 65°C for 72 hours and powdered in a Wiley Mill with steal blades. This 0.5 mm fraction was analysed for P (vanadomolybdate) K (flamephotometry) and N was estimated by microkjeldah method (Jackson, 1967).

The general procedure outlined by Sumner (1982) was followed for developing the preliminary norms for coconut. The leaf analysis data were used to calculate the indexes for N, P and K supplementing the nutrient ratios in the following formula.

$$\text{N index} = \frac{-f(K/N) + f(NK)}{2}$$

$$\text{P index} = \frac{-f(K/P) + f(PK)}{2}$$

$$\text{K index} = \frac{f(K/P) + f(K/N) + f(NK) + f(NK)}{4}$$

$$\text{where } f(K/N) = \frac{(100(K/N - l)}{k/n} \times \frac{10}{CV}$$

when K/N > k/n

OR

$$100\ \frac{1 - K/N}{k/n} \times \frac{10}{CV}$$

when k/n < K/N

K/N = actual value of ratio in the leaf of a test sample

k/n = the mean value of a ratio for the high yielding population

CV = Coefficient of variation of high yielding population

RESULTS AND DISCUSSION

Table 1 indicates the N, P, K foliar diagnostic norms developed for coconut. The variance ratios were highest and significant only for K, K/P, K/N, NK, PK and hence only those ratios were used for caculating the DRIS indices.

The DRIS indices for K suggested that K may not be a limiting nutrient eventhough the plant levels were below the 'critical levels' of 0.8-1.0 percent (Fremond, 1966) in majority of the treatments.

Application of phosphorus alone or combination of phosphorus and potassium (in the absence of nitrogen) effected an average yield of 11.3 nuts/palm/year, the DRIS indices for nitrogen were negative and on the higher side indicating the most required nutrient as nitrogen (Table 2). When the nitrogen alone was applied (350 g N/palm/year) the yield realised was substantial viz., 57.9 nuts/palm/year. Further the indices indicated that N and P are deficient in the system

Table 1. Coconut leaf norms for N, P, K

Low Yielding Population (n=63)					High Yielding Population (n=120)			
Forms of expression	Mean	Variance SA	CV%	Variance ratio SA/SB	Mean	Variance	CV%	Forms of expression
N	1.369	0.02881	12.39	1.1855	1.66	0.0243	9.39	n
P	0.1129	0.000164	11.25	0.6330	0,1130	0.000255	14.14	P
K	0.9529	0 0930	32.00	2.0394**	0.654	0.0456	32.64	K
N/P	12.24	3.4035	15.07	0 6141	14.96	5.5416	15.73	n/p
N/K	1.71	1.0372	59.62	1.3190	2.81	0.7869	31.59	n/k
K/P	8.52	7.91	33.03	2.0230**	5.862	3.91	33.75	k/p
P/K	0.1362	0.00383	45.45	1.1146	0.18895	0.003436	31 024	p/k
P/N	0.08341	0.0001418	14.28	1.1680	0.06854	0.0001214	16.07	p/n
K/N	0.7134	0.06068	34.53	2.8001**	0.39998	0.02167	36.80	k/n
NP	0.1551	0.000783	18.04	0.6692	0.1818	0.00117	18.22	np
NK	1.29	0.17575	32 55	1.5153**	1.08	0.11598	31.56	nk
PK	0.1079	0.001432	35.07	1 7108**	0.07449	0.000837	38.84	pk

Table 2. Relationship between manurial treatments, foliar levels, DRIS norms and yield of palms

Manurial treatments g/palm/year			Foliar levels			DRIS norms			Order of requirement	Yield of nuts/palm/year
N	P_2O_5	K_2O	N	P	K	N	P	K		
0	0	0	1.33	0.110	0 98	−8.1	−2.1	14.0	N>P>K	5 6
0	250	0	1.49	0.125	0.83	2.6	-2.6	7 6	P>N>K	11.5
0	450	0	1.34	0.113	1.07	−8.3	2.5	19.5	N>P>K	9.2
375	0	0	1.72	0.118	0.61	−1 1	−1.2	2.2	P>N>K	57.9
750	225	450	1.70	0.106	0.66	0.2	5 4	1.4	N>K>P	91 6
750	225	900	1.65	0.098	0 78	6.4	−5.1	5.7	P>K>N	103.0
750	450	900	1.64	0.099	0 79	2.8	−4.8	5.7	P>N>K	86.1

and are required in preference to K. So application of 750 g N, 225 g P_2O_5 and 450 g K_2O gave yield of 91.6 nuts/palm/year. The fitting of the leaf analysis data of this treatment to the norms developed, further indicated the order of requirement of nutrient at his hight yield level as N K P. As N cannot be further increased than 750 g (maximum level in the experiment) increasing the dose of application of next limiting nutrient K to 900 g, viz., 750 g N, 225 g P_2O_5 and 900 g K_2O, gave the highest yield of 103 nuts/palm/year. The conclusion of this experiment from where samples were drawn for the present study also indicated that the optimum dose of nitrogen lies beyond the maximum dose tried in the experiment.

The ability of DRIS methodology to pinpoint why a particular fertilizer treatment has produced/not produced desirable results as a function of nutrient balance in the system and the prediction of nutrient needs at higher yield levels are also demonstrated in the examples cited. Sumner (1977 1982) illustrated the advantage of DRIS system in choosing the most required nutrient at higher yield levels

Thus, based on the norms developed nutrient application can be tailored to the optimal needs of production. There is ample scope for refinement of DRIS norms by sampling a larger population and utilizing it as an effective diagnostic tool for fertilizer recommendation.

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REFERENCES

BEAUFILS, E. R. 1973. Diagnosis and Recommendation Integrated System (DRIS) Soil Sci. Bull. No. 1 University of Natal, South Africa. pp. 132

BEAUFILS, E. R. and M. E. SUMNER. 1976. Application of the DRIS approach in calibrating soil and plant parameters for sugarcane. Proc. S. Afr. Sugar Tech. Assoc. 50 : 118-124.

CHITHIRAI SELVAN, R., S. D. SHIKHAMANY, and K. L. CHADHA, 1984. Evaluation of low yielding vines of Thompson seedless, for nutrient indices by DRIS analysis 41 (3 & 4): 166-170.

FREMOND, Y. 1966. Contribution of IRHO to the study of mineral nutrition of coconut palm. In FAO Tech Work. Party on Coconut Production, Protection and Processing-Colombo. 1964, 97-107.

JACKSON, M. L. 1967 Soil chemical analysis, Printice Hall of India Pvt. Ltd., New Delhi. pp. 498.

LANGENEGGER, W. and B. L. SMITH, 1978. An evaluation of DRIS system as applied to pineapple leaf analysis Proc. Int. Coll Plant Anal. Fert. Prob. pp. 263 DRIS Infor Series No. 134, New Zealand.

MELDAL—JOHNSON, A. 1975 An analysis of some factors influencing potato production. Thesis, University of Natal, Pietermaritzburg South Africa.

PREVOT, P. and A. BACHY, 1982. Leaf analysis of the coconut palm. Influence of the leaf rank and of vegetative development on the elemental contents. 10eagineux, 17 (5) : 451-458 Fr.

SUMNER, M. E. 1977. Use of the DRIS system in foliar diagnosis of crops at high yield levels. Commun. Soil Sci. Plant Anal. 8: 251 268.

SUMNER, M. E. 1982. The diagnosis and recommendation integrated system (DRIS) Paper presented Soil Plant Analysts' Seminar on Soil Testing and Plant Analysis Anaheim, CA, December 1, 1982.