DIAGNOSIS AND RECOMMENDATION INTEGRATED SYSTEM (DRIS) A BETTER APPROACH TO COCONUT NUTRITION

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INTRODUCTION

Coconut is grown in more than 90 countries in the world and India occupies the third position with an area of 1.63 million hectares and a production of 12355 million nuts [Anon(a)1993-94]. The crop makes a significant contribution to the national economy to the extent of Rs. 4,000 crores with an annual export earning of Rs. 126 crores [Anon (b) 1993-94] per year which is much below its potential of more than 100 nuts per palm per year. Lack of adequate and proper management of nutrients is one of the reasons for this low productivity,

The continuous harvesting of nuts and the removal of leaves and all other fallen plant parts with practically no chance for recycling from a potential crop garden like that of coconut with a life span of 70 to 80 years or more will deplete the soil of one o r more elements and makes nutrient management difficult. The strategy for nutrient management in coconut must aim at providing a balanced and optimum supply of nutrients required for higher Yields. Accurate determination of nutrient requirement for coconut is difficult. Soil analysis could only reveal the soil condition and not the exact need of the palm. Plant analysis provides a useful measure of the element status of the palm which can help to improve nutrient management.

Research work- conducted in diagnosing nutrient deficiencies in coconut palm using plant analysis has been mainly confined to the critical level approach. One of the limitations of this approach in coconut palm is its inability to test clearly the sufficiency and deficiency levels of several major and micronutrients such as P, Ca, Mg, S. Cl, Fe, Mn, Zn, etc. An objective measure of nutrient balance is also not possible by this technique, though nutrient inter-actions are known to be important in plant nutrition.

More recently, a method of diagnosing nutrient balance and deficiencies has been proposed by Beaufils (1973). It is a comprehensive system which identifies all the nutritional factors limiting crop production and in so doing increases the chances of obtaining higher crop yields by improving fertilizer recommendations. This method known as Diagnosis and Recommendation Integrated system (DRIS) uses the nutrient rations in a suitable plant part for diagnosing nutrient imbalances in the plant. Several advantages of this method had been reported in different crops. These include the use of the data in assessing nutrient balance, identification of not only the most limiting element but the order in which the other elements would likely become limiting, the ability to diagnose the plant nutrient needs much earlier in the life of the crop than the critical level method allowing remedial steps to be taken earlier, greater accuracy and relatively more freedom from the effects of some of the sampling variables such as age of the plant part, geographic locations, etc.

MATERIAL AND METHODS

A study on the applicability of diagnosis and recommendation integrated system in coconut palm was conducted, by the Department of Agronomy, College of Horticulture, Vellanikkara during 1991-94. The study was conducted using coconut populations of variety West Coast Tall aged 252-5

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years being maintained at three research stations of Kerala Agricultural University namely, Regional Agricultural Research Station, Pilicode, Agricultural Research Station, Mannuthy and Coconut Research Station, Balaramapuram.

Eight hundred palms varying in their yield from 6 to 163 nuts per palm per year were selected for developing DRIS norms. Leaf samples were collected from the 14th frond and were analyzed for macro and micro nutrients namely N, P, K, Ca, Mg, S, Cl, Fe, Zn and Mn employing titrimetric spectrophotometric, flame photometric or atomic absorption spectra photometric methods depending on element. DRIS norms were developed using the data generated from the chemical analysis of leaf samples using the methodology of Beaufils (1973).

RESULTS AND DISCUSSIONS

The palm population was divided into low and high yielding sub populations. The means and variances of nutrient concentration as well as their ratios (totaling 90 including inverse ratios) were worked out for the two sub populations.

The variance ratios were then computed for nutrient and each nutrient ratio to examine their statistical significance and those discriminating significantly between the two sub-populations were considered for DRIS norms.

When both the ratio and its inverse form were significant, the one which had a higher variance ratio was selected. Mean values of the selected individual nutrients and nutrient ratios of the high yielding sub-population f6mied the DRIS norms.

Five nutrients namely N, P, Ca, Mg and Cl and as many as 45 nutrient ratios were found to yield statistically significant variance ratios between the low and high yield groups. Among the nutrient ratios, 33 were selected on the basis of their higher variance ratios compared to the inverse f6mis (Mathewkutty 1994). The data for the selected ratios and nutrient elements are presented in Table 1.

Among the nutrient elements, the mean values of N, and Ca were found to be higher for the low yield group than for the high yield group while the reverse was true for P, Mg and Cl. The nutrient ratios which gave higher values for high-yield group were P/K, P/Ca, P/Fe, Mg/K, Mg/Ca and S/K. These DRIS norms give die required concentration of nutrient content for obtaining higher yield.

By utilising the above DRIS norms one could identify the most deficient nutrient either by using DRIS chart or by using DRIS indices. DRIS chart help to compare the relative presence of 3 nutrients only. It allows CORD Vol. XI No. 2 1995 only such sets of three ratios in which one of the nutrients comes: as the numerator or as the denominator twice, to be presented as DRIS charts.

The method of presentation of DRIS chart may be illustrated as follows. The chart given in Fig. 1 relates to N, K and Cl in terms of their ratios. The balance or imbalance among these three nutrients can be found out from this DRIS chart. The point of intersection of the three axes represents N/Cl, K/N and K/Cl corresponds to their respective DRIS norms i.e., their mean values for the high-yielding sub population. Thus, the values represented. by K/N, K/Cl and N/Cl axes at the point of intersection arc 0.86, 1.98 and 2.43, respectively. These values constitute the most balanced conditions for these three nutrients. The departure from this point to either side of the point of intersection indicates increasing imbalance. This can happen due to the excess of one nutrient or the insufficiency of the other. The magnitude of imbalances may be displayed using two concentric circles. The diameter of the inner circle is set at 4SD/3 where SD is the standard deviation for the high-yielding sub population and that of the outer circle is set at 8SD/3 as show in Fig. 1. (Beaufils, 1971, Walworth and Summer, 1987). The values falling within the inner circle arc considered to be niore balanced than those falling within die outer circle. Marked imbalance occurs beyond the outer circle. The degree of imbalance between the two nutrients of a ratio thus increases from the centre of the circle towards the outer. This is denoted by a horizontal arrow (?) in the inner circle, by an arrow at 45^0 C to the horizontal (?) or ( ) in the outer circle and by virtual arrows ( ) or ( ) beyond the outer circle. Identical diagnosis are obtained by considering either excesses or insufficiencies or both.

The use of DRIS chart is restricted to a qualitative assessment of nutritional imbalances involving three nutrients. The DRIS technique also provides another approach that can accommodate any number of nutrient ratios. In this approach nutrient indices are worked. out using standard values or norms and the observed nutrient ratios for the plant under test. The DRIS index for a nutrient indicates its relative abundance among the nutrients considered in its computation. Lower the value of the index for a nutrient, greater is its requirement.

CONCLUSION

The study revealed that DRIS approach could provide information on balance or imbalance of nutrients in coconut palm. DRIS indices supplement information on a relative content of nutrients in the plant system and it arranges the order in which it is to be supplied for a proper balance of nutrients. A comparison of DRIS approach with that of the conventional critical level approach indicated the advantages of DRIS method. Thus diagnosis arid recommendation integrated system is a better approach to coconut nutrition for attaining higher level of productivity.

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Table 1. DRIS Norms for Coconut Palm

Form of Expression	Low Yield Group (A)			High Yield Group (B)			Variance Ratio
	Mean (S^)	Variance	CV	Mean (DRIS Norm)	Variance (S^)	CV (%)	(S^/S)
N	1.68	0.14	22	1.52	0.07	17	2.01
P	0.16	0	23.8	0.19	0	24.6	1.52
Ca	0.31	0.01	28.2	0.25	0.01	27.4	1.68
Mg	0.19	0	19.4	0.2	0	13.1	1.94
Cl	0.63	0.01	15.9	0.64	0.01	12.4	1.62
N/P	11.7	19.4	37.8	8.36	5.99	29.3	3.24
N/Mg	9.23	11	36	7.68	1.79	17.4	6.15
N/S	17.3	100	57.8	9.46	10.8	34.7	9.24
N/Cl	2.74	0.6	28.5	2.43	0.35	24.5	1.69
N/Fe	59.1	844	49.1	57.9	480	37.8	1.76
N/Mn	96	1479	40	80.1	982	39.1	1.51
P/K	0.12	0	32.5	0.17	0.01	43.2	3.47
P/Ca	0.53	0.03	30.6	0.54	0.08	33.7	3.03
P/S	1.44	0.29	37.4	1.16	0.15	33.1	1.97
P/Fe	5.25	5.62	45.1	7.41	11.3	45.3	2
K/N	0.87	0.14	43.4	0.86	0.1	36.7	1.42
K/Cl	2.2	0.43	29.8	1.98	0.29	27.3	1.47
K/Fe	45.9	364	41.6	49.6	713	53.9	1.96
K/Zn	696	97362	44.9	646	59775	37.9	1.63
K/Mn	81.7	2097	56	68.7	1364	53.8	1.54
Ca/N	0.2	0.01	40	0.17	0	38.3	1.45
Ca/S	2.99	2.14	48.8	1.58	0.66	51.5	3.22
Ca/Cl	0.51	0.03	34.6	0.39	0.02	31	2.13
Ca/Fe	10.5	21.4	44	9.2	12.5	38.5	1.71
Ca/Zn	156	2963	40.4	125	2038	36.1	1.95
Ca/Mn	17.4	50.7	41	12.3	13.8	30.2	3.68
Mg/K	0.15	0	30.7	0.17	0	34	1.6
Mg/Ca	0.65	0.03	25	0.86	0.04	24.3	1.67
Mg/S	1.83	0.63	43.2	1.25	0.18	33.8	3.54
Mg/Mn	11.2	22.9	43	10.5	15.1	36.9	1.52
SK	0.1	0	48.4	0.15	0.01	47.8	2.52
Ci/Mg	3.44	1.01	29.1	3.26	0.37	18.6	2.75
Cl/S	6.24	9.24	48.7	4.1	2.9	41.5	3.19
Fe/S	0.31	0.02	49.2	0.19	0.01	57.6	1.97
Zn/Mg	0.01	0.221*	39.2	0.01	0.080*	27.4	2.54
Zn/S	0.02	2.000*	61.9	0.01	0.400*	43.2	5.12
Zn/Mn	0.12	0	41.7	0.11	0	38.6	1.44
Mn/S	0.19	0.01	59.3	0.14	0.01	55.1	2.3

CV: Coefficient of variation

* : $X10^4$

Figure 1. DRIS Chart for N, K and Cl