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PRODUCTIVITY OF CASHEW AS INFLUENCED BY CHLOROPHYLL AND LEAF NITROGEN CONTENT

Productivity of tree crops grown in different nutritional environments from totally unmanured to adequately manured systems does vary greatly. Being the most important element in qualitative and quantitative respects, the internal concentration of nitrogen in the plant system influences the formation of chlorophyll which is the seat of carbon assimilation. The impaired soil plant interaction process can influence the constituent components of chlorophyll. The availability and presence of other elements, especially phosphorus and potassium, in the external nutritional environment as well as in the internal plant system can influence the N concentration in plant due to their interactive role in structure, metabolism and reproduction. Hence, the leaf N and chlorophyll content can serve as a yardstick to judge the need for primary nutrients in relation to the productivity of perennial crops. In this context the relationship between nutrient supply and, N and chlorophyll contents of leaf and their influence on productivity of cashew is studied.

The cashew trees in a long term fertilizer trial established in the KADP Farm, College of Horticulture, Vellanikkara were made use of in this study. The soil was sandy loam with under-laid laterite. The contents of N, available P and available K of soil were 0.179 per cent, 17.8 ppm and 150 ppm, respectively. The experiment was laid out in $3^3 + 1$ factorial RBD and planted with seedling progenies of BLA-39-4. Three levels each of N (250, 500 and 1000 g per tree per year), P (125, 250 and 500 g) and K (250, 500 and 1000 g) along with an absolute control (no fertilizer application since planting) were tried. Chlorophyll contents were estimated (AOAC, 1970) from leaf samples collected at flushing. The leaf N was determined by Kjeldahl digestion and distillation (Jackson, 1958).

Nitrogen and its varying levels influenced chlorophyll 'a' content only marginally. However, chlorophyll 'b' and total chlorophyll contents were significantly increased by N application. Similar increases in chlorophyll 'a' and V components and total chlorophyll were observed with application of P and K, but the varying levels of application resulted only in marginal enhancement. Leaf N content was significantly increased by the application of all the three nutrients but their increasing levels failed to respond in a similar way. The effect of N was more pronounced compared to other nutrients in respect of percentage increases in N concentration (Table 1).

Since N is an important inorganic constituent of chlorophyll, increase in leaf N would naturally result in increased chlorophyll content. Correlation studies showed the existence of positive relationship between leaf N and chlorophyll. However, the significant increase in chlorophyll 'b' with a mean static level of chlorophyll 'a' with N application is indicative of the increase in the relative proportion of chlorophyll 'b' to chlorophyll 'a'. This would mean that at lower levels of N availability, chlorophyll 'a' alone will develop and chlorophyll V which is believed to be derived from chlorophyll 'a' (Shylk *et al.*, 1963; Boardman, 1966) fails to develop probably because of an inhibition in the concerned reactions. This incidentally will explain the reasons for low productivity under low nitrogen situations.

The role of P in enhancing total chlorophyll and its constituent components might be due to its role in energy transfer. An indirect effect due to the enhancement of N availability in soil is also expected. In an inherently P deficient soil, P application might enhance the bacterial population with an average N:P ratio of 4:1 and later release of N into soil through an immobilization - mineralization process. The significant response by K application in all probabilities is due to the improvement in the internal nutritional environment as reported by Marykutty *et al.* (1992).

Table 1. Leaf N, chlorophyll content and yield of cashew as influenced by nutrient supply

		Chlorophyll 'a' (mg/g tissue)	Chlorophyll V (mg/g tissue)	Total Chlorophyll (mg/g tissue)	Leaf N per cent	Yield (kg/tree)
Control vs treatment						
Control		0.39	0.48	0.76	1.89	1.3
Effect due to	N	0.56	0.77**	1.44**	2.04**	5.7**
Effect due to	P	0.50	0.77**	1.29**	1.99**	4.9**
Effect due to	K	0.48	0.59**	1.14"	1.93**	4,1
N levels						
	N_1	0.56	0.74	1.28	2.01	5.3
	N_2	0.65	0.87	1.40	2.13	7.2
	N_3	0.68	0.96	1.67	2.14	7.4
	CD(0.05)	NS	0.12	0.23	NS	1.06
P levels						
	P_1	0.56	0.81	1.38	2.06	5.7
	P_2	0.65	0.85	1.44	2.09	6.5
	P_3	0.68	0.91	1.52	2.13	7.6
	CD(0.05)	NS	NS	NS	NS	NS
K levels						
	K_1	0.61	0.83	1.47	2.06	6.1
	K_2	0.66	0.84	1.37	2.11	6.8
	K_3	0.63	0.89	1.5	2.12	8.9
	CD(0.05)	NS	NS	NS	NS	NS

** Significant difference with control at 1 per cent level

A very similar response obtained in the enhancement of cashew yield (Table 1) is indicative of the strong relation between the chlorophyll development and productivity. Chlorophyll *V* is the main acceptor of radiant energy which is funnelled to P_{700} of chlorophyll 'a'. The increase in chlorophyll 'b' indicated more effective photosynthetic assimilation which was reflected in the increased yield. However, Meyers and French (1960) reported that photosynthetic efficiency will be maximum only in the two pigment system process. A deficiency in one will bring about more than proportionate reduction in assimilation rate. Hence the disproportionate development of chlorophyll 'a' compared to chlorophyll V with respect to added N is indicative of a metabolic malfunctioning which limits the productivity of cashew. Similarly, the lower response to increasing levels of applied N in enhancing the leaf N content might be due to impaired soil plant interactions since the observed leaf N content was well below the critical levels reported.

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