Variation in mineral composition of leaves of cashew (anacardium occidentale L.) as affected by season, position and age

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ABSTRACT

Flowering and fruiting had a depressive effect on the major nutrient composition of cashew leaves Leaves of top portions did not vary in their N P K contents with that of lower portions. Freshly matured leaves, emerged after fruiting recorded higher contents of NPK than the matured leaves of previous season. The variation among the trees with respect to NPK contents of freshly matured leaves is less as compared to older leaves.

INTRODUCTION

The nutritional status of the plant system plays a major role in the production potentials. With the ageing of the canopy, shuffling of the nutrients from older to younger leaves was observed to a greater extent by many workers in crops like guava, citrus, and mango (Chadha et al., 1979, Pathak et al., 1976, Singh et al., 1978). Manipulations in fertiliser management, to meet the nutritional requirements, based on the nutritional shortages of the plant system would help in tapping the maximum potential production. With a view to diagnosing the nutritional status of the plant system, depending on foliar analysis, we have studied the nutrient fluctuations within the plant system as influenced by the season, position, and age of the leaf.

MATERIALS AND METHODS

Twenty 8 year old cashew trees under normal management conditions were selected for sampling purpose. The experimental trees were not fertilised during sampling period. Leaf samples consisting of 100 leaves per tree under two categories i.e. (1) fully matured leaves already existing on the plant and (2). just matured leaves from the shoots emerged in that particular season, were collected from two positions i.e., top (above 50% total height of the plant)and bottom (below 50% total hight of the plant) before fruiting and after fruiting. Leaf samples were collected between 8.00 a.m. and 8.30 a.m. Petioles were removed, washed and dried at 65°C to a constant weight. NPK contents were analysed as described by Jackson (1973). The major nutrient status of the tree as a whole, before and after fruiting, top portions with bottom portions, and matured leaves existing on the plant with just matured leaves of that particular season were compared to see the effect of season, position and age of the leaf respectively.

RESULTS

Effect of season

Fruiting had a depressive effect on the major nutrient contents of cashew leaves (Table 1). Cashew leaves recorded significantly higher contents of nitrogen, phosphorus and potassium after fruiting season. These results are in conformity with the earlier results published by Chadha, et al., 1973 who found low mineral contents of the leaves in fruiting shoots as compared to the non-fruiting shoots of guava.

Effect of position

NPK contents of cashew leaves collected either from bottom portions or top portions did not differ significantly during both the seasons, i.e. before and after fruiting (Table 2).

Effect of age

Nitrogen: Before fruiting, nitrogen contents of fully matured leaves of previous flush maintained higher values as compared to the new flush. However, after fruiting, freshly matured leaves recorded significantly higher amounts of nitrogen compared to the matured leaves of pre-fruiting season (Table 3).

Phosphorus and Potassium: A marginal increase in phosphorus and potassium contents of new flush was observed before fruiting as compared to the matured leaves of previous season. However, after fruiting, the increase in phosphorus and potassium contents of fully matured leaves of that season was three fold and significantly superior to matured leaves of pre-fruiting season (Table 3).

Variability for NPK contents in the population

Variability among different groups of leaves in the population for NPK contents (Table 4) before fruiting was high and almost uniform. With the cessation of fruiting, tree to tree variation with respect to NPK contents in freshly matured leaves of that season was within the limits of experimentation, where as in the leaves of previous season the coefficient of variation was very high.

DISCUSSION

Flowering had a depressive effect on NPK contents of cashew leaves. The lower percentages of NPK contents of leaves during pre-fruiting season may be due to increased mobility of the assimilates from various groups of leaves (Sources) for the maximum flower production and

Table 1. Effect of season on NPK contents of cashew leaves.

Season	N(%)	P(%)	K(%)
Pre fruiting	1.4127	0.0930	0.6277
After fruiting	1.4872	0.1215	0.7927
't' value	2.0262*	3.6717**	4.4807**

** Significant at 1%
* Significant at 5%

Table 2. Effect of position on NPK contents of cashew leaves

Season	Position	N(%)	P(%)	K(%)
Pre fruiting	Bottom	1.3680	0.094	0.6775
	Top	1.4575	0.092	0.5780
After Fruiting	Bottom	1.4855	0.124	0.8125
	Top	1.4890	0.118	0.7729
't' value		0.2248 NS	0.5642 NS	0.5772 NS

NS: Not significant

Table 3. Effect of age on NPK contents of cashew leaves

Season	Age group	N(%)	P(%)	K(%)
Pre fruiting	Fully matured leaves of previous season	1.4885	0.0835	0.5970
	Freshly matured leaves of current season	1.3370	0.0875	0.6585
After fruiting	Fully matured leaves of previous season	1.1855	0.0625	0.4605
	Freshly matured leaves of current season	1.7890	0.1790	1.1250
't' value		13.2343*	16.5637**	32.8493**

** Significant at 1%
* Significant at 5%

Table 4. Pre and post fruiting variation (CV%) in NPK contents among cashew trees with respect to different groups of leaves

Pre fruiting	Nitrogen	Phosphorus	Potassium
Top matured leaves of previous season	13.32	24.90	13.06
Top fully matured leaves of current season	11.57	21.21	11.82
Bottom matured leaves of previous season	13.61	22.57	15.41
Bottom fully matured leaves of current season	8.64	22.03	13.64
After fruiting	**Nitrogen**	**Phosphorus**	**Potassium**
Top matured leaves of previous season	10.91	32.38	20.79
Top fully matured leaves of current season	11.93	17.25	8.49
Bottom matured leaves of previous season	11.49	56.96	17.74
Bottom fully matured leaves of current season	10.87	18.99	4.72

growing fruit and shoot apiece (Sinks). These results are in conformity with those of Embleton, et al., (1963) for Washington oranges and Chadha, et al., (1973) for guava who recorded lower percentages of NPK in fruit bearing shoots as compared to non-fruit bearing shoots.

The non significant differences in NPK contents of leaves collected below or above 50% height of the tree indicate that the cashew plant translocates the synthates in a more rational way within the plant system on the criterion of maturity of the leaf but not by means of total height differences under normal conditions.

Shuffling of the nutrients from previously matured leaves to newly matured leaves was observed in cashew.

The low content of nitrogen in the newly matured leaves before fruiting may be due to higher degree of mobilisation of nutrient for flower production and for dry matter production by the flowering and growing shoots. These results are in conformity with Koo, et al. (1956), Pathak, et al. (1976) and Kumar et al., (1979) who have observed similar type of results in citrus, mango and guava respectively.

In general, before and after fruiting, matured leaves of previous seasons recorded lower percentage of phosphorus and potassium as compared to freshly matured leaves. Chadha, et al., (1973), Koo et al., (1956), Koo et al., (1972), also observed similar type of results in crops like guava, citrus and mango respectively. The non significant increase in phosphorus and potassium contents in freshly matured leaves over matured leaves of previous season during prefruiting period may be due to active translocation of these two elements, irrespective of the type of

source, to the reproductive parts where the sink strength is increased by way of high flower production and fruit development. With the completion of fruiting, the active sink phase is reduced without any appreciable change in the source strength. As growing shoot and root apiece also act as an active sink, the three fold increase for phosphorus and potassium contents was observed in freshly matured leaves.

Tree to tree variation with respect to different groups of leaves for NPK contents was almost uniform before fruiting. The uniform variation may be because developing flowers and fruits have high competitive ability and that with the transition from vegetative to reprodutive development, there was a marked change in the pattern of assimilate distribution, hence a developing fruit has a priority of demand on assimilates from more distant regions (Wardlaw, 1968). However, after fruiting, when the active sink strength is reduced, the growing shoot apiece and just matured leaves would have drawn nutrients from various sources at different magnitude under which the freshly matured leaves recorded minimum variation for NPK contents as compared to older leaves.

References

1. Chadha, K. L., Arora, J. S., Ravel, P. and Sikhamany, S. D. 1973. Variation in mineral composition of leaves of guava (P. guajava L.) as affected by leaf position, season and sample size. Indian J. Agric. sci. 43: 555-561.
2. Chapman, H. D. 1964. Suggested foliar sampling and handling techniques for determining the nutrient status of some field, horticultural and plantation crops. Indian J. Hortic. 21; 97-119.
3. Embleton, T. W., Labananskas, C. K., Jone, W. E. and Cre, C. B. 1963. Inter relation of leaf sampling methods and nutritional status of orange trees and their influence on macro and micro nutrient concentrations in orange leaves. Proc. Am. Soc. Hortic. Sci. 82; 131-141.
4. Jackson, M. L., 1973. Soil chemical analysis, Prentice Hall of India, New Delhi.
5. Koo, R. C. J. and Sites, J. W. 1956. Mineral composition of citrus leaves and fruits as associated with position on tree. Proc. Am. Soc. Hortic. Sci., 68: 245-252.
6. Koo, R. C. J. and Young, T. W., 1972. Effects of age and position on mineral composition of mango leaves. Proc. Am: Soc. Hortic. Sci., 97: 792-794.
7. Kumar, P. and Pandey, R. M., 1979. Sampling for mineral content in leaves of guava cultivar 'Lucknow—49'. Scientia Hortic., 11: 163-174.
8. Pathak, R. A. and Pandey, R. M. 1976. Sampling for mineral content in leaves of mango cultivar "Dashahari" Scientia Hortic, 5: 255-264.
9. Singh, N. P. and Rajput, C. B. S., 1978. Effect of leaf age, position and fruiting status on guava leaf mineral composition. J. Hortic Sci. 53: 73-74.
10. Wardlaw, I. F. 1968. The control and pattern of movement of carbohydrates in plants. Bot. Rev. 34: 79-105.