



A STUDY ON NUTRIENT REMOVAL BY THE CASHEW TREE

by

A. R. MOHAPATRA, K. VIJAYA KUMAR and N. T. BHAT
*Regional Station, Central Plantation Crops Research
Institute, Vittal.*

It is advantageous to determine the amounts of nutrients removed by a crop plant before undertaking field trials to assess its fertilizer requirements. Such information is more readily available for several annual crops (Tamhane *et al.*, 1964), but is difficult to come by in perennial plants like cashew. At present we are not aware of any such information available on cashew. Hence the present study was taken up.

EXPERIMENTAL

A good yielding cashew tree (about 30 years old) was selected for the study. One year's growth (1971-72) was removed from the tree at the time of flowering and nutrient elements were determined in the vegetative part and inflorescence. Instead of taking this for the whole tree, three samples, drawn randomly from the canopy, were taken using a 60.9 x 60.9 cm wooden frame. The surface area of canopy was measured by the following method.

The canopy surface areas of ten young cashew trees were determined by spreading a piece of cloth. These actual values for canopy area were compared with those obtained by a calculation using mathematical formulae (Francis Raj, 1968). Since the cashew trees are normally somewhat spherical in shape, their canopies were assumed as an upper half of ellipsoid of the type :

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1 \dots\dots\dots I$$

where a, b, and c are the semi-principal axes.

For all practical purposes, this can be assumed as $a = b \neq c$. The plane of the vertical cross section of the canopy was considered as an ellipse of the type :

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \dots\dots\dots II$$

where a and b are the semi-major and semi-minor axes. Surface area is obtained by rotating the ellipse around minor or major axes using two formulae as given under :

$$\text{Surface area} = \frac{1}{2} (2 \pi a^2 + \pi \frac{b^2}{\epsilon} \log_e \frac{1+\epsilon}{1-\epsilon}) \dots\dots\dots III$$

$$\text{Surface area} = \frac{1}{2} (2 \pi b^2 + 2 \pi \frac{ab}{\epsilon} \text{Sin}^{-1} \epsilon) \dots\dots\dots IV$$

Where a = semi-major axis
b = semi-minor axis

$$\text{Eccentricity } \epsilon = \sqrt{1 - \frac{b^2}{a^2}}$$

$\text{Sin}^{-1} \epsilon$ = angle in radians corresponding to ϵ

The areas of cashew canopy, both actual and calculated, obtained by employing formulae III and IV and the average of III and IV are given in Table 1 together with 't' values. For calculating this, diameter of the spread and maximum height of the tree were recorded at four places to arrive at mean height and diameter. The result showed that the mean values for canopy areas obtained by formulae III and IV gave the best estimates of the actual canopy areas as compared to those got from either of the two formulae. Hence, this method was used for estimating the canopy area of yielding cashew tree used in the experiment.

The entire harvest could be collected within a period of six weeks. Fresh weights of apples and nuts obtained at different harvests were added at the end to obtain the total yield for the tree. Jackson's (1967) methods were followed for the estimation of N, P and K in vegetative tissue, kernel, shell and apple. Total uptake of individual elements by the tree was calculated by multiplying per cent composition of vegetative part, apples and kernels with their respective yields.

RESULTS AND CONCLUSION

The data on dry matter of vegetative growth, yields of apple and nut of the tree along with their per cent compositions and values for nutrients removal are given in Table 2. This cashew tree, which yielded in the current year 155 kg of apple and 24 kg of nut contained in the same year's growth of vegetative and reproductive tissues 2.135 kg of N, 0.564 kg of P₂O₅ and 0.949 kg of K₂O. An arbitrary addi-

tional dose corresponding to one-third of these three major nutrients may be provided for the year's growth of stem and roots. We, therefore, estimate that a mature and high yielding cashew tree utilises 2.840 kg of N, 0.752 kg of P₂O₅ and 1.265 kg of K₂O. These values may serve as a basic information for laying out future manurial trials in cashew.

ACKNOWLEDGEMENTS

Thanks are due to Mr K. V. Ahamed Bavappa, Director, Central Plantation Crops Research Institute, Kasaragod and Mr M. C. Nambiar, Project Co-ordinator, All India Co-ordinated Spices and Cashewnut Improvement Projects for their interest and encouragement. We are also grateful to Dr. N. M. Nayar,

Joint Director, Central Plantation Crops Research Institute, Regional Station, Vittal, for going through the manuscript and for his helpful suggestions.

REFERENCES

Francis Raj, M. I. 1968. *Calculus*. 10th edn., 342-343 pp. Saint Joseph's Industrial School Press, Tiruchirapalli-1.

Jackson, M. L. 1967. *Soil Chemical Analysis*. 1st edn., 128, 187-190, 152-153, 333 pp. Prentice-Hall of India Private Limited, New Delhi.

Tamhane, R. V., Motiramani, D. P., Bali, Y. P. and Donahue, R. L. 1964. *Soils and their Chemistry and Fertility in Tropical Asia*. 1st edn, 324-325 pp. Prentice-Hall of India Private Limited, New Delhi.

TABLE I. ACTUAL AND CALCULATED AREAS OF CASHEW CANOPY

Tree No.	Actual area (sq.m)	Area by formula III (sq. m)	Increase or decrease over actual area (%)	Area by formula IV (sq.m)	Increase or decrease over actual area (%)	Mean area by formulae III & IV (sq. m)	Increase or decrease over actual area (%)
1	11.23	15.07	+ 34.19	9.59	- 14.60	12.33	+ 9.80
2	11.27	12.44	+ 10.38	9.07	- 19.50	10.76	- 4.53
3	8.46	8.12	- 4.02	7.51	- 11.23	7.82	- 7.57
4	18.89	18.29	- 3.18	16.15	- 14.50	17.22	- 8.84
5	11.25	12.27	+ 9.07	9.24	- 17.87	10.76	- 4.36
6	6.35	8.90	+ 40.16	6.86	+ 8.03	7.88	+ 24.09
7	6.39	8.53	+ 33.49	6.52	+ 2.03	7.53	+ 17.84
8	7.95	8.98	+ 12.95	7.77	- 2.26	8.38	+ 5.41
9	11.33	11.35	+ 0.18	11.07	- 2.29	11.21	- 1.06
10	10.37	11.77	+ 13.50	9.94	- 4.15	10.86	+ 4.73
't'		2.832*		2.794*		0.088 NS	

* Significant at 5% level of probability ; N. S : not significant.

TABLE 2. YIELD, COMPOSITION AND REMOVAL OF NUTRIENTS BY CASHEW TREE

Plant part	Moisture %	Fresh weight		Oven dry weight		Nutrient composition on oven dry basis			Nutrient removal by the tree		
		(g/wooden square)	(kg/tree)	(g/wooden square)	(kg/tree)	N (%)	P (%)	K (%)	N (kg)	P (kg)	K (kg)
Vegetative part	67.690	459.000	148.330	375.462	121.309	1.233	0.117	0.492	1.009	0.095	0.402
S.E.		±55.650	±17.860			±0.059	±0.004	±0.030			
Apple	61.220			154.900	60.105	0.616	0.085	0.390	0.370	0.051	0.234
Shell						0.343	0.005	0.175			
Kernal						2.793	0.410	0.455			
Nut	0.106*			24.135	24.110*	3.136*	0.415*	0.630*	0.756	0.100	0.152
Total									2.135	0.246 (0.564)	0.788 (0.949)
Confidence limits for N, P ₂ O ₅ and K ₂ O at 95 per cent									1.929-	0.525-	0.820-
									2.341	0.693	1.078

* Expressed on air dry basis. Figures in parenthesis represent oxide form of nutrients.