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LEAF AREA DETERMINATION IN CARDAMOM (*ELETTARIA CARDAMOMUM* MATON)

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ABSTRACT

A rapid and reliable method for leaf area estimation of intact leaves based on linear measurement using appropriate regression analysis in cardamom (*Elettaria cardamomum* Maton) is described. The leaf area factor differed with different cultivars.

INTRODUCTION

Several methods have been described by Miller (1938) for leaf area measurement which include blue printing, photographing, tracing the leaf outline on paper followed by planimeter measurements. These methods are found to be more time consuming and laborious for large scale sampling. The recently developed 'automatic area meter' is considered more suitable for rapid and accurate measurement of leaf area. In the absence of area meter indirect methods are being used by several workers to work out leaf area of crop plants. 'Leaf dry weight method' developed by Watson (1937) for wheat is being used by several investigators for different crops. The 'Disk method' (Watson and Watson, 1953) and the 'Rating method' (Humphries and French, 1963) are commonly used and are reported to be satisfactory for measuring leaf area in a variety of crop plants. 'Planimetry' (Jenkins, 1959) and an 'automatic digital type of apparatus' evolved by Orchard (1961) are also in use. Several 'constraints' have also been derived using linear measurements to work out leaf area in different crops. Montgomery (1911) first successfully used product of length and width multiplied by 0.75 constant to estimate maize leaf area. Choudhary and Patra (1972) in a study on rapid method of determining leaf area in tossa jute showed that leaf area could be estimated from length in all the varieties of jute. Gopalakrishnan and Sasmal (1974) showed that the relationship $y = -0.7291 + 0.6054X$ and $y = xX\ 0.6367$ can be used for varieties of *Corchorous capsularis* L. Attempts were also made for estimation of leaf area in grain sorghum from single leaf measurement (Krishna Murthy et al., 1974). Recently more emphasis is being given on the linear measurements of leaf constants of the product of length and breadth.

MATERIALS AND METHODS

The leaf area constants of four types of cardamom *viz.*, Malabar (Malai prostrate), Malabar (clone 37 prostrate), Mysore (Ceylon erect) and Vazhukka (semi erect) cultivated in the Central Plantation Crops Research Institute, Research Centre, Appangala, is worked out. Thirty leaves from each cultivar of the same age were randomly selected from the standing crop, taking only the photosynthetically active and fully opened mature leaves, eliminating the senescent old leaves, and the young immature i.e., not fully opened leaves in the top from bearing tillers. Thirty leaves from each cultivar of the same age were randomly selected from the standing crop. Leaves were detached and dipped in water for about an hour and later dried on the absorbent herbarium sheets. The extreme linear measurement (length × breadth) were recorded. The sketches of the same leaves were drawn on graph paper. The leaf area determined on graph paper was considered to be the true leaf area 'A'. The leaf area determined by taking the product of linear measurement was termed as apparent leaf area 'Y'. To eliminate the chances of errors in linear measurement, the variable of the apparent leaf area were regressed upon the actual leaf area by using a linear and log linear model.

RESULTS AND DISCUSSION

The test statistics indicated that between the apparent (Y) and actual (A) leaf area there was positively significant correlation in all the four cardamom types studied (Table I). Though the two linear equations fitted are equally efficient in estimating the true leaf area, for the sake of simplicity in calculations, the linear model of the form ($A = a + bY$) is considered as better than the other.

The regression analysis reveals that the several regression lines are different. There is significant difference both in intercept and the slope. Separate product coefficients ($K \times L \times B$) where K denotes constant, L, length of leaf and B, breadth of leaf are to be used, while estimating

Table I. *Regression equations for leaf area estimation*

Types of cardamom	A = a + bY			log A = log a + b log Y		
	Intercept (a)	Slope ± S. E. (b ± sb)	Correlation coefficient (r)	Intercept (a)	Slope ± S. E. (b ± sb)	Correlation coefficient (r)
Malabar (Malai prostrate)	-28.81	0.79 ± 0.04	0.96	-0.31	1.06 ± 0.04	0.98
Malabar (Clone 37 prostrate)	- 6.61	0.70 ± 0.03	0.97	-0.16	1.00 ± 0.05	0.96
Mysore (Ceylon erect)	-46.76	0.77 ± 0.03	0.98	-0.45	1.11 ± 0.03	0.98
Vazhukka (semi-erect)	-19.23	0.74 ± 0.02	0.98	-0.19	1.02 ± 0.03	0.99

A = True leaf area (cms.) determined on graph paper
Y = Extreme linear measurements of leaf (Maximum leaf length × Maximum leaf breadth)

leaf area of different varieties. After working out the leaf area using the constant multiplier, necessary corrections for intercept are to be made.

The method has limitations with regard to two aspects. The co-efficients obtained have not been tested for its precision from their samples and secondly the factor may not be used for leaves selected from specified portions, as the coefficients have been obtained from composite samples.

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