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ESTIMATION OF BIOMASS IN *HEVEA* CLONES BY REGRESSION METHOD : RELATION BETWEEN GIRTH AND BIOMASS

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Chaudhuri, D., Vinod, K.K., Potty, S.N., Sethuraj, M.R., Pothen, J. and Reddy, Y.A.N. (1995). Estimation of biomass in *Hevea* clones by regression method : Relation between girth and biomass. *Indian Journal of Natural Rubber Research.*, 8(2) : 113-116.

The relationship between girth and the above ground biomass was studied in two clones, with varied growth habits, of *Hevea brasiliensis*. The clones chosen were RRIM 600 and RRII 118. A set of relationships were developed using the boimass as a power function of girth for different age groups from first year after planting upto fifth year. The regression equations were found non-significant for individual clones as well as for years from second year onwards. A general equation was thus developed and is given as biomass in g(W) = 2.278479 $X^{2.2683}$ (where, X is the girth at 15 cm height from bud union). The relation is found to be good fit from 16 cm or more girth, and is location specific.

Key words : *Hevea brasiliensis*, Girth, Biomass, Regression model.

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INTRODUCTION

In rubber cultivation, girth as well as girth increment have been recognised as important parameters of growth especially during juvenile period. Girth is the only criterion for opening the trees for tapping. Regression equations for girth and biomass of *Hevea* trees have already been established (Shorrocks *et al.*, 1965; Mo and Liang, 1980; Hu and Wu, 1983). The commonly used regression model developed by Shorrocks *et al.* (1965) in Malaysia may not be appropriate in predicting biomass under the varied cultural as well as environmental conditions existing in the non traditional rubber growing tracts of India (Sethuraj *et al.*, 1991).

Since girth is a simple measure of growth of the tree and its correlation with the above ground biomass of the tree is highly significant, it can very well be used in growth analysis of young *Hevea* trees. In the present study, the relationship between girth and biomass of juvenile *Hevea* trees belonging to two clones was established at a non traditional rubber growing region of India.

MATERIALS AND METHODS

The experiment was laid out during 1987 at the Regional Research Farm of the Rubber Research Institute of India at Taranagar (Location : 23° 53'n; 91° 15'E; 30 m MSL; Soil type: Sandy clay loam) in Tripura. The planting materials were budded stumps of clones RRIM 600 and RRII 118 planted in separate plots with spacings of 2.5 m x 2.5m (for the first and second year), 3m x 3m (for destructive sampling in the third year) and 5m x 5m (for fourth and fifth year sampling). Normal' cultural practices were followed throughout the study.

The destructive samplings were done on individual plot basis at the end of every twelfth month. The girth at 15 cm height from the bud union of individual plants were recorded along with the fresh weights of shoots and leaves separately. A known weight of leaf and shoot samples were taken from individual plants and oven dried at 75 to 80°C to a constant mass. The total above ground biomass of individual trees was estimated from the relationship of fresh weight to the dry weight.

A curvilinear model was fitted using the power regression procedures for establishing the relation between girth and biomass with improved precision (Gomez and Gomez, 1984). The regression equations were worked out for individual clones in every year and also by pooling data for all the years. The equations were also fitted for individual years by pooling clones and a general equation by pooling clones as well as years. The closeness of individual relationships were worked out statistically.

RESULTS AND DISCUSSION

The fitted curves are found to have highly significant coefficients of determination (R^2) proving that biomass is a power

Table 1. **Power regression equations relating girth (X) and above ground biomass (W)**

Clone	Year	No. of trees	Fitted equation	Coefficent of determination*	Significance
Relation for clones	(individual year)				
RRIM 600	1988	18	$W = 12.419\ X^{1.374}$	0.866	a
	1989	11	$W = 1.713\ X^{2.664}$	0.830	b
	1990	14	$W = 0.792\ X^{3.322}$	0.891	b
	1991	14	$W = 0.921\ X^{2.951}$	0.971	b
	1992	12	$W = 1.161\ X^{2.860}$	0.945	b
RRII 118	1988	15	$W = 9.277\ X^{1.792}$	0.701	a
	1989	10	$W = 2.425\ X^{2.572}$	0.845	ab
	1990	10	$W = 0.720\ X^{3.264}$	0.711	ab
	1991	15	$W = 0.212\ X^{2.430}$	0.968	b
	1992	12	$W = 0.217\ X^{3.340}$	0.919	b
Relation for clones (years pooled)					
RRIM 600		51	$W = 2.216\ X^{2.672}$	0.980	b
RRIM 118		47	$W = 2.284\ X^{2.672}$	0.980	a
Relation for years (clones pooled)					
	1988	28	$W = 13.763\ X^{1.369}$	0.688	a
	1989	21	$W = 1.518\ X^{2.765}$	0.846	**b
	1990	24	$W = 0.037\ X^{2.743}$	0.704	b
	1991	29	$W = 0.525\ X^{3.133}$	0.962	b
	1992	24	$W = 0.656\ X^{3.024}$	0.923	b
General equation (Years and clones pooled)		98	$W = 2.278\ X^{2.682}$	0.976	b

* Significant at 1% level

** The homogeneity of veriances of regression equations followed by soame alphabet is not significantly different function of girth (Table 1). The fitted equations can be used for precise estimation of biomass from the girth data. Testing the homogeneity of the regression equations showed that the fitted curves are non-significant except for the first year in both the clones. The relationship derived for individual clones are also found non-significant, indicating that a common regression equation can be applied efficiently in estimating biomass from the juvenile girth data from second year onwards irrespective of the clones. The following general equation is derived by pooling data of both the clones from second to fifth year.

$$W = 2.278479\ X^{2.6823} \quad \ldots\ldots\ldots\ldots (1)$$

where, W is the above ground biomass on dry weight basis (g) and X is the girth (cm) at 15 cm from bud union.

To test the efficiency of the common regression model, the biomass was estimated for known girth groups and the deviation of the estimated and observed values were determined. The percentage bias is given in Table 2. It was found that the bias varied from 18 per cent to 50 per cent for the girth groups below 16 cm which may be due to small plants which are generally unbranched. However, the estimated values fitted well with the observed beyond 16 cm girth, indicating that the use of general equation is safe at this level. The present relationship varied from the general equation derived by Shorrocks *et al.*, (1965), when compared graphically (Fig. 1) which suggests that the relationship deviate depending on the environmental and agronomic factors (Mo and Liang, 1980).

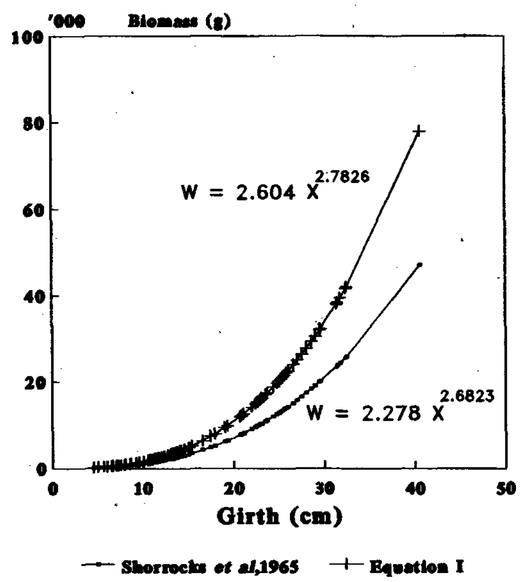

Fig. 1. Comparison of the fitted power relation between girth and biomass with the relation developed by Shorrocks *et al.* (1965)

Table 2. **Efficiency of the general equation**

Girth class (cm)	Mean girth (cm)	Mean biomass (g)	Estimated biomass (g)	Bias estimated (%)
04.0-08.0	6.82	319.75	392.37	18.51
08.1-12.0	10.58	1919.94	1274.04	50.70
12.1-16.0	13.65	3362.07	2524.23	33.19
16.1-20.0	18.02	5150.40	5320.55	3.20
20.1-24.0	22.28	8660.81	9402.35	7.89
24.1-28.0	25.60	12887.07	13644.79	5.55
28.1-32.0	30.40	20471.00	21635.00	5.38

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