

In terms of practical implications, the results illustrate the value of an alkaline potting medium (pH 7.8 - 8.1) to produce good cuttings of pepper. Thus in preparing potting media, the addition of dolomite is considered a suitable cultural operation. The quantity of dolomite will however depend on the initial pH value of the potting medium. This ensures good pepper cuttings with well developed root and

shoot systems and thereby better establishment in the field.

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Faculty of Agriculture, University of Peradeniya
Peradeniya, Sri Lanka

U. R. SANGAKKARA

Biomass Estimation of Cocoa Plant by Regression Analysis*

Growth correlations have been scarcely studied among tree crops. This is mainly due to logistic difficulties in periodic sampling for deriving growth analysis parameters from trees. Regression equations are derived from the data of destructive sampling of cocoa plants and is presented in this paper.

The cocoa (*Theobroma cacao* Linn. Var. *Foresteri*) plants obtained from a

single tree was planted under the shade of arecanut palms (18 year old) in 1982. The spacing for both species was 2.7×2.7 m. Each plant was fertilized annually with 100 g N : 40 g P_2O_5 : 140 g K_2O . The plots were irrigated once in a fortnight during dry periods of the year.

Periodic destructive sampling was carried out. The sample size was 10 plants initially which was reduced to 5

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plants (after 40 months). The root removal was difficult at later stages and complete removal was not possible, resulting in under-estimation. No correction was applied as there is no information on this, but around 30% loss is expected. The component parts were separated for dry matter estimations. Leaf areas were calculated from 10 representative leaves of each tree using linear measurements (Reynolds, 1971). Canopy area was computed from height and radius measurements assuming it to be in the shape of a cone (formula: $\pi r \sqrt{r^2+h^2}$). Multiple regression analysis was carried out.

The correlation matrix of the growth parameters is given in Table I. Highly significant correlations between canopy, stem girth, leaf area and dry weight of plant parts were found. It is thus possible to estimate the total biomass by using independent characters *viz.*, canopy, stem girth and height using regression equations (Table II). The equations are applicable for values in the following range: Canopy $11.86 \text{ m}^2 \pm 9.27$, girth $24.69 \text{ cm} \pm 9.61$ and height $1.51 \text{ m} \pm 0.32$ (values are mean \pm S.D.). Indirect methods for estimating biomass using regression equations have been

Table I. *Correlation matrix for plant characters of cocoa*

Character	2	3	4	5	6	7	8	9	10
Canopy	.90	.24	.88	.78	.93	.87	.93	.93	.94
Stem girth		.24	.84	.70	.93	.86	.92	.92	.91
Stem height			.24	.16	.35	.37	.29	.35	.34
Leaf area				.67	.80	.74	.79	.81	.80
Pod dry weight					.73	.69	.72	.76	.77
Stem dry weight						.97	.96	.99	.99
Leaf dry weight							.89	.98	.97
Root dry weight								.95	.95
Shoot dry weight									.99
Total dry weight									—

Table II. *Regression equations to estimate leaf area and biomass of cocoa plants*

Character	Regression equation	R ²	F
Leaf area	$Y_1 = -15.72 + 2.71 \times_1 + 1.89 \times_2 + 3.53 \times_3$	0.79	38.7**
Stem dry weight	$Y_2 = -5.28 + 0.23 \times_1 + 0.18 \times_2 + 1.56 \times_3$	0.93	132.9**
Leaf dry weight	$Y_3 = -2.40 + 0.09 \times_1 + 0.07 \times_2 + 0.93 \times_3$	0.82	47.1**
Root dry weight	$Y_4 = -0.69 + 0.03 \times_1 + 0.03 \times_2 + 0.13 \times_3$	0.91	101.9**
Shoot dry weight	$Y_5 = -7.68 + 0.38 \times_1 + 0.25 \times_2 + 2.39 \times_3$	0.92	118.1**
Total dry weight	$Y_6 = -8.41 + 0.47 \times_1 + 0.26 \times_2 + 2.69 \times_3$	0.92	116.9**

where \times_1 = canopy area, \times_2 = stem girth and \times_3 = stem height

developed for forest species (Karizumi, 1968; Negi and Sharma, 1987) and coconut (Ramadasan et al. 1985). As canopy area, stem girth and height are highly correlated with biomass, it is easier to use these characters for estimating annual relative production rate instead of classical relative growth rate (Brand, Weetman and Rehler, 1982) or for deriving biomass of cocoa trees.

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Central Plantation Crops Research Institute
Regional Station, Vittal 574 243
Karnataka, India

D. BALASIMHA
B. P. NAIR

Fungicidal Control of Blister Blight of Tea in Kangra Valley in Himachal Pradesh

Blister blight of tea (*Camellia sinensis* (L.) O. Kuntze), caused by *Exobasidium vexans* Masee, is an important leaf disease in the principal tea growing countries. The fungus infects young succulent shoots, affecting the yield. Young nursery plants may die as stems snap off at infection points. The crop loss in unprotected areas is enormous, amounting to 50% of the total annual crop (Venkata Ram, 1968).

The effective control of blister blight is achieved by fungicide spray during active infection phase. Among several fungicides screened for blister blight control, copper formulations containing oxides or oxychlorides of 50% metallic copper, nickel chloride, Sicarol 15% dispersion (2-methyl-5, 6-dihydro-4H-pyran-3 carboxylic acid anilide) and Calixin (N-tridecyl-2, 6-dimethyl-morpholine) are reported