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Estimation of fibre yield in Ramie [*Boehmeria nivea* (L.) Gaud.] through regression equation based on simple biometric observation

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ABSTRACT

Prediction of fibre yield in ramie [*Boehmeria nivea* (L.) Gaud.] is absolutely necessary for well ahead planning of marketing arrangements between the actual grower and the textile mills who are situated geographically in distant locations in India. The regression equation for Ist cutting is Y = 0.0261 X, for 2nd cutting is Y = 0.0297 X, for 3rd cutting is Y = 0.0300 X and for 4th cutting is Y = 0.0270 X. The coefficient of determination (R^2) values for the regression equations were ranged between 0.9186 and 0.8276 and at the same time the predicted values were very close to the actual yield. Therefore, the developed regression equations can predict the fibre yield in Indian ramie cultivar (R 1411) with acceptable accuracy.

Keywords: ***Yield estimation, Total green weight, Regression equation, Ramie (R 1411).***

INTRODUCTION

Exceptionally white, lustrous and very fine textile fibre is obtained from ramie [*Boehmeria nivea* (L.) Gaud.] which has tremendous scope to become a leading textile fibre in India if its supply is assured through extensive cultivation in the north-eastern states of India (Sarkar and Maitra, 2001). Restricted amount of work had been done for fibre yield prediction on physiological basis in Indian ramie cultivar. Non-availability of methodology for yield prediction or estimation before the completion of actual procedure of harvesting, decortication (mechanical method of fibre extraction) and other on farm processes in this crop hindrance future planning of marketing arrangements. The reason behind such embarrassing position of the grower as well as the textile mills is the geographical isolation of growing areas and the location of the textile mills which are generally far away from the north-eastern states. So to overcome the difficulty and to get an idea well ahead about the probable quantum of harvest in terms of fibre, an experiment was designed for estimation of fibre yield.

MATERIALS AND METHODS

A field study was conducted for 4 years during 1997-2000 at Ramie Research Station (26.5°N, 91°E) of CRIJAF (ICAR), sorbhog Assam to develop a method for estimation

of probable fibre yield before the completion of actual harvesting processes. A field was divided in to 27 plots measuring 6m x 4m each and freshly cut rhizome pieces (15 cm length) of ramie (cv R 1411) were planted in May 1997 by following standard agronomical procedures. After sprouting there were few gaps in the plots (due to germination failure which is usual in ramie) and as per practice gap filling was done in the month of June. Therefore, in July the unequal above ground growth was removed through the 'staging' procedure to get a subsequent equal growth. Being a perennial crop once planted ramie can give economic return for 4-5 years under Indian condition. So, in our study the crop was grown for 4 years and during this period total 13 cuttings were obtained of which 2, 4, 4 and 3 cuttings were from 1st, 2nd, 3rd and 4th year respectively. Biometrical data pertaining to the total green weight (above ground portion consists of canes and leaves) of $1m^2$ area was taken just prior to harvest in each cutting in all 27 plots for development of linear regression equation for yield prediction. The remaining portion of the plantation after $1m^2$ sample harvests in each plot was kept for general harvest and the data of total green weight and dry fibre yield were used to judge the validity of the developed regression equation. The hervested canes from $1m^2$ sample area then processed in raspadore decorticator, repeatedly washed in clean water for removal of pectinaceous gummy material and then sun dried for 5 days. The weight of the sun dried fibre was recorded and the data of dry fibre yield was used for developing the regression equations. In this total process of harvesting and decortication, on an average 10 days was spent. The data from the total 13 cutting were grouped as indicated in Table 1.

Table 1. **Cutting-wise grouping of collected data from thirteen cuttings over four years.**

Ist Cutting (May-June)	2nd Cutting (July-August)	3rd Cutting (Sept.-Oct.)	4th Cutting (Nov.-Dec.)
-	-	1997	1997
1998	1998	1998	1998
1999	1999	1999	1999
2000	2000	2000	-

Therefore, for arriving the regression equation for yield estimation of Ist cutting total 81 sets (3 years x 27 plots), for 2nd cutting total 81 sets, for 3rd cutting total 108 sets and for 4th cutting total 81 sets of data of total green weights (X, the independent variable) and dry fibre yield (Y, the variable to be predicted or estimated) were used. The dry fibre was estimated by the use of a linear regression equation $Y = k.X$, where 'k' is a constant for each equation. This equation is a modified form of $Y = a + b.X$, as, if the value of $X = 0$, then $Y = a$ ($0 < a > 0$, and $a \neq 0$), which is not true because no fibre yield can be obtained if there is green matter equal to zero. To accept the developed equation as a true predictor with sufficient accuracy, the coefficient of determination (R^2), the ratio of the sum of squares due to regression and the total sum of squares had been considered. If the R^2 value is sufficiently high, then only the regression equation was considered for the estimation (Abraham and

Ledolter, 1983) and at the same time the predicted fibre yield was compared with that of the actual fibre yield to judge the fitness of the regression equation.

RESULTS AND DISCUSSION

Four linear regression equations one each for estimation of fibre yield of Ist cutting (May-June), 2nd cutting (July-August), 3rd cutting (September-October) and 4th cutting (November-December) were developed (Table 2).

Table 2. **Regression equations for estimation of fibre yield in ramie.**

Cutting Number	Regression Equation	Co - efficient of Determination (R^2)
Ist Cutting	Y = 0.0261 X	0.9186
2nd Cutting	Y = 0.0297 X	0.8276
3rd Cutting	Y = 0.0300 X	0.8777
4$_{th}$ Cutting	Y = 0.0270 X	0.8657

The first regression equation, Y = 0.0261 X for estimation of dry fibre yield from first cutting (in the months of May-June) showed the co-efficient of determination value (R^2 = 0.9186) sufficiently high (> 0.80). So this equation has fibre yield predictability of acceptable accuracy. Similarly, the regression equation for 2nd cutting (Y = 0.0297 X), 3rd cutting (Y = 0.0300 X) and 4th cutting (Y = 0.0270 X) having coefficient of determination values of 0.8276, 0.8777 and 0.8657 respectively, can predict the fibre yield of the respective cuttings of ramie with minimum deviation from the actual. The regression equations considering total green weight as the independent variable (X) accounted for 91.86 to 82.76 % of variance in the predicted dependable variable Y (dry fibre yield).

The high values of prediction (R^2 = 0.9186 to 0.8276 $\approx$1.00) mathematically proved acceptance of the concerned regression equations for quantifying the dependent variable (Lewis and Michael, 1993). Prediction of fibre yield in Chinese ramie cultivars was developed (Xiong *et al.*,1992 & 1998) and they found that biometrical parameters contributing the total weight of ramie plant were directly correlated with the fibre yield and the prediction method achieved as high as 97 % accuracy. It may be concluded that the regression equations developed in this experiment for prediction of fibre yield in ramie are valid and can very well be used for yield estimation from the simple biometric observation i.e. total green biomass in Indian ramie cultivar, R 1411.

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