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# Developing regression models to estimate leaf area of split/ partially split fronds of coconut seedlings

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Leaf area (LA) is an important parameter measuring plant growth as it is highly responsive to the environment. Evaluation of leaf area is essential in plant research as it also helps in estimating plant productivity with net assimilation rate and total photosynthetic area of leaves. Coconut is a major plantation crop widely grown in Sri Lanka. To date, there is no non-destructive method of measuring leaf area of partially/fully split leaves of coconut seedlings. This is a drawback in coconut research as measuring LA is highly time consuming in the field. Therefore, the aim of this study was to determine an easy, accurate, cost-effective, and non-destructive formula to estimate leaf area of split/partially split leaves in 1 - 3 years old seedlings of three commonly grown coconut hybrids; Tall*Tall (TT), Dwarf Green*Tall (DT), and Dwarf Yellow*Tall (DY). Sixty leaf samples were randomly collected from each hybrid from the nurseries of Coconut Research Institute of Sri Lanka. Leaf parameters including maximum length (A), distance between two tips (B), midrib height (C), average length of first two leaflets (D), average length of last two leaflets (E), average length of middle three leaflets (F), average width of middle three leaflets (G), width between middle two leaflets (H), width between first two leaflets (I), and number of leaflets ((J) were collected from each frond. Actual leaf area was measured by LI-COR 3000 electronic leaf area meter. Linear polynomial model and multiple linear regression (MLR) analysis was used to define leaf area estimation models using different variable selection techniques such as the best subset method. Data were normalized (for TT and DY) and log-transformed (for DT) to satisfy the model assumptions. The lowest MSE and the highest $R^2$ values were considered to evaluate the results of the polynomial model and MLR approach. Models with better combinations of variables were developed for both TT and DY varieties by the best subset method. The polynomial model was carried out with the product of F, G, and H variables as an independent variable for DY variety as it did not produce satisfactory results with MLR analysis. Accordingly, the study revealed that the leaf area of Tall*Tall variety was best represented by the equation, Area (TT) = 0.46* (A) - 0.23*(E) + 0.54*(G) with 86% $R^2$ and 0.15 MSE. The best regression model for DY variety acted for; Area (DY) = -0.96 + 1.09*(A) – 0.59*(E) + 0.14*(B) + 1.22*(G) + 0.72*(F). This model had 94.3% $R^2$ as accuracy and 0.01 MSE. The adjustment with product of F, G and J represented 80.63% $R^2$ value, and 0.006 MSE for leaf area of DT hybrid. The model was ln (area) = 2.10 + 0.52*(ln (FGJ)). Neural network approaches with the same parameters will be evaluated to further improve the accuracy of the formula estimating leaf area.

**Keywords:** Dwarf Green*Tall, Dwarf Yellow*Tall, Leaf area, Regression model, Tall*Tall