Construction of a growth model to predict the individual stem volume of *Tectona grandis* L.f. (Teak) in Sri Lanka

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Stem volume is one of the most important variables in commercial forestry since all the management decisions are taken on the volume production of trees. Also volume is the most difficult variable to measure and therefore it has to be predicted using a reliable method. Therefore, a growth model was newly constructed in this study to predict the individual stem volume of teak (*Tectona grandis* L.f.) planted as even-aged monocultures in Sri Lanka.

In order to construct the model, data were collected from 11 plantations in dry zone (Anuradhapura, Hambatota and Puttlam Forest Divisions) and intermediate zone (Kurunegala Forest Division). The selected plantations vary in age from 27 to 44 years. Stratified random sampling was used to collect the data with 0.02 ha circular sample plots. It was decided to use the Newton's formula for volume calculations and for this reason, the standing tree stems were divided into 3-5 sections and end diameters, mid diameter and length of each section were measured. The final section was assumed as a cone. The stem volume was then calculated by adding all the section volumes together. In addition to that, breast height diameter, total height and crown height were also measured. Using those data, tree volume, basal area and top height were calculated which were necessary for the analysis.

A theoretical model was developed to predict the individual tree volume using the relationship of tree volume with form factor, basal area and total height. Three site factors and four transformations which are biologically accepted were used to enhance the quality of the models. When tested for the site differences using top height/age index, five classes were identified from the 11 plantations. At the first stage of analysis, the data of each site class were fitted separately to the basic model structures. As a result, eight common models were identified for all five site classes with R^2 over 91.0 and good standard residual distributions. However, the regression parameters were different for different site classes even for the same model structure.

In order to eliminate the difficulty of using different parameter sets for different site classes, data collected from all plantations were pooled and fitted at the second stage to the selected eight models and new parameter sets were estimated. Then the normal residuals were calculated separately for five site classes using those models and tested using one way ANOVA. Only one model indicated the non-significant residuals for all site types, i.e., $v^{1/2} = 0.5730$ (*basal area * total height*)$^{1/2}$ + 0.0235 [1/ (*top height / age*)]. That model indicated negligible bias (-0.002) and very high modelling efficiency (0.91). When validated with the reserved data which were not used for model building, it indicated a good distribution of normal residuals. Finally it was concluded that the selected model proved its ability of predicting the unbiased volume of individual teak stems of all site classes in Sri Lanka and therefore it is recommended to use in the field.

Estimation of change of taper with age for *Tectona grandis* L. f. (Teak)

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Taper is the change of diameter over a specified length along the tree stem, which varies not only by species and site type, but also by diameter at breast height (dbh), height and other tree growth parameters. Taper is important for the foresters to estimate the upper stem diameters especially in volume calculations.