Modelling Canopy Development of the Fourth Plantation Crop in Sri Lanka

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Gliricidia sepium (Jacq.) Walp. is a leguminous Multi-Purpose Tree (MPT), and is the fourth plantation crop in Sri Lanka. Also it ranks as the second highest consumed leguminous tree in the world. But insufficient quantitative information on eco-physiological response to various climatic conditions has resulted in poor decision making for energy plantation management of farming systems. Quantification of the canopy development and thereby dry matter production by means of a crop model is the only reliable tool to quantify the complex processes involved with physiology and environmental interaction of a crop. Hence, the present study is focused on modelling the leaf area increment and shoot extension (canopy development) in *G. sepium*. The study followed 3 main steps as (1) Model development, (2) Model calibration and (3) Model Validation. The model consists of different sub-modules that deal specifically with weather and crop. The weather module calculates the thermal time for developmental processes of the crop using weather data and cardinal temperatures. The main time step is one day and uses a daily input of weather data, and is designed to simulate canopy development of the crop. The parameters and relationships needed to build the functions in the model were derived from calibration and validation field experiments conducted at the farm, Faculty of Agricultural Sciences, Sabaragamuwa University of Sri Lanka. The canopy development model was calibrated using experimental data for leaf area (LA) and shoot length (SL). The calibration results reported that, the simulated LA correlated well with measured values with model efficiency measure (N-S) of 0.96 and mean absolute error (MAE) of 7.8 cm^2. Similarly, simulated SL correlated well with measured values with N-S, 0.97 and MAE, 1.07 cm. The model validation with independent field data from the shade trees of tea land for LA showed satisfactory model performance with N-S, 0.78; MAE, 12.7 cm^2. The developed model will be useful to predict the LA and thereby Leaf Area Index (LAI) which is essential to calculate dry matter Production for the energy plantations in Sri Lanka.

Keywords: Crop simulation, *Gliricidia*, canopy development, thermal time, cardinal temperatures, modelling

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