Estimating total and browsed leaf area of fodder trees using a photographic gap fraction method

Stéphanie Mahieu, Sophie Dupuy, Ela Frak, Eric Roy, Didier Combes, Sandra Novak, Jean Claude Emile

L19.P.15

Estimating total and browsed leaf area of fodder trees using a photographic gap fraction method

Mahieu S.[1] (stephanie.mahieu@inra.fr), Dupuy S.[1], Frak E.[2], Roy E.[2], Combes D.[2], Novak S.[1], Emile J.-C.[1]

[1] *FERlus, INRA, 86600 Lusignan, France*; [2] *UR4, URP3F, INRA, 86600 Lusignan, France*

The software Tree Analyser (TA) was developed to estimate total leaf area of isolated trees from digital photography (Phattaralerphong and Sinoquet, 2005). Estimations are based on gap fraction inversion. Our objective was to test and adapt this method to estimate total and browsed leaf area of three tree species grown in an agroforestry system for livestock feeding. Experiment was conducted on common ash, white mulberry and italian alder 4 years old. Two branches were collected on 4 trees per species in June and August. Photographs were implemented on branches and trees. The method was tested by comparison with direct estimation of leaf area using the image processing software ImageJ. In parallel branches and leaves were measured, weighted and counted to establish allometric relationships. Reliable allometric relationships were obtained between the leaf area and the total length of shoot axes (r^2>0.9) and the leaves dry and fresh weight (r^2>0.9) and between the total length of shoot axes and the number of leaves (r^2>0.9) for all species. Estimated leaf area with TA was sensitive to the camera calibration, picture discretization, individual leaf size and leaf inclination distribution. Reliable estimations of leaf area using TA were obtained on branches for italian alder (r^2=0.69), common ash (r^2=0.96) and white mulberry (r^2=0.79). The average error in estimating a difference from the analysis of tree crown pictures taken before and after removal of branches were 24%, 86% and 73% for italian alder, common ash and white mulberry, respectively. The method allows fast and non-destructive monitoring of leaf area of trees grown in an agroforestry system. Taking into account the potential to improve accuracy of measurements TA is a promising tool to study the browsing of fodder trees by ruminants.

Keywords: Tree Analyser software, leaf area, allometric relationships, fodder trees.

References:

1. Phattaralerphong J., Sinoquet H. (2005). Tree Physiology 25: 1229–1242.