

Workshop : Forecasting crop yields from data, models and expert knowledge.

Forecasting crop yields for perennials in the tropics: looking for an innovative multiscale methodology

Eric Malézieux^{1,2}, Aina Rabodomanantsoa^{1,2,3}, Julien Sarron^{1,2,4}, Emile Faye^{1,2,4}

¹CIRAD, UPR HortSys, F- 34398 Montpellier, France

²HORTSYS, Univ Montpellier, CIRAD, Montpellier, France.

³Centre Technique Horticole de Tamatave (CTHT), Madagascar ;

⁴Centre de Développement Horticole, CDH, ISRA, Sénégal

For most crops, yields are strategic and key information for both growers and stakeholders of the value chains involved in market supply and exports. In developing countries, information on yields and losses is barely available nor existing, making it difficult to improve the efficiency of the production process and value chain. Information is particularly scarce for fruit tree production by smallholders even in important high value exportation chains towards Europe such as lychee or mango. Our objective was to set up a global methodology to forecast fruit tree production at a regional scale. Our methodology contains an integrative toolbox adapted to different crop species, value chains and local conditions. This innovative methodology includes the following steps : i) to estimate the production of individual trees (i.e. the number of fruits and fruits weight), using structural tree characteristics (i.e. the basal trunk diameter, the diameter breast height, the canopy diameter, the canopy height), and phenological characteristics (i.e. the load charge rate), ii) to estimate fruit production at the orchard scale, based on tree structure and average load charge. At this step, we developed tools to characterize tree height and species, crown area and volume using unmanned aerial vehicle (UAV) photogrammetry and geographic object-based image analysis, iii) to estimate fruit production at a regional scale. This third step includes orchard mapping with remote sensing technology and expert knowledge for orchard cropping systems classification.

The global methodology was set up, adapted and performed at a regional scale in Madagascar and Sénégal for lychee and mango production respectively, giving new perspectives for finer forecasting of crop yields for perennials in the tropical value chains that include numerous smallholders.

Keywords : mango, lychee, Sénégal, Madagascar, yield estimates, forecasting, value chain