

Title How to predict the harvest date of tropical fruit: from simple methods to complex models
Author M. Lechaudel, G. Damour, P. Fournier, J. Joas and M. Jahiel
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Abstract

Predicting the harvest date is important for growers to manage farm systems, and for the other stakeholders involved in the agro-food production chain, such as exporters and distributors, to ensure regular market supply and the quality of fresh and processed products. Since a large part of the production of tropical fruit, such as litchi, pineapple and mango, supply export and processing markets, these supply chains need a well-organised to remain competitive. We present simple to complex models predicting the harvest dates for litchi, pineapple and mango fruit. Firstly, thermal time models are proposed to predict the development of litchi and pineapple fruits. These models are based on accumulation of daily mean temperatures above a threshold temperature, θ , during fruit development. For litchi, θ was estimated as a parameter of the fruit growth curve. For pineapple, θ was estimated by minimising the discrepancies between the model and data related to the flowering-to-harvest time collected in fields at different elevations and with different planting densities. We showed that the planting density influences fruit growth rate. We then introduced this effect into the thermal time model. Finally, a global model of mango functioning was built to predict changes in fruit fresh mass and in flesh composition during fruit growth. This model integrated the effects of environmental and biological factors (i.e., light environment, temperature, leaf-to-fruit ratio) on the main physiological processes involved in fruit development, such as the accumulation of water and dry matter. This complex model established at the branch level and then scaled up to the tree level was able to predict the distribution of harvest dates of trees in an orchard. These models are discussed with a special emphasis on their limits and their practical uses to manage fruit quality and to plan harvest and marketing.