Wind safety of rubber trees in plantations: comparison of the resistance to breakage of two clones

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Abstract

Rubber trees (Hevea brasiliensis) are grown on about 15 million hectares of plantations in tropical plantations, producing 13 million tons of rubber per year of industry (IRSG statistics 2020). However, during their economic life on the plantation, rubber trees appear to be very susceptible to wind damages in general and trunk breakage in particular. The main hypothesis is that bleeding could affect the capacity of the tree to increase its trunk diameter and thus, its mechanical rigidity. According to reports from growers and breeders, there is inter-clonal variability in the susceptibility of trees to breakage. This suggests the possibility to select rubber tree clones that would be less susceptible to wind breakage. Biomechanical analysis of the risk of tree breakage involves i) morphological and geometrical parameters, linked to the tree's architecture (size of the crown, tapering of the trunk, etc.); ii) the mechanical properties of the wood formed in the trunk, particularly its elastic modulus and resistance to breakage. Here, we focus on two rubber tree clones well-known to show contrasted sensitivity to wind breakage; one being considered as "weak" and the other as "resistant". Standing tree bending tests were carried out to the trunk breaking point in two plantation plots (Ivory Coast) to assess the resistance to breakage of each clone. Figure 1 shows the principle of a standing tree bending test and Figure 2 shows an example of a fracture surface. The results obtained during a field tests campaign in 2022 will be presented and discussed.

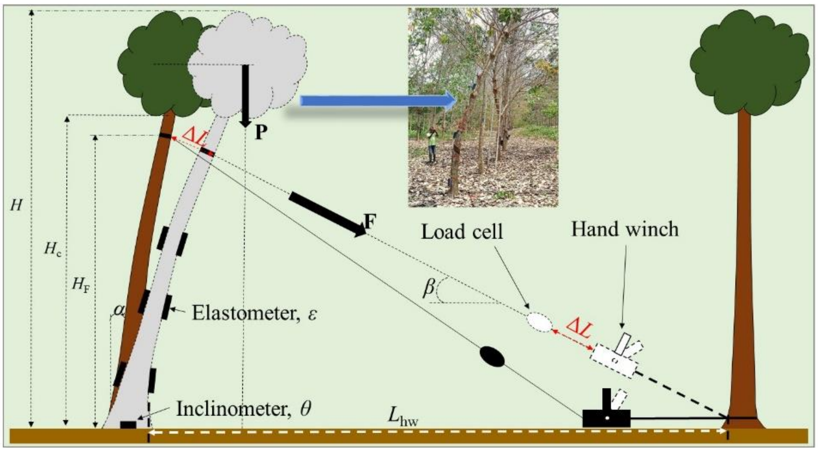

Figure 1: Principle of a trunk-bending test. H: total tree height; H_c: crown-base height; H_F: height of cable attachment to the tree; α: initial inclination of tree base; β: cable angle; L_{hw}: distance from tree base to cable anchorage; ε: surface deformation; θ: inclination of root-ground system; **F**: applied force; **P**: crown weight; ΔL cable shortening.

Figure 2: Trunk breakage of a 6-year-old rubber tree after bending test.