



Trees feel mechanical strain: from genes expression to cambium activity modulation

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Mechanical signals are important factors that control plants growth and development. External mechanical loadings, such as wind, lead to a decrease of primary growth, an increase of secondary growth, modifications of stem mechanical properties and biomass reallocation to roots. Biomechanical studies on tomato and poplar demonstrated that tissue strains are sensed by plants (Coutand and Moulia 2000 ; Coutand, Martin *et al.*, 2009). An integrative biomechanical model (S³m) has been developed. This model supposes that mecanoperception at competent cells scale is proportional to local strain and volume of the considered tissue (Moulia *et al.*, 2011).

In nature, mechanical stimuli do not occur as a single bending. In order to understand how plants acclimate to strain induced by wind, we have studied, on young poplars, the effect of successive bending separated at day scale, mimicking the alternation between windy or quiet weather. Our results show, as soon as a second bending was applied, a diminution of the secondary growth rate. Simultaneously, molecular responses to subsequent bending were observed. Trees acclimated rapidly to mechanical loadings and a desensitization period of a few days occurred after a single transitory bending (Martin *et al.*, 2010).

Stem anatomical observations showed that, in response to bending, cambium activity was locally impacted by the strain. The secondary growth rate was identically stimulated according to the strain level both in the stretched part and in the compressed part of the stem. However, wood differentiation appeared to be modulated according to the sign of mechanical loading (tension or compression).