Mechanical properties of “Flexure Wood”
Benjamin Niez, Jana Dlouha, Evelyne Toussaint, Joseph Gril, Bruno Moulia, Eric Badel

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Wood: a complex material resulting from tree acclimation to growing conditions

Our objective is to determine the impact of these growing conditions on the mechanical properties of wood.

Wood ensuring the mechanical stability of the trunk and branches. Its formation is impacted by windy environments: living cells sense mechanical strains and modify the formation of wood accordingly in terms of quantity and quality: these biological responses are called “Thigmomorphogenesis”.

We bent young poplars three times a day, five days per week during six months. When a stem is bent, wood endures compressive and/or tensile stresses. Our objective is to determine the impact of these growing conditions on the mechanical properties of wood.

Mechanical behaviour of the stem

Main results:
- Bending treatments dramatically enhance the stem bending rigidity (x3.3 for MSa// and x3.56 for MSs//)
- Asymmetrical bending increase the elastic modulus (+32.3% for MSa//)
- Bending treatments increase the MOR (+35.8% for MSa// and +28.8% for MSs//)

=> Mechanical benefit of tree acclimation to bending

Mechanical behaviour of wood tissue

Main results:
- Increase of the basic density of wood formed under compressive stresses MSa-C (+19%) and of “flexure wood” MSs (+22%) compared to control wood C.
- Decrease of specific modulus of wood formed under compressive stresses MSa-C (-20%) and of “flexure wood” MSs (-24%)
- High decrease of damaging for wood formed under compressive stresses MSa-C (-51%) and for “flexure wood” MSs (-36%)
- Increase of mechanical resilience of wood formed under compressive stresses (MSa-C) by +29%

Key message:
- Compressive strains (risky strains for wood) drive the mechanical acclimation of wood to bending treatments
- Wood acclimation to bending provides a mechanical benefit for trees sustainability in fluctuating mechanical environments