



# Drying without dying: do potted saplings of *Fagus sylvatica* design more resistant branches in response to gradual soil drought?

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# Drying without dying: do potted saplings of *Fagus sylvatica* design more resistant branches in response to gradual soil drought?

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## Introduction

Currently, drought year is reported to occur about once every ten years in much of Europe (Rust and Savill 2000). We investigated how the wide spread forest tree *F. sylvatica* will respond to the predicted drier and warmer climate for the coming decades (IPCC 2001). Our goals were to (1) test and interpret sapling response of beech to gradual soil moisture depletion, (2) check whether xylem dysfunction leads to plant mortality, and (3) check whether alive trees adjusted hydraulic features in newly produced shoots after the release from water shortage.

## Material and methods

The experiment was conducted at Crouël, Clermont-Ferrand, France (N 45°77', E 3°14'; altitude of 300 m). We used:



potted beech saplings (153) under greenhouse growth conditions



a TDR, time domain reflectometer for a survey of the soil water status



a pressure bomb to assess xylem water potentials ( $\Psi_x$ )

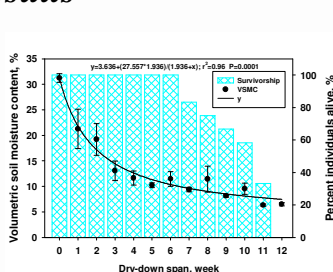


a xylem embolism meter to measure the shoot PLC, percent loss of conductance

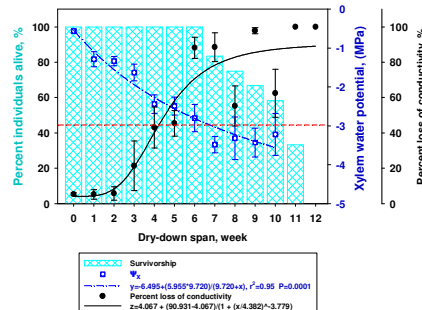


a customized centrifuge 'Cavitron' to assess for shoots the water potential that induced 50% loss of conductance ( $\Psi_{50}$ )

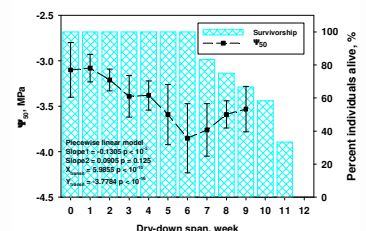
## Results



Relationships between volumetric soil moisture content and survivorship versus dry-down span



Dynamic in volumetric soil moisture content, percent loss of conductivity, xylem water potential and survivorship versus dry-down span



Survivorship and variation in  $\Psi_{50}$  of *Fagus sylvatica* saplings versus dry-down span

We assessed the percent individuals alive budburst (i.e. at the onset of 2009 growing season) and found that beech saplings can withstand more than 2 months without any watering. Xylem water potential decreased steeply over the 6 first weeks and levelled off by week 7 following the water shortage. A progressive decrease in individuals primed when  $\Psi_x$  got lower than -3 MPa. Meanwhile a consistent increase in PLC was observed. A threshold of -3 MPa looked to be critical for the survivorship of the saplings. Along with the severity of the water stress the plants were subjected to during 2008 growing season, the  $\Psi_{50}$  decreased progressively until an inflection point occurred. Our results showed that hydraulic features were critical for beech tree survivorship in extreme drought conditions.

## References

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- Rust, S. and P.S. Savill 2000. The root system of *Fraxinus excelsior* and *Fagus sylvatica* and their competitive relationships. *Forestry*, 73:499-508.

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