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► **To cite this version:**

Shannan Blystone, Guilhem Pagès, Hervé H. Cochard, Pierre Conchon. Measuring tree water content with a portable, unilateral magnet. GERM 2023, Jun 2023, Murol, France. hal-04133617

HAL Id: hal-04133617

<https://hal.inrae.fr/hal-04133617>

Submitted on 20 Jun 2023

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MEASURING TREE WATER CONTENT WITH A PORTABLE, UNILATERAL MAGNET

S. Blystone,^{‡†} G. Pagès,[‡] H. Cochard[†], P. Conchon[†]

[‡]INRAE, UR QuaPA, F-63122 Saint-Genès Champanelle, France

[‡]INRAE, PROBE research infrastructure, AgroResonance facility, F-63122 Saint-Genès-Champanelle, France

[†]Université Clermont Auvergne, INRAE, PIAF, 63000 Clermont-Ferrand, France

E-mail : shannan.blystone@inrae.fr

Keywords: portable MRI, low-field NMR, ¹H NMR, imaging, plants, trees

The use of MRI in the plant sciences has traditionally been limited due to the immobility of the devices, and restrictions with regard to sample size and shape. To overcome these limitations and to be able to study plants directly in their natural environment, we evaluated the capacities of a portable, unilateral magnet: The Nuclear Magnetic Resonance Mobile Universal Surface Explorer (NMR-MOUSE), designed by Blümich et al. [1]. This device permits measuring the water NMR signal in a 100-micrometer slice, and by means of a built-in lift, the magnet can be moved to record an NMR profile within a depth of approximately 25-millimeters from the surface of the device. We tested its capacity to measure tree water content by following the dehydration dynamic of thirty cut branches from six different species and two different functional types. We also tested the device on four *in-situ* trees. There was a linear correlation between the integral of the MRI profiles obtained and the water content of the branches and trees. This correlation was present regardless of tree species or functional type. Using the profiles obtained on the branches, we then tested the capacity of the device to differentiate the conductive tissues, i.e. the xylem and phloem fluxes. The MRI profiles of the branches presented distinct peaks which corresponded to the xylem and phloem tissues, whose location was validated with x-ray microtomography imaging. In conclusion, the NMR-MOUSE is a promising candidate for measuring tree water dynamics in the field.

References

[1] B. Blümich, P. Blümli, G. Eidmann, A. Guthausen, R. Haken, U. Schmitz, *et al. Magnetic Resonance Imaging* **16**, 5-6: 479-484 (1998).