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Catherine Deborde, Ali Boulgsoa, Marie-Françoise Devaux, Fabienne Guillon, David Legland, et al..  
Magnetic resonance imaging of node and internode in maize stalk. 4th INTERNATIONAL PLANT  
SPECTROSCOPY CONFERENCE, Sep 2024, Vienna (AUSTRIA), Austria. . hal-04718891

**HAL Id: hal-04718891**

**<https://hal.science/hal-04718891v1>**

Submitted on 2 Oct 2024

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# Magnetic resonance imaging of node and internode in maize stalk

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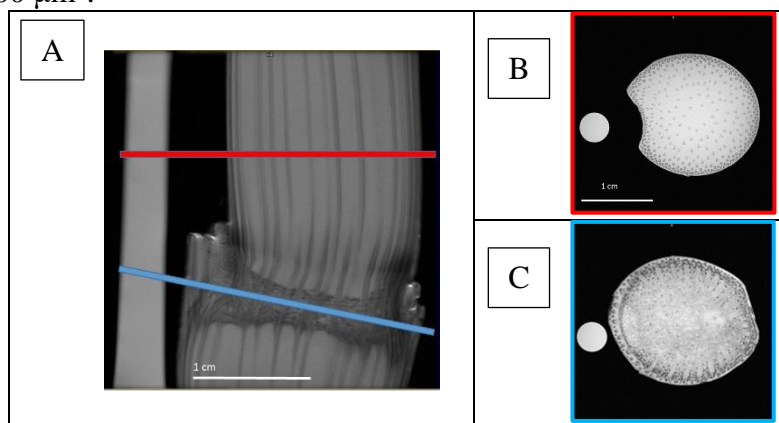
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The maize stalk is roughly cylindrical in shape, with many longitudinally oriented vascular bundles in the pith and a succession of nodes and internodes with a leaf inserted at each node, alternately on either side of the stalk. The internode number and length vary according to genotype, development stage, environment and crop management. The stalk structure has an impact on its use properties for animal feed and its degradability for the biofuels production. The maize internode histology has been investigated using microscopic methods [1], but the study of the node heterogeneous structure has been hampered by the difficulty of preparing microtome sections. Magnetic resonance imaging at the microscopic scale was chosen to investigate non-destructively maize node structure.

The internode under ear with a node, sampled from the stem, carefully wiped and wrapped to prevent desiccation was placed in a 30 mm tube along with a 5 mm one containing doped water for NMR signal amplitude normalization. A vertical wide bore 400 MHz NMR spectrometer equipped with microimaging accessory was used. Images were acquired at room temperature, using a multi-slice multi-echo pulse sequence in order to obtain water mobility image ( $T_2$  images) and water distribution image (normalized proton density images). Two axial slices packages were selected, one within and the second above the node region, and collected with a slice thickness of 500  $\mu\text{m}$  and an in-plane resolution of  $100 \times 100 \mu\text{m}^2$ .



**Figure 1:** Examples of the first echo images of coronal (A) and axial (above (B) and within (C) node) slices from a maize stalk.

Currently other imaging modalities, such as MALDI mass spectrometry imaging, are used to add chemical/metabolite information. The ultimate aim will be to produce a 3D model of the stalk by combining morphological, water dynamics and chemical information in order to gain a better understanding of maize nodes and internodes.

**Funding:** French ANR agency, PEPR B-BEST FillingGaps project (ANR-23-PEBB-0006)

## References

[1] – MF Devaux *et al.*, *Biomolecules* **13**, 1104 (2023).