Combining flow-MRI method and modeling approach to assess water fluxes in tomato plant architecture
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To cite this version:
Jeanne Simon, Maida Cardoso, Eric Alibert, Pierre Valsesia, Gilles Vercambre, et al.. Combining flow-MRI method and modeling approach to assess water fluxes in tomato plant architecture. MRFood, Sep 2018, Rennes, France. 2018. hal-02785661

HAL Id: hal-02785661
https://hal.inrae.fr/hal-02785661
Submitted on 4 Jun 2020

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Results

Flow-MRI measurements

Model predictions

Model predictions of xylem fluxes in the MRI conditions, on a virtual plant with the same aerial architecture as the measured plant, and at the same position on the stem : under the third truss. The assumptions made by the model at night is that the fluxes are only due to fruit activity and that the leaves do not transpire.

Xylem fluxes predicted at the beginning of the experiment: 0.035 mm²/s giving 0.13 g/h

Xylem fluxes predicted after three days of extended night: 0.048 mm²/s giving 0.17 g/h

Model predictions

Environmental conditions

The plant is placed horizontally inside the MRI scanner. The experiments were performed during three consecutive days with no light (extended night conditions). The temperature in the MRI scanner is 20°C.

Plant model

We ran a bio physiological functional-structural plant model [3] until the computed plant achieved the same architecture as the investigated plant. Then, the MRI environmental conditions were reproduced in order to analyze the fluxes predicted under the third truss.

Conclusions and perspectives

The flow-MRI method allows us to measure water fluxes in slow flow conditions. The measurements are in agreement with the predictions of the plant model in the same environmental conditions. These results confirm that this method will be a useful tool to analyse plant responses to abiotic stresses and help to improve the plant model.

Perspectives

• Add some echoes to increase the SNR and have better chances to see phloem fluxes.
• A new ‘H MRI probe as been designed to fit the fruit pedicel plants which will allow us to measure the fluxes going to the fruit.
• The acquisition of a new vertical MRI scanner will allow us to make measurements in better environmental conditions and during longer time periods.

References


Acknowledgments

This work has been carried out thanks to the support of the Investissements d’avenir programme (Labex Agro-ANR-10-LABX-0001-01), under the frame of I-SITE MUSE (ANR-16-IDEX-0006).