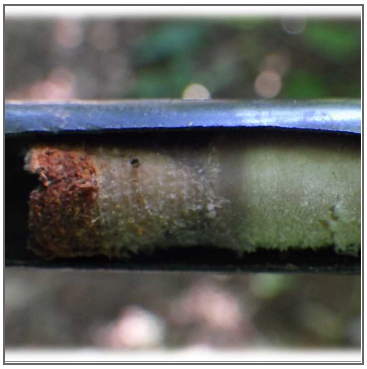

NOV 02, 2023

OPEN ACCESS

DOI:
dx.doi.org/10.17504/protocols.io.dm6gp3xk8vzp/v1

Protocol Citation: Flavie Gerle, Pauline Malherbe, Christelle Boisselet, David Lafleuriel, Julien Godfroy, Pierre Lochin, Baptiste Marteau, Hervé Piegay, Sara Puijalon, Antoine Vernay 2023. Intrinsic water use efficiency estimate: an isotopic method . **protocols.io** https://dx.doi.org/10.17504/protocols.io.dm6gp3xk8vzp/v1

MANUSCRIPT CITATION:

Intrinsic water use efficiency estimate: an isotopic method

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Protocol status: Working
We use this protocol and it's working

Created: Nov 02, 2023

Last Modified: Nov 02, 2023

PROTOCOL integer ID: 90313

Keywords: phloem, d13C, intrinsic water use efficiency, tree

Funders Acknowledgement:
OHM Vallée du Rhone
Grant ID: ANR-11-LABX-0010
FR BioEEnViS

ABSTRACT

Protocol summary and key steps

This protocol describes in detail how to calculate the intrinsic water use efficiency (WUE_i) from ^{13}C measurements in phloem samples collected at breast height in trees. Basically, the isotopic signature of photosynthetized carbohydrates ($^{13}C/^{12}C$) in the phloem sap inform on the assimilation condition: a higher ($^{13}C/^{12}C$) is associated with a lower transpiration rate, increasing heavy isotope (^{13}C) use by the plant (Dawson et al. 2002). A higher $^{13}C/^{12}C$ in the phloem content reflect a higher proportion of assimilated C compared to transpiration rate, in other words, a higher WUE_i. The method described here is based on the isotopic discrimination of $\delta^{13}C$ in trees and considers ecophysiological processes of stomatal and mesophyll conductance (g_s and g_m, respectively). The protocol aims to provide the operator with a step-by-step method from the collection of phloem samples in the field to the final calculation. The protocol is already described in the scientific literature (Klein et al. 2016; Seibt et al. 2008; Vernay et al. 2020) but this document addresses more practical and technical details that a practitioner might expect. WUE (water use efficiency) corresponds to plant productivity or the productivity of an organ of the plant regarding the amount of water used to produce this fresh matter (Théroux Rancourt 2014). At an individual scale, WUE considers a ratio of the biomass produced compared to the amount of water used to produce this biomass. At the leaf level, WUE_i (intrinsic WUE) determines the ratio of CO_2 assimilation per amount of water transpired and can take into account the micro-environment of the leaf, by considering g_s/g_m to be more precise (Vialet-Chabrand 2013).

ATTACHMENTS

WUEi_Protocol_2023.pdf

IMAGE ATTRIBUTION

Antoine VERNAY