THE MICRO IONOME OF PLANTS: AN APPROACH TO QUANTIFY ION UPTAKE AND DISTRIBUTION *IN VIVO*

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Research in plant physiology focuses on understanding plant function on a molecular level to improve plant health and productivity in the long term. This include the goal to design or bread more stress tolerant plants, which for instance can cope better with the increasing threat of drought and salt stress. Metal ion gradients across biomembranes play a fundamental role in cellular function, such as energy storage, nutrient distribution, signaling pathways and enzymatic reactions. However, ion gradients are not static and thus can change depending on leaf age, nutrient supply, light availability or external abiotic stress factors, e.g. soil salinity. Studying these spatial ion fluxes in correlation to factors like leaf age and genotype provides insights into ion transport and its significance for plant function Accordingly, research efforts to analyze the elemental composition of plants designated as ionomics has been intensified in a similar fashion like proteomics and genomics [1]. However, generally these ion studies focus on the macro-scale content e.g. pooled shoot ionome. We have started investigating the plant ionome on a more microscopic level by studying ion gradients corresponding to leaf age *Arabidopsis thaliana* in wild-type and mutant plant leaf tissue using total reflection X-ray fluorescence (TXRF) [2]. TXRF analysis enabled sampling of minute amounts of plant leaf tissue which was sufficient to unveil ion gradients between individual leaves. However, even within one leaf ions are not homogeneously distributed but accumulate in certain structures like plant hairs (trichome) or veins. This phenomenon has been studied by Synchrotron micro-XRF by several groups on chemically fixed clipped tissue samples numerous times [3]. However, some ions like K are known to be highly mobile in the plant tissue. Accordingly, we followed a new approach to study the micro ionome in plants using laboratory based micro-XRF *in vivo.* Using Chlorophyll fluorescence to determine plant vitality throughout the measurements, we could show that plants were not damaged by X-ray exposure [4]. Here, we will present the developed set up and its evaluation. Additionally, we will report about first evaluations of quantification procedures that will eventually give accurate result on ion tissue concentrations.

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[3] Vijayan et al. Plant Cell Physiol. 56(7): 1252–1263 (2015) doi:10.1093/pcp/pcv080
[4] Fittschen et al. XRS in revision