☐ **Talk** ☒ **Poster**

Bioimaging of Element Abundance and Distribution in Response to Boron Availability Extremes

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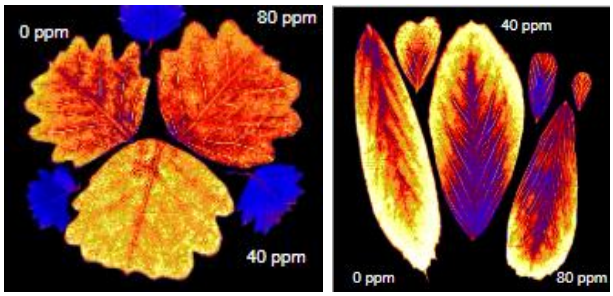
In order to both preserve and improve crop yield, agricultural practices must adapt to extreme and unpredictable soil nutrient availability as a result of changing climate. Boron (B), which acts as an essential micronutrient required for crop productivity, and is a key component for nitrogen fixation, also directly influences the uptake of other required nutrients [2,3]. So far, the mechanism(s) for this codependence is unknown. In this study, we used alfalfa (*Medicago sativa),* an economically significant forage crop grown across large swaths of the US and world. Alfalfa is a legume notable for its high B requirement, making it ideal for evaluating relationships between B and other nutrient elements [1]. The experiment involved leaves being collected weekly from plants grown under controlled B supply over the course of the growth cycle, i.e., B deficiency through toxic excess conditions. Preliminary bioimaging results (left) of alfalfa grown under deficient, sufficient, and toxic B concentrations from the newly commissioned Maia detector at XFM showed a strong influence B has on a suite of biologically salient elements. Nutrients such as Ca (shown), K, Mn, etc., exhibited differences in distribution across leaves, with element exclusion being more likely at B extremes (both deficiency and toxicity), and enrichment peaking at sufficient B. By combining results obtained at the XFM beamline with bulk concentration measurements of these and other elements made via Inductively Coupled Plasma Mass Spectrometry (ICPMS), our experiment introduces a multi-modal approach for studying plant physiology. This allows for the study of alfalfa's adaptability to environments where B availability may not be optimal, further driven to extremes by climate change, while also providing fundamental insights into B's influence on other correlated essential nutrients.



References

[1] Kelling, K.A. Alfalfa fertilization (2000) *Cooperative Extension, University of Wisconsin--Extension*, vol. 2448.
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