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X-ray microspectroscopy at ESRF beamline ID21: applications in Plant science.

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Trace metal distribution and speciation in plants is an active research field, whether to understand metal biological roles, to improve food quality or to understand and prevent the accumulation of toxic metals in edible crops. This research domain is one of the core activities at beamline ID21 of the European Synchrotron. ID21 is a beamline dedicated to X-ray fluorescence (XRF) mapping and X-ray absorption spectroscopy (XAS) in the tender X-ray range (2-11keV), this energy range allows detecting important nutrient elements (P, S, K, Ca, Mn, Fe, Cu, Zn) as well as rare earths and pollutants (Cd, Ag, Ce, La, Gd). A brand-new X-ray nanoscope is being installed at the beamline to complement the existing microscope, and it will be soon available to users. It will offer enhanced capabilities for nano-XRF mapping, nano XAS and hyperspectral XRF mapping. This new state-of-the-art instrument will offer higher lateral resolution (down to 100 nm) with better XRF detection capacities (sub-ppm), higher acquisition speed, an improved cryogenic sample environment, preserving user-friendliness thanks to a new graphical user interface. Cryo-fixed plant samples can better cope with intense X-ray beams and the elemental distributions, chemical states, and sample morphologies are close to the in-vivo state under frozen-hydrated conditions. This presentation will highlight present and future capabilities at ID21 for the plant science user community. Some examples of research done at ID21 will be used to illustrate sample preparation protocols, and data acquisition and analysis strategies.

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