

# Elemental imaging of iron-bioengineered wheat grain using synchrotron X-ray fluorescence microscopy.

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Over the past decades, efforts have been made to increase the nutrition value of staple food crops including wheat grain. Recently, we were able to produce a metabolic engineered wheat variety capable to increase the accumulation of iron (Fe) in grain (Beasley et al., 2019). In order to determine the distribution of elevated Fe levels and other elements in this grain, we performed elemental imaging studies at the Australian Synchrotron X-ray fluorescence microscopy (XFM) beamline. XFM imaging was conducted on transverse cross-sections of representative mature grains from two null segregant (NS) and two genetically modified (GM) wheat (*Triticum aestivum*) using two synchrotron-based XFM imaging systems: a 384 Maia detector and a Vortex-EM detector. Grain samples (80  $\mu\text{m}$  in thickness) were analysed in continuous mode in the horizontal direction by a sampling interval of 4  $\mu\text{m}$  and a step size of 4  $\mu\text{m}$  in the vertical direction with a transit analysis time of 5.2 ms. The XRF signal was used to generate the elemental maps of Fe, zinc (Zn), copper (Cu), manganese (Mn) and phosphorous (P). Elemental maps were generated and analysed using GeoPIXE software. The results indicated a difference in Fe distribution between NS and GM grains. The increase of Fe accumulation in GM grain occurred in the endosperm, crease and aleurone regions relative to NS grain. The results provide a unique insight into the mechanisms of Fe distribution in iron-bioengineered wheat grain and highlights the significance of using synchrotron-based XFM imaging in the study of metal distribution in plants.

Beasley, J.T., Bonneau, J.P., Sanchez-Palacios, J.T., Moreno-Moyano, L.T., Callahan, D.L., Tako, E., Glahn, R.P., Lombi, E. and Johnson, A.A.T. (2019) Metabolic engineering of bread wheat improves grain iron concentration and bioavailability. *Plant Biotechnol. J.*, <https://doi.org/10.1111/pbi.13074>

## Speakers Gender

Male

## Travel Funding

No

## Level of Expertise

Early Career <5 Years since PdD

## Do you wish to take part in the poster slam

No

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**Session Classification :** Welcome Function