

Using ICP and micro-PIXE to investigate possible differences in the mineral composition of genetically modified versus wild-type sorghum grain

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ABSTRACT:

In the present study, possible differences in the mineral composition of transgenic versus non-transgenic sorghum grains were investigated using inductively coupled atomic emission spectroscopy (ICP-AES); and, in-tissue elemental mapping by micro Proton-Induced X-ray Emission (micro-PIXE) analysis. ICP AES was used to analyse the bulk mineral content of the wholegrain flour derived from each genotype; whilst micro-PIXE was used to interrogate localised differences in mineral composition specific to certain areas of the grain, such as the bran layer and the central endosperm tissue. According to the results obtained, no significant difference in the average Fe, Zn or Ca content was found to differentiate the transgenic from the wild-type grain using ICP-AES. However, using micro-PIXE, a significant reduction in zinc could be detected in the bran layer of the transgenic grains relative to wild-type. Although it is difficult to draw firm conclusions, as a result of the small sample size used in this study, micro-PIXE has nonetheless proven itself as a useful technique for highlighting the possibility that there may be reduced levels of zinc accumulation in the bran layer of the transgenic grains. Given that the genetic modification targets proteins that are highly concentrated in certain parts of the bran tissue, it seems plausible that the reduced levels of zinc may be an unintended consequence of the silencing of kafirin proteins. Although no immediate health or nutritional concerns emerge from this preliminary finding, it is noted that zinc plays an important biological role within this part of the grain as a structural stabiliser and antioxidant factor. Further study is therefore needed to assess

more definitively the extent of the apparent localised reduction in zinc in the transgenic grains and how this may affect other important grain quality characteristics.