Tissue accumulation and quantification of Zn in biofortified *Triticum aestivum* L. grains – development of a functional food

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Abstract

With the growth of the world population, there is an urgent need to increase the production of staple foods. Zinc deficiency is the fifth leading cause of mortality and disease in developing countries, leading to loss of brain function, changes in growth and weakening of the immune system. This micronutrient has a fundamental role at the regulatory, functional and structural levels. One way to make up for these deficiencies may involve biofortification, which is a process in which there is an enrichment of both content and the bioavailability of micronutrients in edible tissues of staple foods. Thus, the biofortification of wheat will allow the development of functional foods with added value and differentiators in the market. Two wheat crops (fields 1 and 2) located in Beja, Portugal, with two varieties (Paiva and Roxo) of *Triticum aestivum*, were selected to be part of a zinc biofortification itinerary. Both varieties were sprayed three times with a zinc fertilizer in two different concentrations and were compared to the control samples. To quantify and locate Zn in the wheat flour and within the grains, XRF analyser and μ-EDWRF analyser were used, respectively, at harvest. Applying XRF analyser to wheat flour, the average biofortification index of Zn varied between 24 - 73% for Paiva and Roxo varied between 29 and 44 % in field 1. In field 2, the results varied between 134 - 146% for Paiva and between 108 - 143% for Roxo. The μ-EDWRF analyses revealed that Zn was preferentially localized in the embryo and aleurone in both varieties. To sum up, Zn biofortification of wheat resulted in a higher accumulation of the mineral in the embryo and aleurone, particularly in the samples with higher levels of Zn applications. Therefore, integral wheat flour consumption should be considered as to improve human health.

Recent Publications

1. Cakmak I, Kutman UB (2018) Agronomic biofortification of cereals with zinc: a review. European Journal of Soil Science 69(1):172-180.
2. Ciccolini V, Pellegrino E, Coccina A, Fiaschi AI, Cerretani D, Sgherri C, Quartacci MF, Ercoli L (2017) Biofortification with Iron and Zinc Improves Nutritional and Nutraceutical Properties of Common Wheat Flour and Bread. Journal of Agricultural and Food Chemistry 65(27):5443-5452.
3. Cardoso P, Mateus TC, Velu G, Singh RP, Santos JP, Carvalho ML, Lourenço VM, Lidon F, Reboredo F, Guerra F (2018) Localization and distribuition of Zn and Fe in grains of biofortified bread wheat lines through micro- and triaxial-X-ray fluorescence spectrometry. Spectrochimica Acta Part B 141:70-79.
4. Ramos I, Pataco IM, Mourinho MP, Lidon F, Reboredo F, Pessoa MF, Carvalho ML, Santos JP, Guerra M (2016) Elemental mapping of biofortified wheat grains using micro X-ray fluorescence. Spectrochimica Acta Part B 141:70-79.
5. Bouis HE, Saltzman A (2017) Improving nutrition through biofortification: A review of evidence from HarvestPlus, 2003 through 2016. Global Food Security 12:49-58.



Biography

Inês Luís started her academic training in Biochemistry, moved on to Production Technologies and Agro-Industrial Transformation and presently she is in the Doctoral Program in Agroindustrial Technologies. Her work focuses on biofortification of staple crops, mainly on the foliar applications of Zn in bread wheat. She fosters ways of delivering food to populations with mineral deficiencies in order to provide an increase in the quality of human health. Moreover, this work enables her to develop new functional food alongside the creation of competitive food products. In her daily work, she contacts with spectrometry techniques related to mineral quantification and localization, techniques related to the quality of the wheat and she also monitors the conservation of wheat through time.

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Notes/Comments: