Determination of interactions between nutrients in *Oryza sativa L.* naturally enriched in Se: tissue localization and characterization using XRF and atomic absorption

Ana Margarida C. Marques, Master, Faculdade de Ciências e Tecnologia-UNL, Portugal
Inês Luís, Master, Faculdade de Ciências e Tecnologia-UNL, Portugal
Ana R. F. Coelho, Master, Faculdade de Ciências e Tecnologia-UNL, Portugal
Cláudia C. Pessoa, Master, Faculdade de Ciências e Tecnologia-UNL, Portugal
Diana Daccak, Master, Faculdade de Ciências e Tecnologia-UNL, Portugal
Fernando C. Lidon, Professor, Faculdade de Ciências e Tecnologia-UNL, Portugal
Paula S. Afonso, Investigator, Instituto Nacional de Investigação Agrária e Veterinária, Portugal
Maria M. Simões, Professor, Faculdade de Ciências e Tecnologia-UNL, Portugal
Ana Sofia Almeida, Investigator, Instituto Nacional de Investigação Agrária e Veterinária, Portugal
Carlos Galhano, Professor, Faculdade de Ciências e Tecnologia-UNL, Portugal
José C. Ramalho, Investigator, Instituto Superior de Agronomia-UL, Portugal
Mauro A. M. Guerra, Professor, Faculdade de Ciências e Tecnologia-UNL, Portugal
Roberta G. Leitão, Professor, Faculdade de Ciências e Tecnologia-UNL, Portugal
Paula Marques, Centro Operativo e Tecnológico do Arroz, Portugal
Ana I. F. Ribeiro, Investigator, Instituto Superior de Agronomia-UL, Portugal
Fernando H. Reboredo, Professor, Faculdade de Ciências e Tecnologia-UNL, Portugal
Maria F. Pessoa, Professor, Faculdade de Ciências e Tecnologia-UNL, Portugal
Maria M. Silva, Professor, Escola Superior de Educação Almeida Garrett, Portugal
Paulo Legoinha, Professor, Faculdade de Ciências e Tecnologia-UNL, Portugal
Nuno Leal, Professor, Faculdade de Ciências e Tecnologia-UNL, Portugal
Isabel P. Pais, Master, Instituto Nacional de Investigação Agrária e Veterinária, Portugal

Abstract

Selenium (Se) was first considerate as toxic, being today considered as an antioxidant trace mineral important for health and development. Lack of selenium in humans has been associate with high risk of mortality, deficient immune functions, cognitive decline, Keshman disease and white muscle disease. The growing demand for efficient, bioeconomic and sustainable strategies to increase Se content in rice is therefore justified, as is the study of the technical and nutritional implications inherent to its production and industrial processing for food products.

Se biofortification is a strategy that promotes nutrient enhancement in food crops and can increase nutrient uptake and accumulation in the human body. The technical itinerary was implemented, using two commercial varieties of rice (Ariete and Ceres) and two advanced lines of INIAV National Rice Genetic Improvement Program (OP1505 and OP1509). Five selenium concentrations were tested in the forms of selenate and sodium selenite by foliar application. It was verified using the EDXRF M4 Tornado ™ system, by spectral mapping, the preferential location of Se in rice. As such, it was found that Se was preferentially accumulated in the inner zone of rice grain. The contents of C, H and O, present in the different treatment concentrations, were also quantified. The average of Se biofortification index in variety Ceres was 16,3 % and the opposite was verified in variety Ariete, by atomic absorption.

The natural biofortification of rice in Se will thus constitute an added value to product in its production chain and it will constitute a dynamic and innovative market niche attractive to the business community. Considering that biofortification with Se consists in the development of a baby food product, it is concluded that it's possible to develop a new product.

Recent Publications

1. Oliveira, K., Pataco, I., Mourinho, M., Santos, C., Pelica., J., Leitão, A., Pais, I., Campos, P., Reboredo, F., Pessoa, M., Ramalho, J., Lidon, F., 2015. Selenium Biofortification in Rice - A pragmatic perspective. Emirates Journal of Food and Agriculture. 27(3), 231-234, DOI: 10.9755/ejfa.v27i3.19285.
2. Deng, X., Liu, K., Li, M., Zhang, W., Zhao, X., Zhao, Z., Liu, X., 2017. Difference of selenium uptake and distribution in the plant and selenium form in the grains of rice with foliar spray of selenite or selenate at different stages. Field Crops Research. 211, 165–171. DOI: 10.1016/j.fcr.2017.06.008
3. Li, M., Zhao, Z., Zhou, J., Zhou D., Chen, B., Huang, L., Zhang, Z., Liu, X., 2018. Effects of a foliar spray of selenite or selenate at different growth stages on selenium distribution and quality of blueberries. Journal of Science of Food and Agriculture. 98, 4700-4706. DOI: 10.1002/jsfa.9004
4. Mangueze, A., Pessoa, M., Silva, M., Ndayiragije, A., Magaia, H., Cossa, V., Reboredo, F., Carvalho, M., Santos, J., Guerra, M., Ribeiro-Barros, A., Lidon, F., Ramalho, J., 2018. Simultaneous zinc and selenium biofortification in rice. Accumulation, localization and implications on the overall mineral content of the flour. Journal of Cereal Science. 82, 34-41. DOI: 10.1016/j.jcs.2018.05.005…
5. Bouis, H. E., Hotz, C., McClafferty, B., Meenakshi, J. V., Pfeiffer, H. W., 2011. Biofortification : A New Tool to Reduce Micronutrient Malnutrition. Food and Nutrition Bulletin 32(1): 31–40



Biography

Ana Margarida Coelho Marques is a PhD student at FCT-UNL, in Portugal. Her research focuses on the biofortification of *Oryza sativa* L. in Selenium. She has extensive experience and mastery of various analytical procedures and methods such as: X-ray fluorescence, atomic absorption spectrophotometry, MDA, pigment determination, xanthophylls, carotene, lutein and sugars.

Email:anamargarida.am@homail.com