Contribution ID: **102** Type: **Poster**

Selenium in bread and durum wheats grown under a soil-supplementation regime in actual field conditions, determined by cyclic and radiochemical neutron activation analysis

Monday, 12 May 2014 17:15 (1h 30m)

Selenium (Se) is an essential trace nutrient whose importance in human health is simply not up to par with its relative abundance in the Earth's upper continental crust: it is one of the least-common elements, with an average concentration that makes it rarer than, for instance, gold. Though ubiquitous, Se also features an uneven distribution in agricultural soils, that act as its port of entry into the nutritional path through uptake and accumulation by edible plants, even if such an element is not required for their own growth. Since the Se transfer up the soil-plant-(animal)-human food chain is generally efficient, that soil-Se imbalance easily translates into substantial variation in food-Se content and, ultimately, into significant divergence in human-Se intake.

The ever-increasing attention paid to the role of selenium and selenoproteins in human health stems primarily from an ever-growing body of evidence about not only their actual (general) importance for defending against oxidative stress/damage and thyroid malfunction – that is against immune failure at large – but also about their potential (beneficial) effect in a plethora of life-threatening issues (cardiovascular disease, critical illness and, especially, cancer) or, at least, life-deteriorating (cognitive, metabolic and reproductive) conditions. Some evidence may be inconclusive or even inconsistent, yet the relevance of selenoproteins to health seems unquestionable. Such an importance has since been recognised by both global organizations and national authorities, leading to a range of dietary recommendations for Se intake that currently averages 60 and 53 microg per day for adult men and women, respectively.

An extensive investigation of Se levels in cereals and their cultivation soils has been carried out across the main production areas of mainland Portugal, with a view to an eventual Se supplementation of major cultivars. Breads and cereal derivatives (breakfast blends, pastas, etc) make up a considerable share of Portuguese diets, so an increase in the bioavailability of Se through supplementation of crops may contribute to an upgrade in the Se status of the whole population. Cereals are far from being the main sources of Se on a content basis, but they are likely the major contributors to intake on a daily basis. The present paper focuses on the ability of bread and durum wheat – Triticum aestivum L. and Triticum durum Desf., respectively – to accumulate Se after supplementation via a soil-addition procedure. Four of the most representative wheat cultivars in the country – Jordão and Roxo (bread); Marialva and Celta (durum) – have been selected for supplementation trials, following the same agronomic practices and field schedules as the regular (non-supplemented) crops of the same varieties (seed planting: November 2010; crop harvesting: July 2011).

Soil additions were performed at sowing time, using sodium selenate and sodium selenite solutions equivalent to field supplementation rates of 4, 20 and 100 g of Se per ha. Total Se in field samples was determined by cyclic instrumental neutron activation analysis, via the short-lived nuclide 77mSe (half-life time: 17.5 s) at the Technological and Nuclear Campus (Portugal), and by radiochemical neutron activation analysis, via the long-lived nuclide 75Se (half-life time: 120.4 d) at the Nuclear Physics Institute (Czech Republic). Quality control of the procedures was regularly asserted through analyses of NIST-SRM 1515, NIST-SRM 1567a and NIST-SRM 8433. Results show that soil supplementation at top rate can increase Se contents in mature grains up to 2, 16, 18 and 20 times for Jordão, Roxo, Marialva and Celta, respectively, when compared to grains from non-supplemented crops. These findings are also discussed with respect to Se-biofortification data from

another field experiment, in which wheat crops were grown under an alternative Se-supplementation method (foliar application).

Primary authors: Prof. PACHECO, Adriano (CERENA-IST, University of Lisbon); Ms GALINHA, Catarina (CERENA-IST, University of Lisbon)

Co-authors: Dr ALMEIDA, Ana Sofia (INIAV, National Institute of Agricultural and Veterinary Research); Dr MAÇÃS, Benvindo (INIAV, National Institute of Agricultural and Veterinary Research); Prof. WOLTERBEEK, Hubert (Department of Radiation Science and Technology, Delft University of Technology); Prof. KUČERA, Jan (Department of Nuclear Spectroscopy, Nuclear Physics Institute of the ASCR); Mr COUTINHO, José (INIAV, National Institute of Agricultural and Veterinary Research); Dr FIKRLE, Marek (Department of Nuclear Spectroscopy, Nuclear Physics Institute of the ASCR); Dr FREITAS, Maria do Carmo (URSN/CTN-IST, University of Lisbon)

Presenter: Ms GALINHA, Catarina (CERENA-IST, University of Lisbon)

Session Classification: Poster Session - Nuclear Analytical Methods

Track Classification: Nuclear Analytical Methods