Selenium: Global Perspectives of Impacts on Humans, Animals and the Environment.
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Beneficial Roles of Selenium in Plants

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Introduction

Selenium (Se) is an essential micronutrient for animals and humans. For higher plants Se is not considered to be essential yet (Pilon-Smits and Quinn, 2010), although Wen et al. (1988) have suggested a possible essential role of Se as a component of tRNA. Selenium deficiency has been estimated to affect 0.5-1 billion people worldwide (Combs, 2001). Just as important, Se has been implicated to have important health benefits, e.g. improving immune function, reducing viral infection, and slowing down the aging process. In addition, Se has been shown at supranutritional levels to function as a cancer preventative agent in reducing the incidence of prostate, colon, and lung cancer (Fairweather-Tait et al., 2011).

Selenium and Plant Growth

Several studies reported beneficial effects of Se on higher plants because Se increases the antioxidant activity in plants, and leads to better plant yield (Hartikainen, 2005; Lyons et al., 2009). Growth benefits of Se are usually associated with protecting plants against several types of abiotic stress, alleviating UV-induced oxidative damage, improving the recovery of chlorophyll from light stress, increasing antioxidative capacity of senescing plants, and regulating the water status of plants exposed to drought (Kuznetsov et al., 2003; Hartikainen, 2005). Recently, a beneficial effect of Se on heavy metal toxicity has been reported by Pedrero et al. (2008), showing the response of broccoli subjected to Cd toxic conditions together with the application of Se. This study reported that Se application diminished the malondialdehyde (MDA) content, decreased the translocation of Cd towards shoot, and thereby reduced oxidative stress induced by Cd.

New Findings on Se Nutrition of Plant

Selenium is absorbed by plants from soil and can be converted into Se-methionine (SeMet), which is incorporated into proteins in place of methionine. In some plants, SeMet accounts for more than 50% of the total Se content in plant. However, Rios et al. (2010) reported that the influence of Se on increasing nitrate reductase activity in lettuce plants might lead to a better efficiency of nitrogen utilization. This result is in agreement with a recent study in which Se application increased photosynthesis and activities of urease and nitrate reductase, depending of the cultivar (Reis et al., 2011).

Genotypic Variation in Se Accumulation

Selenium in the diet is obtained from animal and plant products, including cereals, grains and vegetables. Earlier studies have demonstrated both significant and non-significant genetic variability for Se accumulation in the edible parts of crops (Table 1). Clearly, in order to apply the breeding approach for Se biofortification, further research will be needed to better understand the influence of genetics on Se accumulation in food crops.

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Table 1. Genotypic variation of Se accumulation in agricultural crops.

Crop	Se (μg kg^{-1})	Reference
Lettuce‡	1800–7500	Ramos et al. (2011)
Sweet pepper†	133–1197	Golubkina et al. (2000)
Soybean§	12–45	Yanling et al. (2002)
Wheat§	9–244	Lyons et al. (2005a)
Wheat§	37–120	Lyons et al. (2005b)
Wheat§	33–440	Zhao et al. (2009)
Wheat§	24–116	Bóna et al. (2009)
Triticale§	22–140	Bóna et al. (2009)
Rice§	29–103	Zhang et al. (2006)
Rice§	15–122	Moraes (2009)
Broccoli¶	50–95	Farnham et al. (2007)
Broccoli¶	34–89	Farnham et al. (2007)
Pasture¶	82–147	McQuinn et al. (1991)

†Fruit
‡Lettuce leaves
§Grains
¶Leaves

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