GENOTYPIC VARIATION IN THE ACCUMULATION OF RARE EARTH ELEMENTS (REE) IN *PHALARIS ARUNDINACEA* L

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Rare earth elements (REEs) represent a number of economically valuable elements whose increasing demand is closely associated with rapidly growing high-tech sectors such as high-tech electronics and "green energy technologies". In soils REEs are actually not rare but occur widespread with concentrations comparable to some essential plant nutrients (e.g. Zn). Thus, a promising chance to improve supply of these resources could be phytomining.

The aim of the present study was to explore effects of genotype and selected soil properties (organic matter content, pH) on the accumulation of REEs in plants of *Phalaris arundinacea*.

In a field experiment 12 different genotypes and 15 populations of *Phalaris arundinacea* (reed canary grass) were cultivated on four substrates with differing organic matter contents and pH-values in order to distinguish effects of genotype and soil properties. On each of the substrates each genotype was cultivated on plots (4 m^2 each) with three replications. After harvest REE concentrations in the shoots were measured by means of ICP-MS.

High contents of organic matter and low pH significantly increased ($p < 0.001$) the REE concentrations in all tested plants showing a strong impact of soil properties on REE availability. Compared to plants cultivated on the alkaline substrate (sums of REEs: 13 mg kg^{-1}), plants on the acidic substrate were characterized by concentrations that were a factor of roughly three higher (28 mg kg^{-1}) with maximum concentrations in those plants amended with compost (up to 78 mg kg^{-1}).

Considering all substrates we found substantial genotypic variation in the accumulation of REEs in shoots of the plants. For the acidic substrate REE concentrations between genotypes ranged from 10 mg kg^{-1} to 80 mg kg^{-1} with a low variability between the replications of a certain genotype. The substrates used in this study significantly affected the efficiency of the genotypes to accumulate REEs in the shoots indicating a high genotypic plasticity with regard to this trait. REE concentrations in the shoots correlated significantly positively ($r = 0.94$) with those of Fe suggesting a strong relationship between the accumulation of REEs and Fe acquisition in the rhizosphere.

It is concluded that accumulation of rare earth elements in *Phalaris arundinacea* heavily depends on the genotype. REE accumulation can be increased by application of organic substances to the soil and adjusting pH to acidic values. Uptake of REEs may be related to iron nutrition of plants.

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