**Uptake and Transport of Rare Earth Elements in *Zea mays***

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Rare Earth Elements (REE) are a group of 17 elements; the lanthanides, scandium, and yttrium. They used in many high tech applications without economic ways of recycling [1]. Gadolinium (Gd), for instance, is applied as contrast agent in human medicine and as a result, constantly released into waterbodies by hospital effluents [2]. While non-toxic in complexed form, Gd is highly toxic as trivalent cation. REE were applied in agriculture, typically in concentrations ranging from 50 to 700 mg L-1 depending on application form. Soil contents vary between 41 and 544 mg kg-1 in soils from Central Germany [3][4]. REE are expected to become emerging pollutants and research regarding their environmental behavior is necessary to predict their possible fate. To assess the fate of REE entry into the environment, a study using an important agricultural crop, *Zea mays*, was carried out [5].

*Zea mays* (cv. *Ronaldinho*) was exposed to three concentrations of uncomplexed Gd and Y; 0.1, 1 and 10 mg L-1 in hydroponic cultures. The plants were grown in a growth chamber (14/10 day night rhythm, 23/18°C, 60% rel. humidity and 350 µmol/m2s photosynthetically active radiation) and separated into roots, stem and leaves at harvest after 21 days. Dried and homogenized samples were digested with HNO3 and H2O2 and analyzed for REE and the nutrients; Cu, Fe, Zn, Mo, Mn, B, using inductively coupled plasma mass spectrometry (ICP-MS, Agilent 7700) and inductively coupled plasma atomic emission spectroscopy (ICP-OES, Spectro Arcos) for Ca, Mg, P, S and Fe.

It could be shown that concentrations of up to 1 mg L-1 of Gd and Y in the nutrient solution did not affect plant growth or alter the nutrient balance. At 10 mg L-1, however, Gd or Y resulted in REE concentrations of up to 1.2 weight-% (dry weight) in the roots and severe phosphate deficiency symptoms accompanied by reduced biomass production. Transfer rates indicate that there was little transport of Gd and Y from roots to shoots, with 0.1-4% of the total Gd and Y in shoot tissue. Significant correlations were found between the concentration of Gd and Y in the nutrient solution and the root tissue concentration of Ca, Mg and P. While the P content increases with the applied dose of REE, the content of the two earth alkaline metals Ca and Mg, which have similar ionic radii to REE, decrease in the roots; an effect which is reversed in shoots and leads to deficiency symptoms of the plant.

REE significantly affect the biomass and nutrient balance at the highest dose, by strong interactions with phosphate and Ca, especially at the roots. Further investigations will elucidate the speciation of Gd at their main target of toxicity, revealing if they are deposited outside roots, maybe as hardly soluble REE phosphates, or inside apoplast or cells.

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