



The influence of phosphorus nutritional status on the uptake of germanium in *Panicum miliaceum* and *Brassica alba*

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In order to investigate the influence of the phosphorus nutritional status on the uptake of germanium (Ge) in biomass two species, white millet (*Panicum miliaceum*) and white mustard (*Brassica alba*) were grown and sampled in a greenhouse experiment. The cultivation took place on two different substrates. The plants were fertilized with different nutrient solutions which differed in their phosphate content, and artificial addition of Ge was held via the casting solution. During the test period, measurements of the pH value, electric conductivity, and phosphate content of the soil solution were conducted. To transfer germanium from soil and plant material in solution, melting and microwave digestion processes were done.

The experiment showed that in both species the additional Ge supply also leads to an increasing germanium content in the aboveground plant material. The two species, however, behave differently in response to this Ge supply. *Panicum miliaceum* accumulates Ge in the above-ground parts of plants stem, leaf and fruit to a much greater extent than *Brassica alba*. On the other hand the Ge accumulation in the roots of both *B. alba* and *P. miliaceum* was very high. In case of *B. alba* the root content was found by far higher as compared to the other parts of the plant.

The addition of phosphate in the system changes the behavior. Without additional Ge its natural uptake from soil decreases in both species but in *B. alba* it is more characteristic. Increasing Ge supply (for both species) leads to an increased Ge uptake, until it reaches a maximum, regardless of the presence of phosphate addition. Phosphate, on the other hand, has positive effects on Ge uptake only in the case of *B. alba* roots, and to a limited extent in roots of *P. miliaceum*. In addition, for *Panicum miliaceum* an increase of germanium mainly in the underground parts was achieved. A further addition of phosphate did not have a positive effect on a greater enrichment of germanium.

Whereas in *Brassica alba*, the addition of phosphate had a slightly positive effect on the Ge concentrations in leaves, in general *B. alba* is less capable accumulator than *P. miliaceum*. In the latter species the aboveground plant accumulate high Ge concentrations, exceeding mostly the Ge concentrations in roots. The concentrations of the aboveground parts in *P. miliaceum* typically increase with the Ge supply, here there is no plateau observable. In summary *Brassica alba* roots (with phosphate) and *Panicum miliaceum* leaves (without additional phosphate) showed the highest Ge concentrations.