

affected by the plant sulfur supply/status. In addition to sulfate taken up by the roots, *Brassica* species are able to utilize atmospheric sulfur gasses, viz. H<sub>2</sub>S or SO<sub>2</sub> taken up by the leaves as sulfur source for growth. In the current study the impact of H<sub>2</sub>S or SO<sub>2</sub> on glucosinolate metabolism was studied in two *Brassica* species characterized by a high (*B. juncea*) and low (*B. rapa*) glucosinolate content. 10-day-old seedlings were grown on a 25% Hoagland nutrient solution containing 0.5 mM sulfate for 3 days and subsequently transferred to fresh 25% Hoagland solution at 0 mM sulfate (-S) or 0.5 mM sulfate (+S) and exposed to 0.25 µl l<sup>-1</sup> H<sub>2</sub>S or SO<sub>2</sub> for 7 days. At an ample sulfate supply, exposure of both species to H<sub>2</sub>S or SO<sub>2</sub> hardly affected content and composition of glucosinolate. H<sub>2</sub>S or SO<sub>2</sub> exposure resulted in a slight decrease in expression of APS reductase expression whereas that of APS kinase and ATP sulfurylase remained unaffected. Sulfate-deprivation of plants resulted in a decreased biomass production and glucosinolate content. Expression of APS reductase was strongly enhanced in sulfate-deprived plants but expression of both APS kinase and ATP sulfurylase hardly changed. When sulfate-deprived plants were exposed to H<sub>2</sub>S or SO<sub>2</sub>, plant growth was restored, however, the glucosinolate content remained lower than that of sulfate-sufficient plants. Moreover, the expression of APS reductase was partially down-regulated again, whereas expression of APS kinase and ATP sulfurylase remained unaffected.

### 8) Effect of S-limitation on osmotic potential components in oilseed rape leaves: towards the development of early indicators?

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Oilseed rape (*Brassica napus*) is a S demanding crop, S-limitation resulting in a reduction of yield and of nutritional quality of seeds. Optimization of S fertilization requires to identify indicator of S nutrition that could be used early in the growth cycle.

In this study, we examined the effects of S-limitation on osmotic potential components of oilseed rape leaves. Plants were grown at vegetative stage and submitted to S-limitation (S+: 508.7 µM SO<sub>4</sub><sup>2-</sup> or S-: 8.7 µM SO<sub>4</sub><sup>2-</sup>) and were harvested at 0, 1, 2, 3, 7, 13, 24 and 34 days of S-limitation. Each plant was sampled as old leaves, new leaves emerging after S-limitation, roots and petioles.

Plant growth was maintained during the first 13 days of S-limitation as a result of massive internal sulfate mobilization mostly from leaves and its subsequent assimilation. This was at least partly compensated for by an accumulation of malate, nitrate, chloride and phosphate in leaves and to a lesser degree in roots. More surprisingly, leaf osmotic potential decreased after two days of S-limitation. Other compounds such as amino acids, soluble sugars and cations will be quantified in order to evaluate their contribution to the leaf osmotic potential. Additional data (<sup>15</sup>N-nitrate uptake, nitrate reductase activity, transcript levels of sulfate and nitrate transporters) show that under

S-limitation, osmotic potential is affected earlier than growth or N metabolism suggesting that field measurements of leaf ion contents, acting as osmoticum, could be used as early indicators for S fertilization management.

### 9) Elucidating the molecular components that allow *Salicornia* and *arcocornia* to thrive in high sulfate and sulfide levels

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*Salicornia* and *Sarcocornia* are extreme halophytes that grow on sea water with high sulfide and sulfate levels and have been recently introduced as new crops for extreme salt conditions such as in the level of Dead Sea water. We are exploring the mechanism/s that allows these plants to cope with sulfate and sulfide levels, which are toxic to many other plants. We grew the plants at different NaCl, sulfate and sulfide levels and we are scanning for relevant genes and proteins that might be related to plant resistance to those stresses.

### 10) The role of sulfite reductase in sulfite homeostasis

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Using *Arabidopsis* and tomato plants with modified SiR expression, we investigated the role of SiR in various metabolic processes in plants. We observed that resistance to ectopically applied SO<sub>2</sub>/sulfite was a function of SiR expression levels and that plants with reduced SiR expression exhibited higher sensitivity than the wild type. The sulfite sensitive mutants accumulated sulfite and showed a decline in glutathione levels. In contrast, mutants that over-express SiR were more resistant to sulfite toxicity; exhibiting little or no damage. Resistance to high sulfite application was manifested by fast sulfite disappearance and increase in glutathione levels. The notion that SiR plays a role in the protection of plants against sulfite was supported by the rapid up-regulation of SiR transcript and activity within 30 min of sulfite injection into *Arabidopsis* and tomato leaves. Our results indicate that, in addition to participating in the sulfate assimilation reductive pathway, SiR also plays a role in sulfite homeostasis together with sulfite oxidase and the other members of the sulfite network.

### 11) Regulatory Network of SO<sub>2</sub> detoxification

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