The cytosolic glutamine synthetase GLN1;2 plays a role in the control of plant growth and ammonium homeostasis in Arabidopsis rosettes when nitrate supply is not limiting

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Résumé en anglais	Glutamine synthetase (EC 6.3.1.2) is a key enzyme of ammonium assimilation and recycling in plants where it catalyses the synthesis of glutamine from ammonium and glutamate. In Arabidopsis, five GLN1 genes encode GS1 isoforms. GLN1;2 is the most highly expressed in leaves and is over-expressed in roots by ammonium supply and in rosettes by ample nitrate supply compared with limiting nitrate supply. It is shown here that the GLN1;2 promoter is mainly active in the minor veins of leaves and flowers and, to a lower extent, in the parenchyma of mature leaves. Cytoimmunochemistry reveals that the GLN1;2 protein is present in the companion cells. The role of GLN1;2 was determined by examining the physiology of gln1;2 knockout mutants. Mutants displayed lower glutamine synthetase activity, higher ammonium concentration, and reduced rosette biomass compared with the wild type (WT) under ample nitrate supply only. No difference between mutant and WT can be detected under limiting nitrate conditions. Despite total amino acid concentration was increased in the old leaves of mutants at high nitrate, no significant difference in nitrogen remobilization can be detected using 15N tracing. Growing plants in vitro with ammonium or nitrate as the sole nitrogen source allowed us to confirm that GLN1;2 is induced by ammonium in roots and to observe that gln1;2 mutants displayed, under such conditions, longer root hair and smaller rosette phenotypes in ammonium. Altogether the results suggest that GLN1;2 is essential for nitrogen assimilation under ample nitrate supply and for ammonium detoxification.

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