## Abstract

Photorespiration is caused by the catalytic properties of RubisCO and leads inevitably to a loss of energy, reducing power and fixed carbon in $C_3$ plants. In this work two alternative glycolate catabolic pathways capable of reducing those losses and photorespiration itself by increasing local $CO_2$ concentration should be introduced into plastids of the $C_3$ plant *A. thaliana*. The starting enzyme glycolate oxidase (GO) was identical for both proposed pathways. Unfortunately, the $H_2O_2$ produced by the action of the GO lead to severe deteriorations in GO expressing plants and rendered the introduction of an additional catalase necessary. Finally, a modification of one of the proposed pathways consisting of a glycolate oxidase, a malate synthase and a catalase has proved successful. Plants expressing this pathway presented enhanced biomass accumulation and displayed a higher photosynthetic efficiency than the wild-type. Furthermore they did not suffer from the adverse effects of $H_2O_2$ anymore.

During the establishment of these pathways several transgenic lines have been generated and examined, in part showing very interesting and meaningful phenotypes. The investigation of the light-amount-dependent phenotype of the NADP-malic-enzyme expressing plants lead to new insights on the role of malate and fumarate in light/dark-metabolism and as possible signal molecules of the carbon status (Fahnenstich et al. 2007). Additionally the plastidic expression of tartronic-semialdehyde synthase together with tartronic-semialdehyde reductase yielded plants that displayed a higher degree of salt- and cold tolerance compared to the wild-type – a phenomenon which remains elusive.