

Depletion of leaf-type ferredoxin-NADP⁺-oxidoreductase results in permanent induction of photoprotective mechanisms in chloroplasts of *Arabidopsis thaliana*

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Two leaf-type ferredoxin-NADP⁺-oxidoreductase (FNR) isoforms present in *Arabidopsis thaliana* have been shown to possess specialized properties but are nevertheless largely redundant in their function [1,2]. We have defined how a serious reduction of FNR, catalyzing the final step of photosynthetic electron transfer chain, affects phenotype of the plants by generating and characterizing FNR double mutants. Depletion of FNR in *Arabidopsis* double heterozygote *fnr1xfnr2* plants (F1 generation) resulted in a small and pale green phenotype and marked downregulation of photosynthetic pigment-protein complexes. The mutant plants suffered from over-excitation of electron transfer chain, which was partly compensated by induction of cyclic electron flow. The mutant plants possessed high content of xanthophylls, α -tocopherol and chloroplast ascorbate peroxidase enzymes, which apparently assists in coping with oxidative stress. The *fnr1 fnr2* double mutant plants (F2 generation) containing no detectable amounts of FNR could only survive under heterotrophic conditions. Complete lack of FNR resulted in extreme downregulation of the photosynthetic machinery, yet the biogenesis of a few malformed chloroplasts could be detected in *fnr1 fnr2* double mutant plants.

Lintala et al. (2007) *Plant J.* 49:1041-1052.

Lintala et al. (2009) *Plant J.* 57:1103-1115.