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Photosynthetic response of transgenic soybean plants, containing an *Arabidopsis P5CR* gene, during heat and drought stress

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Summary

The biochemical basis of heat/drought tolerance was investigated by comparing the response of antisense and sense transgenic soybean plants (containing the L-Δ^1-pyrroline-5-carboxylate reductase gene) with non-transgenic wild-type plants. The plants were subjected to a simultaneous drought and heat stress of 2 days, whereafter they were rewatered at 25°C. During this time the sense plants only showed mild symptoms of stress compared to the antisense plants which were severely stressed. Upon stress, nicotinamide adenine dinucleotide phosphate ($NADP^+$) levels decreased in antisense while it increased in sense plants. Recovery with respect to $NADP^+$ levels was best in sense plants. Sense plants had the highest ability to accumulate proline

Abbreviations: ABS/CS, absorption flux per leaf cross section; ABS/RC, average antenna size; CS, cross section; CF, chlorophyll-*a* fluorescence; e^-, electron; ET, electron transport; *F*, maximal fluorescence intensity when all the RCs are closed; F_0, fluorescence intensity at 50 μs when all RCs are open; IHSP, inducible heat shock promoter; JIP test, quantification of the Chl-*a* fluorescence F_0—*J*—*I*—*P* transient; $NADP^+$, nicotinamide adenine dinucleotide phosphate; NADPH, nicotinamide adenine dinucleotide hydrogen phosphate; OEC, oxygen-evolving complex; *P5C*, L-Δ^1-pyrroline-5-carboxylate; *P5CR*, L-Δ^1-pyrroline-5-carboxylate reductase; P5CDH, P5C dehydrogenase; PDH, proline dehydrogenase; $PI_{(CS0)}$, performance index expressed relative to CS; PSII, photosystem 2; RC, fully active reaction center; RC/CS_0, density of active units per leaf area; TR, trapping flux; *V*, relative variable fluorescence normalised between F_0 (50 μs) and F_m; V_J, relative variable fluorescence at *J* step (2 ms); *W*, relative variable fluorescence normalised for single turn-over events between F_0 (50 μs) and F_J (2 ms); W_K, relative variable fluorescence at *K* step (100–300 μs); Q_A, primary quinone acceptor of PSII; $\varphi_{(P0)}$, quantum efficiency of primary photochemistry (flux ratio TR_0/ABS)

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