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ENHANCED TOLERANCE AND PHOTOSYNTHETIC CAPACITY OF TREHALOSE-PRODUCING TRANSGENIC TOBACCO UNDER HIGH TEMPERATURE

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We previously reported that transgenic tobacco plants, harboring *E. coli* TPS (trehalose-6-phosphate synthase) gene (*ots*A) and producing trehalose, exhibited enhanced tolerance against dehydration, but without improved photosynthetic capacity under dehydration. Using same lines of homozygous transgenic plants in F2 generation, we also examined their physiological and photosynthetic responses to heat stress. All transgenic plants survived better under extended period of growth at 40°C~45°C, but degree of tolerance was varied depending on the level of TPS expression. Plants showing high level of expression looked healthy and almost normal even after 15 days of heat stress at 45°C. Furthermore, seeds from trehalose-producing plants were able to germinate normally after heat stress at 50°C during imbibition while those of wild type plants failed to germinate.

Trehalose-producing plants also showed improved ability of holding photosynthetic activity, measured by O2 evolution, Chl fluorescence, and IRGA, after heating at 40°C~45°C. Pmax of O2 evolution in transgenic plants declined about 50% after heating at 45°C for 4 h in the dark while that in wild-type plants was near to zero. Chl fluorescence parameters (Fo and Fv/Fm) also remained more favorable in transgenic plants after same heat treatment. After heating, the decrease in Fv/Fm (maximal photochemical efficiency) for transgenic plants was only half of that in wild-type plants. Increase in Fo after heating was much more prominent in wild-type plants. CO2 gas exchange measured by IRGA showed a similar trend. The current results, combined with our earlier reports, suggest the possible application of trehalose-producing plants for engineering plants resistant to multiple environmental stresses.