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Response of Tomato Introgression Lines to Low Root Zone Temperature and Drought

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Abstract

Tomato (*Solanum lycopersicum* L.) is an economically important vegetable cultivated worldwide. It is a thermophilic crop and low root zone temperature (RZT) and drought can hamper plant growth, development and total biomass production. Sub-optimal temperature also limits the tomato growing season and area, e.g. in Tropical Highlands and may result in increasing production costs if greenhouses are needed. Developing a cold and drought tolerant tomato variety with sustainable field performance is a big challenge in tomato breeding. Breeding programs should include the detection of quantitative trait loci (QTL) and evaluation of allelic performance by cultivating introgression lines under sub-optimal conditions. Introgression lines (IL) carrying QTL alleles for cold tolerance have already been identified in a *S. lycopersicum* × *S. habrochaites* IL-library.

The main objective of this study is to reveal the physiological basis of drought and cold tolerance in tomato. Responses of introgression lines to low root zone temperature and drought were studied and measured in terms of stress tolerance index, stomatal conductance, leaf expansion rate, total green leaf area, percentage of wilted leaf area, water use efficiency, osmotic adjustment, biomass accumulation and partitioning.

Tube grafting was carried out seventeen days after seedling emergence. The grafted plants were grown under three different growing conditions including well watered low RZT (10°C) and optimum RZT (15–20°C) and drought stress conditions with optimum RZT. All plants were well watered before transplanting into the experimental units and the plants were subjected to stress by withholding irrigation repetitively for five to six days intervals. After seven weeks of treatment plants were harvested for destructive measurements. Results show that the graft combination comprised by the recurrent parent as scion and an introgression line, which is supposed to carry a QTL with positive effects on plant vigour under low temperature, as rootstock produced significantly higher leaf area and dry mass. The highest assimilate production in the recurrent parent-introgression line combination gives hint that a hormonal signal from the roots leads to improved performance of canopy growth under abiotic stress.

Keywords: Cold tolerance, drought, introgression lines, low root-zone temperature, QTL, *Solanum lycopersicum*, tomato

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