

Transnational Access Report

1. General Information

Project Acronym (ID):	IPDT-HU2013
Project Title	Investigation of the mechanism of drought tolerance and photosynthetic efficiency in potato plants
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2. Duration of access

Begin of the project	End of the project
01.02.2013	15.05.2013

3. Project summary (max. 250 words)

To respond to global warming, we proposed a new approach to complex plant protection and preservation of crop yield productivity upon drought stress. Annexins are a multifunctional multigene family whose expression in plants is differentially regulated by abiotic stresses. Our previous experiments showed that in *Arabidopsis thaliana* elevated level of annexin-1 (AnnAt1) resulted in reduced ROS accumulation after ABA treatment and enhanced drought-tolerance (Konopka-Postupolska et al. 2009).

We aim to adopt these observations to improve drought tolerance of an ergonomically important crop - potato (*Solanum tuberosum* L.). Therefore, potato cultivar Santé with moderate drought tolerance was engineered to over-express AnnSt1 (OE) the closest sequence homologue of AnnAt1. Preliminary experiments showed in OE plants positive correlation between the higher level of annexin-1 and photosynthetic (PSII) efficiency. OE plants were subjected to water deficit during tubers initiation and their responses to temporary drought were compared with those of parental Santé variety (WT). Genetic modification has no negative impact on agronomic characteristics of OE tubers (shape, size, starch content) produced in field trials.

The main objective of this project was to characterize the effect of annexin (AnnSt1) over-expression on drought tolerance of potato by utilizing a phenotyping facility SSDS-HAS in Biological Research Center in Szeged. The facility allows maintaining larger number of plants and precisely controlling the plants grow (weight, water usage). Furthermore this approach gave access to many tools in one moment as: gas exchange, thermal and digital imaging, chlorophyll fluorescence and chlorophyll imaging. This all tools allowed to deeply investigate the possible mechanisms in which annexin 1 can be engaged during the abiotic stress.

4. Main achievements (max. 250 words)

During this project we confirmed the protective function of annexin 1 on potato. The results showed that OE plants keep the stomata open longer and had cooler leaves in the subsequent days of drought than WT plants. OE plants had ~40% higher WUE for total biomass and 34% higher for biomass after the drought due to prolonged photosynthesis and starch biosynthesis. After the drought the tuber yield of OE plants was 4x times larger than for WT plants. Additionally we conclude that annexin 1 may be engaged in the protection of photosynthetic apparatus and energy dissipation during the drought. This observation needs more deep and detailed investigations, but it opens new possible role for the annexin 1 in abiotic stress.

Finally, the usage of phenotyping facility gave the opportunity to investigate of plenty of independent parameters during the one experiment. And for the breeders those results gave evidence than the annexin1 supports universal mechanism of crop drought tolerance which can be used in the innovative agriculture.