Transnational Access Report

1. General Information

Project Acronym (ID):	WHEAT_N_ROOT
Project Title	Genotype-dependent interactive effects of nitrogen and water supply on root development in wheat under greenhouse conditions
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4. Project summary (max. 250 words)

Water supply together with N availability is among the major abiotic factors that affect agricultural productivity of important crop species, including wheat, worldwide. Because of the contradictory reports on the complex interaction between water limitation (water withdrawal) and nitrogen availability is poorly understood. On one hand, the fertilizer-induced increase in plant growth can result in higher water usage, on the other hand optimal nitrogen nutrition has been shown to alleviate the negative effects of drought stress on plants in greenhouse experiment. The promotion of root growth by mineral application under drought conditions may also facilitate the extraction of water and nutrients from deeper soil layers.

The main objective of the present project is to monitor the development of the root system by testing various wheat cultivars under different combinations of water and nitrogen supply levels with the use of the HAS-RSDS root phenotyping platform. Identification of root length, root architecture, and the detectable root mass served as basic parameters. These characters were monitored during the seedling stage as well as on adult plants. By using selected genotypes cell cycle parameters were also analyzed. Since water- and N-limitation affects not only root development, but also shoot development and seed production in a connecting project we analyzed the responses of the shoot system as well by using the HAS-SSDS platform in the same cultivars under similar conditions that are used for the root phenotyping in this project.

6. Main achievements (max. 250 words)

Since it is evident that the root system plays a pivotal role in the adaptation to water limitation and efficient uptake of nutrients therefore the phenotypic characterization of root architecture and growth becomes an integrated part of plant breeding programs. We have developed an imaging technology for the continuous monitoring of the root system growth in soil. We have identified a Serbian cultivar (Suboticanka) that was able to continue root growth in soil with limited water supply. The quantitative response of cultivars to drought and nitrogen supply is presented in the enclosed supplement. In addition to calculate root biomass we have developed the methodology to analize the cell division frequency under different water and nitrogen regime. Based on these studies we have identified a Serbian genotype (NS Avangarda) that was able to continue the cell division under low soil water capacity.
In the present phase of the Serbian-Hungarian collaborative project we invented technologies for the characterization of root phenotypes of different cultivars.
Based on these technologies we opened the way for an extended program to help cereal breeding with the possibility of phenotyping underground organs like the root system in order to ensure yield stability under suboptimal conditions.