Transnational Access Report

1. General Information

Project Acronym (ID):	WHEAT_OSMOTIC_ROOT
Project Title	Genotype-dependent interactive effects of drought and salt stress on root development in wheat under greenhouse conditions
Name of Consortium Leader	Dr Ankica Kondić-Špika
Name of organization	Institute of Field and Vegetable Crops

2. Project summary (max. 250 words)

Every continent is affected by salinized soil and water. Soil salinization is one of the serious forms of soil degradations, which can arise from natural causes and human-mediated activity, such as irrigation in arid and semi-arid regions. Approximately 20% of the irrigated lands in the world are presumably affected by soil salinization. More than 800 million hectares of land throughout the world are salt-affected. This amount accounts for more than 6% of the world's total land area.
Salinity acts like drought on plants, preventing roots from performing their osmotic activity where water and nutrients move from an area of low concentration into an area of high concentration. Therefore, because of the salt levels in the soil, water and nutrients cannot move into the plant roots. In some cases, salinity also has a toxic effect on plants because of the high concentration of certain salts in the soil. Salinity prevents the plants from taking up the proper balance of nutrients they require for healthy growth.

The main objective of the present project was to monitor the development of the root system by testing various wheat cultivars under different combinations of water and salt stress levels with the use of the HAS-RSDS root phenotyping platform. A further important objective was to obtain information on salt tolerance at the level of root responses in cultivars originating from different geographical locations (Austria, Azerbaijan, and Serbia). Since water and salt stress affect not only root development, but also shoot development and seed production in a connecting project we analyzed the shoot responses as well by using the HAS-SSDS platform in the same cultivars and under similar conditions that are used for the root phenotyping in this project.

3. Main achievements (max. 250 words)

Since it is evident that the root system plays a pivotal role in the adaptation to water limitation and salt stress 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 by which root density can be obtained at different developmental stages. These data were compared with those obtained from a parallel experiments in which shoot development, biomass accumulation, grain yield and photosynthetic parameters were determined in the same cultivar under the same environmental conditions. A characteristic response to combined water limitation (20 % field capacity) and salt stress (2g NaCl/1000 g soil) was a significant decrease of the root density relative to the well watered (60 % field capacity) control without salt addition. The root density also decreased when only water limitation was applied as a single stress factor in the absence of salt addition. Application of salt stress alone under well watered conditions induced variable root density responses: (i) Significant decrease, comparable to that in the presence of water+salt stress, was observed in the 5 Azerbaijan and 2 Serbian (Balkan and NS 40S) cultivars, while the root density was little affected in all Austrian and 2 Serbian (NS Avangarda and Suboticanka) cultivars.
Comparison of the root density data with the shoot development and grain yield data showed a positive correlation between grain yield and root density in some cultivars, such as Capo and Suboticanka, which

were among the best and worst performing lines under double salt and water stress, respectively. However, this correlation was not general and other lines, such as Tale-38, which showed high biomass and grain yield even when the root density was apparently low. A possible interpretation of this finding is that the estimation of root density at the surface of the transparent plexiglass cylinder may not work equally well for all cultivars in the case of wheat plants.

4. Publications related to the access granted, acknowledging the support by EC.

A publication covering the shoot and root phenotyping data is in preparation.