PROJECT TITLE

The architecture and development of the roots system in barley plants grown under drought conditions in relation to flowering acceleration.

CONSORTIUM

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SUMMARY OF THE REPORT

The aim was to evaluate the root system parameters of 50 spring barley genotypes using different imaging techniques. The plants were subjected both to control and water scarcity conditions. Root phenotyping on the platform was performed at the National Plant Phenomics Center (NPPC), Aberystwyth University, Wales. The experiment was conducted on phenotyping systems installed in NPPC, under controlled temperature and light conditions. The choice of the phenotyping systems was related to the high throughput of the installation and the possibility of modeling soil moisture. The analyzes were carried out before the occurrence of water shortage, during its duration and in the final period of drought stress. Water scarcity stress continued from the tillering phase (phase 21 on the BBCH scale) for a period of 14 days. Control plants were grown under optimal condition and monitored in the same manner. Plant imaging, among others, focused on the total root length (depth), number of lateral roots and root elongation rate.

The first experiment (**part one**) was carried out to develop an appropriate method and adjust the experimental conditions. The results allowed direct imaging of roots in a novel deep rhizotron system. Using recurrent imaging, root structures were recorded at various time points of the growth period under 2 different water treatments. A difference was observed in the development of lateral and vertical roots in two different soil moisture conditions (control and stress conditions), with different genotypes showing different strategies for root growth. Precise shoot analysis (**part two**) on selected barley genotypes (30) will allow to evaluate the dynamics in plant response to drought condition.

In the rhizotron experiment the effect of soil moisture management was directly assessed on the root behaviour. To achieve this, novel image segmentation techniques were devised, providing a direct estimation of the amount of lateral and vertical (seminal) root development. Software developed for image and data analysis for root segmentation and classification in mini-rhizotron allowed for detailed examination of roots properties in plants subjected to well-watered as compared to drought stress conditions.

Subsequent data analysis across all examples has empirically shown dynamic differences between treatment effects. Under drought stress (also under other abiotic stresses), above ground growth is significantly reduced, and the second experiment assessed the shoot behavior and grain filling of a large subset of the same genotypes, again under well-watered and drought conditions. The behaviour of the different genotypes on the different platforms will be compared with each other and with plants from the field to better understand the G×E interaction.