PROJECT: HTPTDWWLDS

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PROJECT TITLE

High Throughput Phenotyping of Tunisian durum wheat landraces under drought stress

CONSORTIUM

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SUMMARY OF THE REPORT

The Mediterranean region has been indicated as one of the most prominent hotspots where the oncoming climate change will strike harder (Reynolds et al., 2016). The agricultural sector is going to face enormous challenges in order to feed the 9.6 billion people that are going to inhabit the planet by 2050 (Elbehri, 2015). In addition, Drought affects a significant proportion of the population, particularly those living in semi-arid and arid zones (Steduto et al., 2012). Climate change threats on wheat cultivation is even intensify by the great genetic uniformity of this crop in developed countries. In fact, wheat production for industrial food making generally relies on few cultivated varieties closely related and genetically uniform (Lopes et al., 2015). These occurrences have increased the efforts of using in breeding schemes, the reservoir genetic diversity present in germplasm collection to identify traits able to mitigate the effects of climate change on crop production (Pignone et al., 2015). Some experiences have in fact demonstrated that in plant breeding or new agricultural practices approaches, intense experimental plant phenotyping is required to study and assess plant resilience to stresses.High-throughput phenotyping (HTP) has unlocked new perspectives for non-destructive phenotyping over time.

In our project, a collection of durum wheat genotypes has grown in the greenhouse at the Research Center of Metapontum Agrobios - ALSIA. Twenty height genotypes have been studied. Five treated and five control replicates of each of the 28 genotypes were randomly distributed on the conveyor of ALSIA Phenotyping Platform in greenhouse. Wheat plants were kept fully irrigated (100% field capacity) up to the booting stage, when the drought stress (DS) was be imposed to the tester lot for 45 days, by maintaining the amountsof water in the soil around 50% field capacity (FC) through an automatically irrigation system following pot weighting. The control lot is kept at 100% FC in the same period. The plants were imaged every 4 days by using 3D RGB imaging by means of a Scanalyzer 3D system (LemnaTec GmbH, Aachen, Germany). The imaging involving three mutually orthogonal vantage points to evaluate morphometric parameters of the plant, such as height, width, or biomass. In particular, they have been used to calculate the digital biovolume (DB) of each plant. This index was chosen to monitor and evaluate the differences in growth following DS in comparison to the set kept fully irrigated per each genotype. The use of the DB index allowed building growth curves of each genotype under both DS conditions and fully irrigated control conditions. Differences in the growth curve, in fact, can evidence the tolerance or susceptibility of the plant to the stress administered. Moreover, the RGB images were analysed based on the colour domain. The green colour indicates a higher Water Use Efficiency (WUE) ratio in the plant and the red colour indicates a lower WUE.