PROJECT: METABO-DURUM-2

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PROJECT TITLE

Comparative analysis of drought-induced changes in the metabolome of durum wheat leaves in the field and in greenhouse

CONSORTIUM

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SUMMARY OF THE REPORT

Drought is the major abiotic stress limiting wheat yield worldwide. Global climate warming models predict a substantial mean temperature increase in the next decades coupled with more severe heat waves and droughts, especially in the Mediterranean Basin. These predictions underline the importance and urgency to better understand the genetic and functional basis of the adaptive response of wheat to heat stress, particularly when associated to drought stress. The study of osmotic adjustment (OA) and relative water content (RWC) is of major importance in wheat in order to understand the genetic and molecular dynamics of stress tolerance among different genotypes/varieties. UNIBO, in collaboration with University of Arizona in Maricopa (USA) tested 189 durum panel varieties in the field for drought stress resistance during 2018 and 2019. RWC and OA were measured for all the accessions and 14 genotypes were selected based upon their contrasting OA capacity (7 with high OA (HOA) and 7 with low OA (LOA)). In order to compare results obtained in the field also in a controlled environment, in collaboration with Dr Kerstin Neumann and Dr. John C. D'Auria (IPK-Gatersleben Institute), the 14 accessions were evaluated on the APPP-B platform (medium sized phenotyping platform). This facility allowed to plan the drought stress for every accession under a controlled water regime for 6 weeks, moreover images were taken every day with top and side view RGB and fluorescence cameras. Each accession was replicated in 15 plants for control experiment and 15 plants for drought experiment, plant available water (PAW) content was kept at 90% in control plants, whilst the drought experimental plants flag leaves were sampled on 4 time points under different stress levels: 50%, 30%, 10% and 5%. During every time point, a leaf was collected from 5 plants to measure RWC and another for metabolite analysis under GC-MS, while at T4 (5%) a sample for OA was collected as well. RWC data after the 4 sampling dates showed a strong drought stressed occurred, increasing at every time point, going from 80% at T1 in stressed plants to 60% at T4. Differences were detected between control and stressed plants from T2 (weak) to T3-T4 (very strong). As regards to OA, more osmolites were detected in stressed plants in comparison to controls as expected, consistent with RWC data. Leaf measurements and photosynthetic activity were determined as well, showing that HOA genotypes have a more efficient photosynthetic activity. After imaging period, plants grew to maturity outside the platform. Yield traits showed differences among stressed and control genotypes only for some of them: biomass, grain weight, straw weight ear and fertile ear number.