

PROJECT TITLE

Physiological phenotyping under controlled conditions of durum wheat accessions differing for heat stress tolerance in field conditions

CONSORTIUM

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SUMMARY OF THE REPORT

This study focused on drought stress rather than heat stress as originally planned, because the 2-month grant would not have allowed to complete two phenotyping cycles at two different temperatures with plants reaching maturity. Additionally, investigating drought effects at the biochemical level allows for a more complete characterization of the 16 genotypes already tested under well-watered (WW) and water-stressed (WS) regimes in the field at Maricopa and in the greenhouse at IPK.

This experiment investigated how osmotic adjustment (OA) regulation affects leaf relative water content (RWC), water use, water-use efficiency, drought tolerance and the activity of key enzymes of carbohydrate metabolism. Multispectral and RGB imaging were applied to track changes in morpho-physiological parameters of the 16 genotypes exposed to WW and WS conditions. Leaf samples were collected, snap-frozen and stored at -80°C. A second step, still ongoing, evaluated the activity of key enzymes of carbohydrate metabolism.

Project activities

1) To evaluate under WW and WS conditions in the PhenoLab platform 16 durum wheat accessions contrasted for OA capacity as previously evaluated under progressively increasing in Maricopa (USA).

2) To determine (a) activity of key enzymes of primary carbohydrate metabolism (resource/assimilate allocation), (b) antioxidant metabolism, (c) phytohormone profiles (regulation) in drought stressed plants.

Plants were grown at 25°C/18°C nig with a 6/18 h photoperiod. All genotypes were evaluated in WW and WS regimes (fully irrigated and 30% field capacity, respectively). The 16 durum wheat accessions were evaluated using 15-L pots, each with 8 seedlings to start with, then thinned to 4 seedlings following 4 consecutive samplings (1 plant/sampling) during the increasing drought. For the WS and WW treatments, 4 and 3 reps were considered, respectively, for a total of 117 pots.

On 19/8, the 117 pots were transferred to the PhenoLab platform and grown until 20/9. The drought treatment started on 08/09 until 18/09, after which the WS pots were rewatered to evaluate drought recovery. On 20//09, pots were transferred to the greenhouse to complete the recovery phase. At maturity (likely in mid-November), plants will be removed from pots, and root and shoot dry weight, seed weight and grain production will be measured.

Stress was monitored according to pots weight measured daily. The *Vision Station* acquired chlorophyll fluorescence, multispectral (VIS 365-970 nm) and thermal images twice a day. Leaf RWC was calculated measuring leaf fresh weight (FW), weight at full turgor (TW) and dry weight (DW) using the formula: $RWC = [(FW - DW) / (TW - DW)] \times 100$.

Main achievements

We characterized for water use and water-use efficiency 16 durum wheat genotypes differing in OA capacity under drought conditions.

Dissemination and publication

Data is being collected as part of a Master's Degree project. A manuscript will be submitted in 2022 to a peer-reviewed journal.